6-14-2014

Improving Consistency of Goal Attainment to Increase Physical Activity

Elizabeth Anne Solley
University of South Florida, eabanta@mail.usf.edu

Improving Consistency of Goal Attainment to Increase Physical Activity

by

Elizabeth Anne Solley

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Applied Behavior Analysis
Department of Child and Family Studies
College of Behavioral and Community Sciences
University of South Florida

Major Professor: Raymond Miltenberger, Ph. D.
Kimberly Crosland, Ph. D.
Lisa Witherspoon, Ph. D.

Date of Approval:
June 24, 2014

Keywords: accelerometer, goal-setting, action plan, self-monitoring

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

Researchers have successfully increased physical activity with self-monitoring, goal setting, and feedback. Goal attainment is a crucial part of what makes goal setting successful; however, it is often unreported in the literature or implied that goals were not reached consistently. A potential way to achieve this consistency is to create an action plan, or a detailed account of exactly how and when the individual will engage in the desired physical activity to reach his or her goal. This study evaluated whether making a detailed action plan would allow individuals to reach their physical activity goals more consistently than when using goal setting and self-monitoring alone. Action planning increased goal attainment for all participants but only resulted in increased physical activity for 2 of 3 participants. Future research should replicate this study to validate these findings and further explore methods for improving the success of goal setting as an intervention.

CHAPTER ONE:

INTRODUCTION

Physical activity (PA) is an area of national concern. The Centers for Disease Control and Prevention (2007) report that only 50% of American adults are meeting the national PA recommendation of at least 30 min a day of moderate-intensity activity for 5 days a week or 20 min per day of vigorous activity on 3 or more days a week. A common component of many behavioral interventions to increase PA is goal setting (Booth, Nowson, & Matters, 2008; Chan, Ryan, & Tudor-Locke, 2004; Croteau, 2004; Donaldson & Normand, 2009; Normand, 2008; Sidman, Corbin, & Le Masurier, 2004; Tudor-Locke et al., 2004; VanWormer, 2004; Wack, Crosland, & Miltenberger, 2014).

Goal setting entails setting specific objectives for changing behaviors (Fellner & Sulzer-Azaroff, 1984), and although it is often conceptualized as a cognitive process (Locke & Latham, 2002), it can also be effectively measured and examined behaviorally (Fellner & Sulzer-Azaroff, 1984). A goal specifies a behavioral outcome and a time frame for completing the behavior (e. g., run 3 miles three times per week).

Most interventions that used goal setting to increase PA used a treatment package that also included self-monitoring (recording some measure of the PA completed) and feedback in the form of positive reinforcement or encouragement from investigators (Booth et al., 2008; Chan et al., 2004; Croteau, 2004; Donaldson & Normand, 2009; Normand, 2008; Sidman et al., 2004; Tudor-Locke et al., 2004; VanWormer, 2004; Wack, et al., 2014). These interventions

have been found to increase such target behaviors as steps taken throughout the day (Booth et al., 2008; Chan et al., 2004; Croteau, 2004; Normand, 2008; Sidman et al., 2004; Tudor-Locke et al., 2004; VanWormer, 2004), distance run (Wack et al., 2014), and calorie expenditure (Donaldson & Normand, 2009).

Many interventions used a pedometer or a heart-rate monitor to measure PA (Booth et al., 2008; Chan et al., 2004; Croteau, 2004; Donaldson & Normand, 2009; Normand, 2008; Sidman et al., 2004; Tudor-Locke et al., 2004; VanWormer, 2004). During the intervention, participants logged the measure of the target behavior in a variety of ways: on a tailored website (Booth et al., 2008; Chan et al., 2004), in daily emails to investigators (Donaldson & Normand, 2009; Normand, 2008; VanWormer, 2004), or on a personal calendar or log (Chan et al., 2004; Croteau, 2004; Sidman et al., 2004; Tudor-Locke et al., 2004). Although these devices have been tested for reliability and accuracy (Booth et al., 2008; Croteau, 2004; Normand, 2008; Sidman et al., 2004; Tudor-Locke et al., 2004; VanWormer, 2004), few of these studies ensured the reliability of the participants' reported data (Booth et al., 2008; Chan et al., 2004; Croteau, 2004; Donaldson & Normand, 2009; Normand, 2008; Sidman et al., 2004; Tudor-Locke et al., 2004; VanWormer, 2004). The exceptions are Donaldson and Normand (2009) and Normand (2008), who used a heart-rate monitor and a pedometer, respectively, which stored data in the device memory and could be recalled by the investigators. These devices allowed the researchers to assess the reliability of the participants' self-reports while allowing participants to self-monitor their progress.

Newer devices, such as the Fitbit accelerometer (Fitbit Inc, 2013), provide another convenient solution for both participants and experimenters. This affordable and commercially available device has been found to be reliable and valid (Lee, 2013; Takