Bryant University

HONORS THESIS

Effects of Self-Monitoring and Social Support on Exercise Adherence

BY Dominic Cauteruccio

ADVISOR • Joseph Trunzo

Submitted in partial fulfillment of the requirements for graduation
with honors in the Bryant University Honors Program
April 2016

Table of Contents

Abstract 1

Introduction 2

Methodology 19

Results 24

Discussion 26

Appendices 31

Appendix I – Self-Monitoring Tool 32

Appendix II – Demographic Information 33

Appendix III – ISSB Results 34

Appendix IV – IPAQ Results 35

References 36

ABSTRACT

The purpose of this study was to look at the effects of self-monitoring and social support on minutes of exercise per week. Specifically, self-monitoring examined whether self-monitoring and self-monitoring in combination with social support would increase minutes of exercise over a four week period. The study was four weeks long, with participants randomly assigned into three groups: a control group (group 1), a self-monitoring group (group 2), and a self-monitoring plus social support group (group 3). Exercise time was measured using the International Physical Activity Questionnaire (IPAQ), and social support was measured using the Inventory of Socially Supportive Behaviors (ISSB). In total, 32 participants volunteered, 18 of whom qualified as eligible participants. Results showed groups 2 and 3 increased their exercise time over the four weeks; whereas group 1 did not. However, group 2 showed a greater increase in exercise time over the four weeks compared to group 3. Overall, the results trended towards supporting self-monitoring as an effective behavior change aid, but did not support the hypothesis that using the two interventions will have a superior effect compared to just using one.

INTRODUCTION

People exercise for a variety of reasons, including, but not limited to, athletic performance, weight loss, or body image. Most individuals have engaged in some type of exercise before, yet the majority fail to follow even the most sincere plans. Despite this lack of adherence, people still hold out hope they can reach their fitness goals, continuously searching for something that will finally help. Many have turned to the field of exercise and sports psychology to find a solution.

Background/History

Over 100 years old, the field can be traced back to as early as the 1890's, when Dr. Norman Triplett looked at the behavior of cyclists, studying how the presence of competition helped produce faster times (Triplett, 1898). Around the same time, a new type of psychological research developed, which involved the use of testing and measurements to gain general knowledge, as opposed to the philosophical approach previously being used.

From 1921 to 1938, the field developed very rapidly, due in large part to Coleman R. Griffith, who is widely considered the father of sport and exercise psychology (Kroll & Lewis, 1970). A University of Illinois psychologist, Griffith opened the first sports psychology lab, conducting numerous studies on sports teams and coaches (including the Chicago Cubs), and wrote a number of papers relevant to the subject. He also wrote two books, *Psychology of Coaching* and *Psychology and Athletics* (Weinberg & Gould, 2011). Augmenting the contributions made by Griffith, this era saw the beginning of athlete testing for reaction times, concentration, personality, and aggression.

The subsequent 25 years proved to be monumental for the development of the science of the field. Franklin Henry was a catalyst, devoting his life to studying the psychological

aspects of sport and motor skill development (Henry, 1951; 1952). Perhaps his most significant contribution was teaching a new generation of psychologists, many of whom went on to become pioneers in reshaping curriculums and developing the field of kinesiology. This era was also home to one of the first women to practice and research sport psychology, Dorothy Hazeltine Yates, who worked extensively with university boxers to manage emotions and enhance performance using the relaxation set-method (Kornspan & MacCracken, 2001).

From 1966 to 1977, the academic side of sports psychology grew dramatically; at that time there became a shift from studying motor learning to focusing on how psychological factors influence performance in sports. This time also saw the development of the first sports psychology societies and research journals, as well as a shift from laboratory work to field work (Landers, 1995). Such works included looking at relationships between reducing anxiety levels and exercise (Cureton, 1963; Cattell, 1960). From 1978 to 2000, the field exploded in popularity, becoming widely accepted and respected. With the increase in popularity, ethical guidelines and common practices emerged, professional licensing was established, and full-time positions for new individuals in the field started to become more available (Weinberg & Gould, 2011). Also, exercise psychology started to develop as a specialty field when the study of motor learning development separated from sports psychology. Today, the field continues to grow, as exercise psychology is thriving and new issues such as how to properly prepare and educate students arise (Weinberg & Gould, 2011).

Underlying Theories

A major area of study within sport and exercise psychology is behavior change. Four of the most relevant theories of behavior change are Social Cognitive Theory, the Theory of Planned Behavior, the Health Belief Model, and the Transtheoretical Model. Whether directly

or indirectly, the majority of research in the area on behavior change is in some way influenced by one of these.

Social Cognitive Theory

Social Cognitive Theory, developed by Albert Bandura, specifies a core set of five determinants that are critical in building effective health practices. First, one must have a knowledge of the risks and benefits of different health practices (Bandura, 2004). People must be aware of the risks they are trying to avoid and the benefits to be gained by making the change. This awareness is gained through a variety of different ways, but one very important avenue is vicarious capability (Bandura, 1986). Instead of learning through direct action and experiences, people can observe others and see the effects on them, thus learning without having to experience the consequences themselves. Another avenue is through media; persuasive health education campaign ads (Bandura, 1997) are crucial in spreading awareness for the various risks and benefits of certain practices.

The second, and perhaps most important, is self-efficacy. Specifically, it is the belief in one's ability to control their health habits (Bandura, 2004). One must believe they have the ability to enact change themselves or they will never be committed enough to succeed. Self-efficacy is the basis for all the other factors, as Bandura claims it to be "the foundation of human motivation and action" (Bandura, 2004). Self-efficacy is the determining factor in behavioral intensity (Ng & Lucianetti, 2016). Even if people understand certain health risks, they will not seek change unless they believe they can do it (Bandura, 1997). Self-efficacy is really the product of self-regulation and self-reflection (Bandura, 1986). One has an internal set of standards they believe they should meet; so they work toward meeting those standards through their actions. People then reflect on their abilities to deal with different tasks,

deciding how much time and effort to put into completing them (Bandura, 1986) and how much to persevere in the face of difficulty.

Part of this decision process is an evaluation of the expectations of outcomes and the expected costs and benefits for different health habits (Bandura, 2004). There are three main parts to this evaluation process. The first is physical outcomes; that is, what are the expected pleasures and aversive effects. The second is behavioral; the social approval and disapproval the action provokes is influential in the decision to partake in it. The third piece is the determination of how the outcomes will be personally beneficial to achieving one's goals. These expectations come about through a process Bandura calls symbolizing capability (1986), which is a human's ability to test possible solutions to problems in their mind rather than going through the physical process of testing each one individually. This allows a decision to be made based off the results of one's thoughts.

A major part of the evaluation process of outcomes is the comparison of them to personal short and long term goals. Long term goals set the foundation for change (Bandura, 2004). However, due to the chaos of everyday life, long term goals are ineffective at influencing behavior. Short term, attainable goals, on the other hand, help to guide behavior in the here and now so the long term goals can be met (Bandura, 2004). The goals people set for themselves are influenced by their own self-regulation, as their internal standards create a mindset for where one believes they should be. The discrepancy between reality and those standards (Bandura, 1986) is what drives this goal setting process. Self-regulation has been shown to be an effective intervention for health outcomes in weight loss, asthma, and cardiac rehabilitation (Tougas, Hayden, McGrath, Huguet, & Rozario, 2015).

Finally, one must evaluate the perceived facilitators and social and structural impediments to the changes they seek (Bandura, 2004). Perceived facilitators can best be described as agents that aid in helping people change, where the impediments are obstacles that stand in their way. A person will look at how likely they are to overcome the obstacles and how much the facilitators will help them do so, thus forming an opinion for how likely they are to succeed. This relates to the formerly mentioned self-efficacy concept, showing how much of a role Social Cognitive Theory believes self-perception plays in the behavior change process.

In 2005, Bandura produced a paper that discussed the role of self-regulation in health promotion through the lens of his Social Cognitive Theory. In the research, he points out that self-management requires the exercise of motivational and self-regulatory skills (Bandura, 2005). This is reverberated in Weinberg and Gould's textbook, *Foundations of Sport and Exercise Psychology*, which discusses both self-monitoring and social support as techniques that could be used to increase exercise adherence. Overall, Social Cognitive Theory is a credible theory to develop interventions for various health conditions (Tougas et al., 2015).

Theory of Planned Behavior

The second major work is the Theory of Planned Behavior. The theory states that the performance of any behavior is a result of behavioral intentions and perceived control over the behavior and its outcomes (Ajzen & Madden, 1986). Behavioral intention is the plan of action to engage in a behavior and the motivation to do so. This is determined by three individual aspects. First, there is perceived behavioral control. This is a personal belief that one can do what they intend to do, essentially referring to one's self-efficacy. If a person

wants to exercise every day and believes in their own ability to do so, they are more likely to do it.

Perceived social norms are another major factor in predicting the performance of a behavior (Ajzen & Madden, 1986). One who believes his family and friends exercise consistently will feel more pressure to do so as well compared to the one who is surrounded by people who never workout. If the goal behavior is negatively viewed among peers, a person is less likely to go through with the change process. Finally, there is the attitude of the individual (Ajen & Madden, 1986). An individual will evaluate the positives and negatives of engaging in a particular behavior, and make a determination as to whether or not he or she thinks it will be beneficial to do it. Once this determination is made, the person will have an attitude towards the behavior that is either positive or negative, greatly influencing their engagement.

A 2005 study looked into the Theory of Planned Behavior and tested its ability to predict actual participation in physical activity. This study had 94 participants who were enrolled in a gym in the South of England (Armitage, 2005). Those participants were given a survey that they were asked to fill out, which included questions pertaining to the main factors of Planned Behavior Theory. It was found was that not only was the Theory of Planned Behavior a good predictor of maintenance behavior, but so too was past behavior (Armitage, 2005). This could be because that past behavior was influenced by the different factors of this model, such as someone's attitude toward the behavior. Someone with a consistent attitude towards an act over time is likely to have consistent behaviors relating to that act as well.

Health Belief Model

The Health Belief Model states that a person makes two assessments when looking at a potential health concern. Based off of those assessments, one can predict the likelihood of a person engaging in a particular behavior. The first assessment was a pros and cons evaluation of the benefits and barriers of the behavior (Rosenstock, 1974). One will look at how the behavior will be beneficial to them and what the challenges or costs are of engaging in it. After weighing both sides, the person will make a final assessment as to whether or not it will be worthwhile to perform the action.

The second assessment is the perceived threat of the specific health issue. This assessment is influenced by three main parts: perceived seriousness, perceived susceptibility, and cues to action (Rosenstock, 1974). Perceived seriousness is the evaluation of how physically and socially serious the problem is. The more serious a person believes the problem is, the more likely they are to engage in a preventative behavior against it (Champion, 1984). For example, if a person believes obesity is a serious concern, either for the health issues or social implications, they will be more likely to engage in regular exercise to prevent it. Perceived susceptibility is a person's evaluation of how likely they are to develop the health issue (Rosenstock, 1974). The more susceptible they believe they are, the greater chance there is for them to engage in the preventative behavior. Cues to action are reminders and alerts about the health problem (Walker, Steinfort, & Keyler, 2015). The more cues to action a person is exposed to, the more likely they are to engage in the preventative behavior.

A 2014 study looked at the components of the Health Belief Model in relation to students' involvement in vigorous physical activity. In it, a convenience sample of 480

students from a Midwestern University was given a 21-item survey that looked at the benefits, barriers and cues to their involvement in vigorous physical activity (King, Vidourek, English, & Merianos, 2014). It was found that parent and peer involvement and encouragement was associated with higher levels of physical activity. Along with that, many cited improved health, appearance, and maintenance of a healthy weight as perceived benefits to engaging in vigorous physical activity (King et al., 2014). The Health Belief Model was also found to be effective at predicting bycicle helmet use among college undergraduates (Ross, Ross, Rahman, & Cataldo, 2010).

Transtheoretical Model

The Transtheoretical, or stages of change, Model states that the change process occurs in five steps, and that people in different steps will have different psychological characteristics. This theory developed through an analysis of different psychotherapy models in an effort to synthesize the similarities among the different theories (Prochaska, 1979). The five main steps are precontemplation, contemplation, preparation, action, and maintenance. In the precontemplation stage, people are not considering change, either because they have not thought about it yet or they just do not want to. In contemplation, people recognize that a problem exists and are seriously considering taking action to change their behavior (Prochaska, 1979). The preparation, or determination, stage is where one decides he or she wants to make a change, and creates a concrete plan to do so. This stage lasts around two hours to two months, during which the person makes a serious commitment to change their behavior (Prochaska and DiClemente, 1982). The action stage is typically around the first six months of a person's change tactics, while the maintenance stage is where one will actively manage their behavior to maintain the success they achieved in the action stage. In therapy,

this maintenance stage is the point in time when someone would decide they can manage on their own and no longer need to see a therapist. (Prochaska, 1979).

The Transtheoretical Model has been studied heavily through the lens of smokers, specifically looking at those trying to quit. In 1991, it was found that the different stages of the model helped predict the attempts and cessation success to quit smoking (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, and Rossi, 1991). More recently, a study looked at the effectiveness of the Transtheoretical Model to understand changes in exercise behavior among members of fitness clubs. It researched 33 different studies related to this topic to view the results and summarize the findings. The paper found multiple studies that linked self-efficacy, decisional balance, and processes of change to the increase of exercise behavior (Middelkamp & Steenbergen, 2015). It does note, however, that there is a dearth of studies and a lack of randomized controlled trials (Middelkamp & Steenbergen, 2015). However, overall, it shows the effectiveness of the elements of the Transtheoretical Model as a way to examine exercise behavior and explain the change process.

Recurring Themes

The aforementioned theories have many overlapping themes, perhaps none bigger than their emphasis on self-efficacy. Social Cognitive Theory states one's belief in themselves to enact change is the most important part of establishing new behaviors. Similarly, Planned Behavior states one must believe they can complete the behaviors they think are necessary to change or they will not try. While self-efficacy is a little less directly referenced in the Health Belief and Transtheoretical models, it is still prevalent. The assessment of barriers faced and benefits gained in potentially changing behavior are derived from a personal belief in one's own ability to complete the necessary tasks to recognize those gains or overcome those

barriers. Similarly, the progression through the stages of change in the Transtheoretical model cannot take place without self-efficacy. In order to even enter the process of trying to change a person must be willing to do so, and the only way they would be willing is if they feel like they have the ability to do it. As one progresses from one stage to the next, their level of self-efficacy rises (DiClemente et all., 1991), making them more and more confident in their ability to keep changing.

The authors of these four models designed them to be used proactively rather than reactively. The models all focus on preventing future health issues by changing current behavior to create healthier habits. Social Cognitive Theory, Planned Behavior, and the Health Belief Model all claim that part of the ability to change comes from a knowledge and understanding of specific health risks and benefits. This knowledge and understanding leads to another theme among the models, the personal evaluation of future tasks. The Social Cognitive Theory, Planned Behavior, and Health Belief Model suggest that the personal evaluation of upcoming obstacles, benefits, or future tasks is critical in a person's outlook on how advantageous changing their behavior will be. Ultimately, this is part of the self-regulation and self-reflection processes, as people see how the new behavior will help them achieve their goals. In the Transtheoretical Model, this evaluation would take place during the contemplation stage. Intuitively, this makes sense; these evaluations occur just prior to someone deciding to take action, so how they evaluate these things directly leads into whether or not they will progress into the next stage in the change model.

Social influence is the last major theme among the theories. Social Cognitive Theory and Planned Behavior state that social norms and perceived social approval or disapproval for an action may influence one's decision to engage in a task. The Health Belief Model suggests

that the amount of cues to action a person is exposed to is related to how likely they are to act in a preventative way. These cues can be emails, phone calls, advertisements, commercials or other forms of social influence. Ultimately, they are all saying that people are heavily influenced by others, and our actions are guided by what others will think of us. This social influence lends well to the idea that other people may help one stick to, and possibly increase, certain healthy behaviors, such as exercising. One reason for this is because persuasion from others is a way to increase belief in oneself (Bandura, 1997), so having social support prevalent can boost self-efficacy and increase the likelihood of behavior change.

Patterns

Self-monitoring and social support have emerged through these theories as popular methods to aid in this behavior change process. Self-monitoring tools help to turn people's forethoughts of future outcomes into action by providing a way to manage and encourage self-reflection (Bandura, 1986). Focus on personal achievements have been shown to enhance self-efficacy (Bandura, 1997), and using these tools is a way for one to see progress and improvement. For instance, a recent study looking at self-monitoring and goal setting for children noted that childhood obesity is seen as a significant public health problem worldwide (Riiser et al., 2014). Another study looked at minimizing weight gain during the holiday season (Boutelle, Kirschenbaum, Baker, & Mitchell, 1999). In turn, they see self-management as good medicine against these risks. According to Bandura, if the huge benefits of self-regulation were incorporated into a pill, it would be considered a scientific milestone within the medical field (2004).

Self-monitoring and social support can be considered 'commitment devices'. A commitment device is described as a strategy used to limit future behaviors (Rogers,

Milkman, & Volpp, 2014). It usually has two basic features (Rogers, Milkman, & Volpp, 2014). The first is that people voluntarily elect to use them, meaning they have to be self-aware enough to know that their future actions might not line up with their current goals. The second is having a consequence associated with not achieving a goal (Rogers et al., 2014). Both self-monitoring and social support are used as ways to help individuals act a certain way in the future, usually to eat healthier or exercise more. They also both have consequences, as not engaging in a particular behavior will result in disappointing a workout partner or not filling out a booklet.

Self-Monitoring

There has been little dichotomy with the research on self-monitoring and its efficacy. In almost all cases, across all different situations, people who self-monitor are better able to perform to their desires than those who do not. In 1993, a study was done to examine the relationship between self-monitoring and weight control. It was an 18 week study that had people self-monitor different variables relating to time, food, and calories. They found that the most consistent self-monitors were the ones who lost the most weight (Baker & Kirschenbaum, 1993). Furthermore, they found five main variables that, when monitored, correlated the most with weight loss. While this shows a correlation between weight loss and self-monitoring, it fails to rule out other factors that could have influenced the results, such as self-efficacy, or perhaps previous weight history.

A study done in 1999 recognized the benefits of self-monitoring and tested its effects on minimizing weight gain for obese individuals during the holiday season. The experiment had participants self-monitor their eating for eight weeks, starting three weeks prior to the holiday season, and ending three weeks after. It found that people who self-monitored gained

significantly less weight during the holidays than those who did not (Boutelle, Kirschenbaum, Baker, & Mitchell, 1999). While neither the intervention group nor the control group lost weight during the two weeks of holidays, the intervention group did manage their weight better. These results not only corroborate the previous study done by Baker, but also build on it, by showing the versatility of self-monitoring across multiple situations. However, it is interesting that the intervention group also received phone calls and reminders to fill out their booklets, where the control group received nothing. That added dimension takes away from the conclusions one can draw about self-monitoring from this study. These phone calls and reminders act as a cue to action for the participants, which, according to the Health Belief Model, would be an aid in changing behavior. While the self-monitoring aspect is still a driver of the results, the totality of the outcome is driven also by these reminders and phone calls.

In 2006, Helsel tested what degree of self-monitoring would produce maximum weight loss results. The study had two groups, one that remained on a detailed self-monitoring intervention for eight weeks, and one that shifted from a detailed intervention to a less detailed plan. The results showed no difference in weight loss between the two groups (Helsel, 2006), suggesting that it does not necessarily matter what or how much you self-monitor, only that you engage in the act of doing so. This is slightly different from the 1993 study by Baker and Kirschenbaum, which stated that there were certain variables more correlated with weight loss than others. While Helsel argues the simple act of self-monitoring is enough to change behavior and produce results, Baker and Kirschenbaum believe there are certain ways to go about it that will produce the best results.

Further adding to the support of this method is a research paper looking at self-monitoring in combination with automated coaching, claiming this approach as a cost-

effective way to "increase physical activity at a population level" (Richardson, 2010). One not uncommon caveat the author specifically notes is to attribute the results only to short-term effects, as more research is needed to determine its long-term impact. A 2014 study looking at improving cardiorespiratory fitness (CRF) and Health Related Quality of Life (HRQoL) for overweight and obese children found its intervention (which involved students setting goals and monitoring their results) to have significant *short-term* effects as well (Riiser et al., 2014). Similarly, Anshel and Seipel found self-monitoring to be an effective way to maintain adherence to an exercise program in the short-term (2009), resulting in the increase of selective measures of fitness, such as push-ups.

In general, researchers have measured the effectiveness of self-monitoring in two ways. Much of the research discussed so far has dealt with measuring effectiveness through improving health metrics, such as HRQoL, CRF, or weight loss. However, there are also studies that look at how self-monitoring can influence the frequency of healthy behaviors. A study looking at the relationship between self-weighing frequencies, weight control behaviors, and weight status for people with a history of obesity found that those who are considered "frequent self-weighers" (weigh themselves once a week or more) are more likely to engage in healthy weight control behaviors such as eating healthy foods and not snacking in-between meals (Alm, Neumark-Sztainer, Story, & Boutelle, 2009). They were also more likely to engage in more consistent physical activity and employ more behavior change strategies than those who weighed themselves less frequently (Alm et al., 2009). Both approaches to self-monitoring are valid, as each has its own body of support in the field.

Social Support

Social Cognitive Theory, the Theory Planned Behavior, and the Health Belief Model emphasize the importance of social influence on decision making, using it as a predictor of future behavior. It is reasonable to suggest, then, that creating a positive environment (i.e. providing someone with social support) would help to encourage positive health behaviors and lead to better exercise adherence.

The research on the effectiveness of social support to create this effect has solidified this viewpoint. In 2010, a study was done to look at finding a cost-effective way to lose weight using a phone intervention (Sherwood, Jeffery, Welsh, Van Wormer, & Hotop, 2010). The experiment contained three groups with varying frequencies of phone coaching sessions (0, 10, or 20 sessions depending on the group), finding that the group receiving the most frequent coaching sessions lost twice as much weight as the other two. However, due to a small sample size the results were not statistically significant (Sherwood et al., 2010). Despite this, the benefits of constant intervention were still present, something prevalent across all the research discussed. This form of coaching is essentially a social support tactic, as it provides the same benefits. Both act as constant reminders while also providing a resource of accountability and encouragement. Also, failing to act in accordance to one's plan will result in disappointment from either the coach or workout partner.

Perhaps the most direct piece of evidence for social support comes from a 2014 study that looked at how social support would influence exercise time (Rackow, Scholz, & Hornung, 2014). This study makes an interesting distinction, separating social support into perceived and received. Perceived social support would be considered as more passive encouragement from friends and family, while received support would be more active, such as

having a direct workout partner. The study had the intervention group exercise with a workout partner for eight weeks, which they found to help increase exercise time (Rackow et al., 2014). Again, the reasons for this can be explained by considering social support a commitment device; by committing to a workout partner, one will engage in regular exercise or risk disappointing their partner.

Data Validity

The most common flaw in this field is determining how reliable the self-reported data is, specifically in studies that rely on this as their measurements, such as the Rackow study on received social support (which used self-reported exercise times to determine effectiveness of their intervention). A study done in 2006 looked to answer that question, by determining the validity of self-reported data by athletes who coach themselves. The study involved 29 athletes self-reporting the duration of their workouts for three weeks, followed by being observed for two weeks. Only 59% of the athletes in the study accurately recorded their workouts, while 24% overestimated and 17% underestimated them (Borresen & Lambert, 2006). While this experiment has a small sample size, it does give pause to fully trusting self-reported data as an accurate way to measure results.

Conclusion

The research done on self-monitoring and social support has helped to shape some of the methods and purposes of this project. While there is already abundant research on self-monitoring and social support, there lacks an examination of the interaction between the two. The current research helps to confirm these methods as sound commitment devices that help improve healthy behaviors. Also, with most of the experiments being quantitative in nature,

looking at the different methodologies, specifically the three group experiments, has helped to shape the direction of this current study.

There are also many lessons to be learned from the current research. First, self-monitoring has been proven across all different situations as being an effective device to help shape behavior. Social support, on the other hand, still has areas that can be explored further. One of the reasons for this is the interpretation of social support as either perceived or received, with the two having quite different denotations from each other. The most significant takeaway from the research, however, was finding an accurate and reliable way to measure minutes of exercise per week. With limited resources, utilizing the IPAQ will allow for a quick, effective method of recording participant's minutes exercised per week.

The main focus of this project is to examine the influence of self-monitoring and social support on physical activity. This study is designed to test the effects of each variable on minutes of exercise per week. Specifically, the experiment will focus on looking at whether or not there is a superior effect on exercise when these two strategies are combined, compared to when just one is used. The two main research questions being tested are:

1. Will there be a significant increase in exercise time per week in the experimental groups, self-monitoring and self-monitoring plus social support, compared to the control groups?
2. Does self-monitoring, combined with social support, have a superior effect on participants' exercise time compared to the control and self-monitoring groups alone?

As such, the hypotheses are:

1. Participants in the self-monitoring group will have a significantly larger increase in total time per week from time zero to time three compared to participants in the control group.
2. Participants in the self-monitoring plus social-support group will have a greater increase than participants in the self-monitoring alone and control groups.

Qualtrics, an online data collection tool, will be used to measure physical activity, social support, and minutes exercised per week. Participants will be eligible for this study if they do not already have a consistent exercise schedule, but hope to increase their level of exercise in the future. People who already have a structured program will be excluded because it leaves little room for actual improvement, creating a possible ceiling effect and masking results. Further, this study will strictly monitor quantity of exercise, while not delving into measuring the quality of the exercise being performed. The scope will be limited to determining if these two methods, alone and in conjunction with each other, will increase time spent exercising.

METHODOLOGY

Recruitment

The ideal participant in this experiment was someone who did not already have a consistent exercise schedule established of two or more times per week, but would like to establish one. These people would be classified under the contemplation or preparation stage

of the Transtheoretical Model; they recognize they are not exercising as much as they would like and are seriously considering changing their behavior.

In order to recruit participants for the experiment, the researchers reached out to various companies around the Rhode Island, Massachusetts, and Connecticut area in the hopes of recruiting their employees. The researchers allowed any company specific benefits the administration was willing to offer for participation in the experiment. Also, after receiving approval from the Internal Review Board (IRB), students from Bryant University were recruited, and offered extra credit in certain classes as an incentive to sign up and complete the experiment. A rolling recruitment strategy was used, starting participants on the experiment within a week, typically the following Monday, of them contacting the researchers of their interest. Due to a lack of responses from companies, the majority of participants came from Bryant University students who were receiving extra credit as an incentive.

In total, 32 people signed up for the experiment, 26 of which completed it. Of the 26 that finished the experiment, 8 were already following a consistent exercise schedule of two or more times per week, and thus were excluded from the analysis. In total, 18 participants were included in the analysis, eight of which were in the control group, six were in the self-monitoring group, and four were in the self-monitoring and social support group. Seven of the participants were male and eleven were female. The majority of them (16 out of 18) were students at Bryant University in Rhode Island, and most (15 people) were white, while 2 were of Hispanic Latino ethnicity and one considered themselves Asian/Pacific Islander. Other demographic information collected shows two of the participants considered themselves smokers, while thirteen said they drank alcohol regularly (Appendix II). The average age of participation, 35 years old, was skewed due to two outliers in the data, but the median was 21

years old, which is a much more representative number of the sample. Average height was 5'6" and average weight was 143 lbs. Of the 18 participants, 16 claimed to have followed a consistent exercise schedule at some point in their life.

Materials

Participants in the experimental groups were given a tool to use as a self-monitoring intervention. This tool was an excel sheet (Appendix I) that listed everyday of their four weeks during the experiment. The tool was designed by the researchers, and participants were given freedom to fill it out as they saw fit due to the fact that how much one self-monitors may not have an impact on how much the intervention helps (Helsel, 2006). Participants could generalize their daily activity, or break it down into specifics; their only requirement was to estimate the total number of minutes exercised for the day.

Social support levels were measured using the Inventory of Socially Supportive Behaviors (ISSB) scale, a 19 question survey with each question giving five answers between "not at all" and "about every day". Thirteen questions were taken from this survey that were deemed relevant to the current study and used to conduct the analysis. The thirteen questions were averaged, with lower scores showing less social support. The ISSB was given to participants at the beginning and end of their four weeks. In 1988, Heitzmann and Kaplan conducted a study evaluating 20 social support measures, one of which being the ISSB. The study found the ISSB to have a test-retest reliability of greater than 80%, while also having strong correlations with a number of the other surveys in the paper.

Measurements of physical activity were taken on a weekly basis. The measurement tool used was the short version of the International Physical Activity Questionnaire (IPAQ), a self-administered questionnaire that measures minutes of exercise per week. The IPAQ, and

the ISSB were delivered to participants through Qualtrics, an online survey and data collection device that makes it simple to collect and input the data into the statistical software, SAS Enterprise Guide.

The IPAQ questionnaire is useful due to the fact that it does not treat every minute of exercise equally. It breaks down physical activity into three categories: vigorous (VPA), moderate (MPA), and walking (WALK). Vigorous physical activity is defined as actions that cause sweat and heavy breathing, such as running, playing basketball, or high intensity weight lifting. Moderate physical activity is described as actions that are more strenuous than walking, but do not cause heavy breathing. An example of this would be yard work such as pushing a lawn mower or raking leaves. Finally, walking time is included only if the participant walks for ten or more minutes at a time. In order to analyze the results of the IPAQ, a scoring variable was created that took into effect the type of exercise the respondent performed. A weighted score was calculated by multiplying the total minutes of vigorous physical activity by eight, the total minutes of moderate physical activity by four, and the total minutes of walking by three and three tenths. This weighted score was used to analyze exercise activity for the participants; the higher the score the more they exercised.

$$\text{Score} = \text{VPA}*8 + \text{MPA}*4 + \text{WALK}*3.3$$

The International Physical Activity Questionnaire (IPAQ) is a survey designed to have people recall their exercise activity from the past week. The IPAQ was meant to fill the need for an internationally agreed upon measure of physical activity, and to eliminate some of the ambiguity in self-recorded data, such as how different people define “vigorous” physical activity (Booth, 2000). The survey looks at five domains of everyday life and asks participants to write down how much time they spent exercising within each (Booth, 2000). In

2003, a study was conducted to test the validity of the IPAQ, and to compare its two forms, the short and long versions (Craig, 2003). Both were found to be effective at accurately reporting exercise time, and the short form was found to be just as effective as the long form (Craig, 2003). Employing the short form IPAQ instead of the long form will have no effect on accuracy but may decrease attrition by creating a less burdensome task for participants.

Procedure

Upon enrollment, participants were given a consent form to sign and a short questionnaire to record some demographic information and determine whether or not they were eligible to participate. Subjects were then randomly assigned to one of three groups; a control group (group 1), a self-monitoring group (group 2), and a self-monitoring plus social support group (group 3). Every participant was given a pre-experiment survey to record a baseline level of minutes of exercise per week while also being asked to write down any personal goals they have for the experiment. No additional aids were given to the control group. The self-monitoring group was given an excel sheet (Appendix I) to record their daily physical activity. Participants were able to fill this out numerous different ways, such as generalizing what they did or breaking it down in more detail.

The self-monitoring and social support group was given the same excel sheet and was paired with another participant in the experiment to provide and receive social support. No participant was required to physically meet their partner, but rather was asked to communicate through email. Communication between partners may have involved sharing any tips they might have, giving encouragement to each other, discussing their exercise activity for the week, holding each other accountable, or asking for help.

RESULTS

Social Support

Analyzing the results of the social support survey to measure the effectiveness of the email intervention required some data cleaning. Due to the fact that one participant in group 1 and one participant in group 2 did not have complete data for social support scores, they were removed from the analysis. The decision to remove them as opposed to running an imputation to fill in those missing values was based on the fact that a typical method of imputation would result in the average score from the rest of the data being filled in for the missing value. However, with such a large standard deviation in the data, the mean in this case would not be that reliable. As such, it was decided that an acceptable imputation would not be possible, so the data point was removed.

Results from the ISSB survey show group 2 recorded the highest levels of social support at time 0, followed by group 1 and then group 3. At time 4, group 2 again recorded the highest ISSB scores, but group 3 surpassed group 1 for second highest ISSB scores. Group 1 showed minimal increase in social support, group 2 showed a decrease in social support levels over the duration of the experiment, while group 3 increased substantially (Appendix III). Group 3 produced an average increase of ISSB scores of .3077, while group 2 showed an average decrease of -.0923, and group 1 increasing by .011.

A new variable was created in SAS, ISSB_diff, which subtracted the ISSB score at time 0 from the ISSB score at time 4 for each participant, to create a variable that showed the difference in scores over the duration of the experiment. A positive difference shows the group increased in social support over the experiment, while a negative difference shows a

decrease (Appendix III). A One-Way ANOVA test (Appendix III) of the variable showed a non-significant (p = .7110) difference between the increases in social support over time for the three groups.

IPAQ Scoring

Group 1 recorded the highest initial (t=0) level of IPAQ scores, followed by group 3 and then group 2. At time 4, group 1 recorded the highest levels of exercise, followed by group 2 and then group 1 (Appendix IV). Similar to how the ISSB data was treated, a new variable, Score_difference, was created to represent the difference in IPAQ scores for a participant from time 0 to time 4 (Appendix IV). A positive difference represents an increase in IPAQ score from time 0 to time 4, while a negative difference shows a participant decreased their exercise over the experiment duration. Group 2 produced the largest change in exercise over the four weeks, with an average increase in IPAQ score of 1289, while group 3 produced an increase of 591. Group 1, on the other hand, actually showed a decrease in exercise, with an average score change of -249.

The data shows that the intervention groups showed a much more positive change in their exercise times over the four weeks than the control group did. However, the data also shows that group 2 showed a greater increase in exercise than group 3, despite only receiving one of the interventions while group 3 received both. A One-Way ANOVA test (Appendix IV) showed no significant difference (p=.2269) for change in exercise over the four weeks between the three groups.

DISCUSSION

Implications

Due to a small sample size the results of both the social support scores and the exercise time scores tested not significant. The sample size of this experiment would have made it very difficult to find a statistically significant result, regardless of the data. As such, it is important to not heavily emphasis the p-values when discusses the meaning of the results. Instead, by looking at what the data says, some promising conclusions can be drawn. First, the data for social support scores show that the email intervention trended towards creating an increase in social support for the participants who received it. Group 3 was the only group to show a substantial increase in social support over the four weeks, while groups 1 and 2 showed either a trivial increase or decrease. Most people have email addresses that they regularly check, so utilizing that to create social support could be very beneficial towards the future. While there was a lack of significance, the data showed that this method of a social support intervention could be effective given a larger sample size.

Looking at the IPAQ scores, the two groups who received interventions showed increases in exercise time from time zero to time four, while the control group actually showed a slight decrease. The data illustrates that using a self-monitoring tool to aid in helping to increase exercise time could be effective. Also, it shows more support for the idea that it may not matter how one much one self-monitors, as the results trended towards support of self-monitoring despite using an untested tool and not standardizing how that tool was used. However, support is not given for the benefits of combining the two interventions, self-

monitoring and social support, to create a superior effect on exercise time. In fact, group 2 actually showed a much higher increase in exercise over the four weeks than group 3.

This might be because social support may not be effective at producing initial adherence; it may need time to develop and may only be effective in more long term situations (Kravitz & Furst, 1991). Looking back at the research, many of the studies showing evidence of the effectiveness of social support were long term (Rackow et al., 2014; Sherwood et al., 2010), ranging from anywhere between eight weeks and six months. Another possible reason may be that combining two interventions has a negated or even negative effect on the behavior change. Perhaps the use of two interventions becomes tedious for a person, causing them to feel frustrated and overwhelmed with these aids that are meant to be helpful but end up being hurtful. This could result in the person not putting as much effort into the goal of increasing exercise, or even cause him or her to give up on changing because it becomes too much.

The results show that the major theories discussed earlier may be accurate in their analysis of behavior change. Social Cognitive Theory, Theory of Planned Behavior, and Health Belief Model state that self-regulation and self-reflection could help a person be more successful when trying to establish healthy habits, and the success of the groups using the self-monitoring tool may indicate that this is true, since that is a form of self-regulation. However, the experiment's data shows no trend in line with the idea that social influence could be an indicator of behavior change and could help someone successfully move through the process. Given the strong emphasis on social influence in the theories discussed, this was an interesting observation that should be explored further.

Limitations

This study had three major limitations. First, there were a lack of manipulation checks, or cues to action, for participants. There were no periodic reminders and check-ins to make sure the participants were doing what was asked of them. According to the Health Belief Model, using these could have helped increase the likelihood of participants doing what was asked of them, making it easier to fully analyze the benefits of the two interventions. Also, there was no way to measure self-monitoring, as the completed self-monitoring tools were not collected at the end of the experiment. The only way to determine whether people participated was to look at the results of the data.

The second limitation was a lack of goal setting at the beginning of the experiment. Participants were not asked to write down any personal goals at the beginning, so there is no way of knowing whether or not there was some end goal in mind for each person. Along with that, the initial demographic survey only asked about whether or not people had an established exercise schedule. However, of those who did not, the initial probing failed to address whether or not they wanted to increase their exercise activity at all. Essentially, it failed to explore whether people were in the precontemplation, contemplation or preparation stage of the change process. People in the precontemplation may have had no desire to increase their activity at all, so the interventions may not have been effective for them.

The biggest limitation with the study was the recruitment struggle resulting in a small sample size. Companies that were contacted about participating many times did not respond, and when they did respond they showed no interest in helping out. With no incentive to encourage these companies to participate, it is understandable why they would be hesitant to commit to a four week study that could require some effort to participate in. Because of this,

the sample had to come mostly from students from Bryant University, who had the incentive of extra credit in a class for participating. The use of Bryant students could be problematic for two reasons. First, since a rolling recruitment method was used, some students participated in the experiment during Spring Break, while others did not. This could have potentially created some issues with the data. Second, the sample was not very diverse, so a very specific group of people were studied during this. This means the results are not generalizable across a larger population, and only help to explain the effects of these interventions on college students.

Current Literature and Future Research

This paper is in line with the already deep field that shows the benefits of self-monitoring as an effective behavior change tool. While no solid conclusions can be drawn due to the small sample size and lack of significance, the results are trending towards support and suggests that with a larger sample they may test more significant. Given the results, it may be interesting to look further into the different variations of self-monitoring. Looking at commercial products that essentially serve as self-monitoring tools and comparing them to basic, personal-made tools (such as this excel sheet or even just a blank notebook) may shed light on just how necessary those commercial products are.

This experiment does not draw any conclusions about the isolated effects of social support on exercise time, since it only looked at it in combination with self-monitoring. However, this experiment is unique in that it created an experimental intervention of social support, whereas most studies looked at measuring perceived levels of support and finding correlations with other variables. While the results of this experiment do show an initial trend supporting email communication as an effective intervention, further research is needed to solidify this view and create a consensus. Also, this is the first known literature that looks at

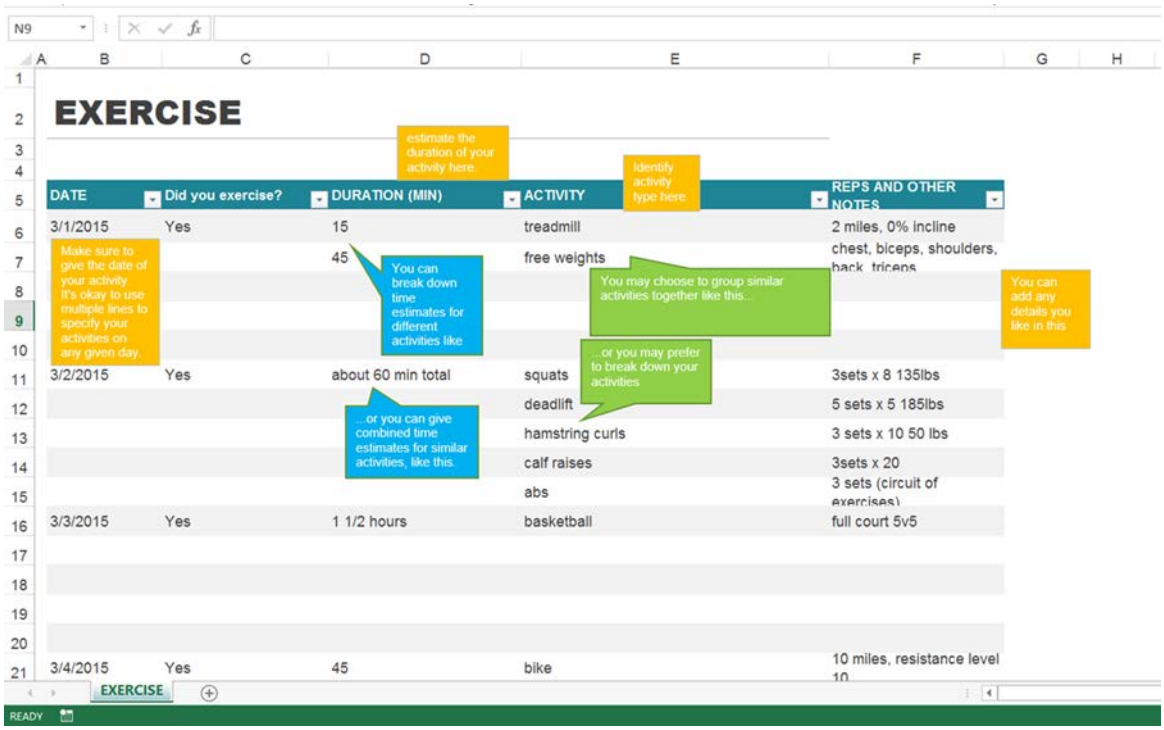
the combined effects of social support and self-monitoring on exercise adherence. As a result, it has opened up a door for future research to continue to look at this, and determine whether or not combining different interventions is beneficial in the behavior change process. It also may be beneficial to incorporate cues to action and initial goal setting to help people better follow their guidelines. Looking at incorporating other interventions and looking at whether or not certain strategies work well with each could be beneficial to future knowledge and the field as a whole.

Conclusion

Overall, the experiment trends toward supporting the hypothesis that using these interventions will help increase exercise time, but the results did not test statistically significant due to a small sample size. Also, the data does not provide support that combining two interventions will have an increased benefit on exercise, as no added effect was evident in group 3 compared to group 2. Further research is needed to test the combined effects of these two interventions and create a consensus as to whether or not it is beneficial to use more than one.

APPENDICES

Appendix I – Self-Monitoring Tool



Appendix II – Demographic Information

Charts showing the demographic information of participants.

Demographic		n	%		n	%
sex	male	7	61%	female	11	39%
Organization Affiliation	Bryant	16	89%	Other	2	11%
smokers	yes	2	11%	no	16	89%
drink on a weekly basis	yes	13	72%	no	5	28%
Consistent Workout Schedule at any time	yes	16	89%	no	2	11%

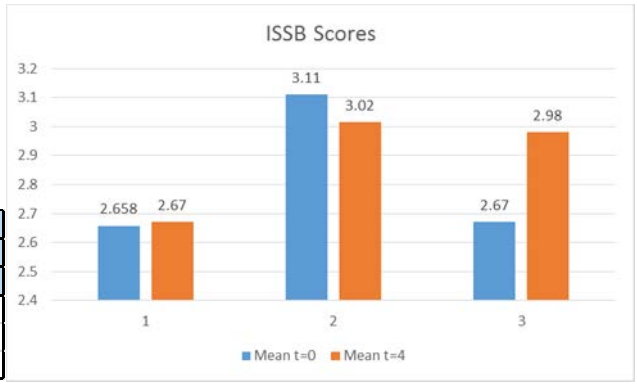
Ethnicity	n	%
White	15	83%
Hispanic Latino	2	11%
Asian/Pacific Islander	1	6%

Demographic	Mean	Std Dev	Median
Age	34.72	44.03	21
Height	5' 6"	0.19	5' 6"
Weight	143 lbs	24	135 lbs

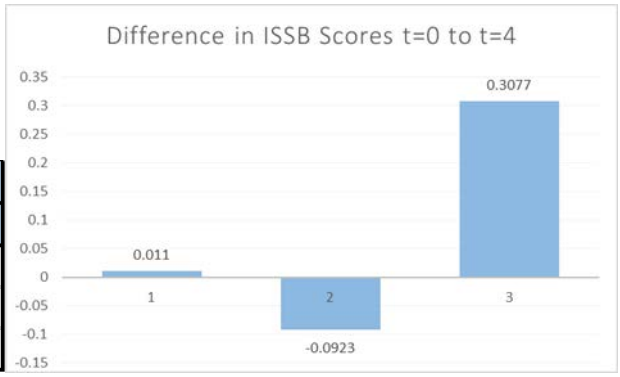
Appendix III – ISSB Results

Charts and graphs showing results of social support measurements, as well as an ANOVA test showing the statistical significance test.

Average ISSB Score for t=0 and t=4					
		Mean		Std Dev	
Group	N	t=0	t=4	t=0	t=4
1	7	2.658	2.67	1.12	1.2
2	5	3.11	3.02	0.67	0.78
3	4	2.67	2.98	0.65	0.38



Difference in ISSB Scores from t=0 to t=4			
Group	n	Mean	Std Dev
1	7	0.011	0.6272
2	5	-0.0923	1.051
3	4	0.3077	0.2738



One-Way Analysis of Variance

Results

The ANOVA Procedure

Dependent Variable: ISSB_diff

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.37739856	0.18869928	0.35	0.7110
Error	13	7.00388842	0.53876065		
Corrected Total	15	7.38128698			

R-Square	Coeff Var	Root MSE	ISSB_diff Mean
0.051129	1387.933	0.734003	0.052885

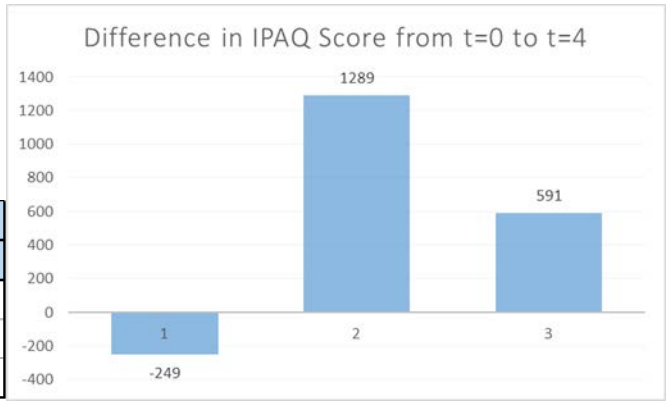
Source	DF	Anova SS	Mean Square	F Value	Pr > F
Group	2	0.37739856	0.18869928	0.35	0.7110

Appendix IV – IPAQ Results

Charts and graphs showing results of exercise time measurements, as well as an ANOVA test showing the statistical significance test.

Average IPAQ Score for t=0 and t=4					
		Mean		Std Dev	
Group	N	t=0	t=4	t=0	t=4
1	8	3805	3556	2622	3090
2	6	1367	2656	1177	2382
3	4	1813	2404	2426	2603

Difference in IPAQ Score from t=0 to t=4			
Group	N	Mean	Std Dev
1	8	-249	1210
2	6	1289	2284
3	4	591	631



One-Way Analysis of Variance

Results

The ANOVA Procedure

Dependent Variable: Score_difference

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	8203609.51	4101804.75	1.64	0.2269
Error	15	37511328.27	2500755.22		
Corrected Total	17	45714937.78			

R-Square	Coeff Var	Root MSE	Score_difference Mean
0.179451	351.1138	1581.378	450.3889

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Group	2	8203609.507	4101804.753	1.64	0.2269

REFERENCES

Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions and perceived behavioral control. Journal of Experimental Social Psychology, 22(5), 453–474.

Alm, M. E., Neumark-Sztainer, D., Story, M., & Boutelle, K. N. (2009). Self-Weighing and Weight Control Behaviors Among Adolescents with a History of Overweight. *Journal of Adolescent Health*, *44*(5), 424–430. http://doi.org/10.1016/j.jadohealth.2008.08.016

Anshel, M. H., & Seipel, S. J. (2009). Self-Monitoring and Selected Measures of Aerobic and Strength Fitness and Short-term Exercise Attendence. *Journal of Sport Behavior*, *32*(2), 125–151.

Armitage, C. J. (2005). Can the Theory of Planned Behavior Predict the Maintenance of Physical Activity? *Health Psychology*, *24*(3), 235–245. http://doi.org/10.1037/0278-6133.24.3.235

Baker, R. C, & Kirschenbaum, D. S. (1993). Self-monitoring may be necessary for successful weight control. *Behavior Therapy. 24*,377-394.

Bandura, Albert. *Self-Efficacy: The Exercise of Control*. New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co, 1997. Print.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.

Bandura, A. (2004). Health Promotion by Social Cognitive Means. *Health Education & Behavior*, *31*(2), 143–164. http://doi.org/10.1177/1090198104263660

Bandura, A. (2005). The Primacy of Self-Regulation in Health Promotion. *Applied Psychology: An International Review*, *54*(2), 245–254. http://doi.org/10.1111/j.1464-0597.2005.00208.x

Booth, M. (2000). Assessment of physical activity: an international perspective. *Research Quarterly for Exercise & Sport*, *71*(2 Suppl), 114–120.

Boutelle, K. N., Kirschenbaum, D. S., Baker, R. C., & Mitchell, M. E. (1999). How can obese weight controllers minimize weight gain during the high risk holiday season? By self-monitoring very consistently. *Health Psychology, 18*(4), 364-368. doi:10.1037/0278-6133.18.4.364

Borresen, J., & Lambert, M. (2006). Validity of self-reported training duration. *International Journal Of Sports Science & Coaching*, *1*(4), 353-359.

Cattell, R.B. (1960). Some psychological correlates of physical fitness and physique. In S.C. Staley, T.K. Cureton, L.J. Huelster, & A.J. Barry (Eds.), *Exercise and fitness* (pp. 138-151). Chicago: Athletic Institute.

Champion, V. L. (1984). Instrument development for health belief model constructs. *Advances in Nursing Science*, *6*(3), 73–85.

Cora L. Craig. (2003). International Physical Activity Questionnaire: 12-Country Reliability and Validity. *Medicine & Science in Sports & Exercise*, *35*(8), 1381–1395.

Cureton, T.K. (1963). Improvement of psychological states by means of exercise-fitness programs. *Journal of the Association of Physical and Mental Rehabilitation*, 17, 14-l7.

DiClemente, Carlo C., Prochaska, James O., Fairhurst, Scott K., Velicer, Wayne F., Velasquez, Mary M., and Rossi, Joseph S.. "The Process of Smoking Cessation: An Analysis of Precontemplation, Contemplation, and Preparation Stages of Change." *Journal of Consulting and Clinical Psychology* 59.2 (1991): 295–304. Print.

Henry, F. M. (1951). Increase in speed of movement by motivation and by transfer of motivated improvement. *Research Quarterly of the American Association for Health, Physical Education, & Recreation*, *22*, 219–228.

Henry, F. M. (1952). Independence of reaction and movement times and equivalence of sensory motivators of faster response. *Research Quarterly of the American Association for Health, Physical Education, & Recreation*, *23*, 43–53.

Heitzmann, C. A., & Kaplan, R. M. (1988). Assessment of methods for measuring social support. *Health Psychology*, *7*(1), 75–109. http://doi.org/10.1037/0278-6133.7.1.75

Helsel, D. L. (2006). Comparison of self-monitoring techniques for tracking eating and exercise behaviors. *Dissertation Abstracts International*, *66*, 4732.

King, K. A., Vidourek, R. A., English, L., & Merianos, A. L. (2014). Vigorous physical activity among college students: using the health belief model to assess involvement and social support. *Archives of Exercise in Health & Disease*, *4*(2), 267–279.

Kornspan, A. S., & MacCracken, M. J. (2001). Psychology applied to sport in the 1940s: The work of Dorothy Hazeltine Yates. *The Sport Psychologist*, *15*(3), 342–345.

Kravitz, L., & Furst, D. (1991). Influence of reward and social support on exercise adherence in aerobic dance classes. *Psychological Reports*, *69*(2), 423–426. http://doi.org/10.2466/PR0.69.6.423-426

Landers, D. M. (1995). Sport psychology: The formative years, 1950–1980. *The Sport Psychologist*, *9*(4), 406–417.

Ng, T. W. H., & Lucianetti, L. (2016). Within-individual increases in innovative behavior and creative, persuasion, and change self-efficacy over time: A social–cognitive theory perspective. *Journal of Applied Psychology*, *101*(1), 14–34. http://doi.org/10.1037/apl0000029

Prochaska, James O. *Systems of Psychotherapy: A Transtheoretical Analysis*. Oxford, England: Dorsey, 1979. Print.

Prochaska, James O., and Carlo C. DiClemente. "Transtheoretical Therapy: Toward a More Integrative Model of Change." *Psychotherapy: Theory, Research & Practice* 19.3 (1982): 276–288. *EBSCOhost*. Web. 5 Mar. 2016.

Prochaska, James O., and John C. Norcross. "Stages of Change." *Psychotherapy Relationships That Work: Therapist Contributions and Responsiveness to Patients.* Ed. John C. Norcross and John C. (Ed) Norcross. New York, NY, US: Oxford University Press, 2002. 303–313. Print.

Rackow, P., Scholz, U., & Hornung, R. (2014). Effects of a new sports companion on received social support and physical exercise: An intervention study. *Applied Psychology: Health And Well-Being*, *6*(3), 300-317. doi:10.1111/aphw.12029

Rhodes, R. E., & Courneya, K. S. (2000). Effects of a Health-Based versus Appearance-Based Persuasive Message on Attitudes Towards Exercise: Testing the Moderating Role of Self-Monitoring. *Journal of Social Behavior & Personality*, *15*(3), 321–330.

Richardson, C. R. (2010). Objective monitoring and automated coaching: a powerful combination in physical activity interventions. *Physical Therapy Reviews*, *15*(3), 154–162. http://doi.org/10.1179/1743288X10Y.0000000006

Riiser, K., Løndal, K., Ommundsen, Y., Småstuen, M. C., Misvær, N., & Helseth, S. (2014). The Outcomes of a 12-Week Internet Intervention Aimed at Improving Fitness and Health-Related Quality of Life in Overweight Adolescents: The Young & Active Controlled Trial. *Plos ONE*, *9*(12), 1-21. doi:10.1371/journal.pone.0114732

Rogers, T., Milkman, K. L., & Volpp, K. G. (2014). Commitment devices: Using initiatives to change behavior. *JAMA: Journal of the American Medical Association*, *311*(20), 2065–2066.

Rosenstock, I. (1974). Historical Origins of the Health Belief Model. *Health Education Monographs.* Vol. 2 No. 4.

Sarafino, E. P., & Smith, T. P. (2014). *Health Psychology Biopsychosocial Interactions*. Hoboken, NJ: John Wiley & Sons, Inc.

Sherwood, N. E., Jeffery, R. W., Welsh, E. M., Van Wormer, J., & Hotop, A. M. (2010). The Drop It At Last Study: Six-Month Results of a Phone-Based Weight Loss Trial. *American Journal of Health Promotion*, *24*(6), 378–303.

Suh, Y., Motl, R. W., Olsen, C., & Joshi, I. (2015). Pilot trial of a social cognitive theory-based physical activity intervention delivered by nonsupervised technology in persons with multiple sclerosis. *Journal of Physical Activity & Health*, *12*(7), 924–930. http://doi.org/10.1123/jpah.2014-0018

Tougas, M. E., Hayden, J. A., McGrath, P. J., Huguet, A., & Rozario, S. (2015). A systematic review exploring the social cognitive theory of self-regulation as a framework for chronic health condition interventions. *PLoS ONE*, *10*(8). Retrieved from http://bryant.idm.oclc.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2015-37405-001&site=ehost-live

Triplett, Novrman. “The Dynamogenic Factors in Pacemaking and Competition.” *The American Journal of Psychology* 9.4 (1898): 507–533. *EBSCOhost*. Web.

Walker, K. K., Steinfort, E. L., & Keyler, M. J. (2015). Cues to action as motivators for children’s brushing. *Health Communication*, *30*(9), 911–921. http://doi.org/10.1080/10410236.2014.904030

Weber, J., & Wertheim, E. H. (1989). Relationships of Self-Monitoring, Special Attention, Body Fat Percent, and Self-Motivation to Attendance at a Community Gymnasium. *Journal of Sport & Exercise Psychology*, *11*(1), 105–114.

Weinberg, R. S., & Gould, D. (2011). *Foundations of sport and exercise psychology (5th ed.)*. Champaign, IL, US: Human Kinetics.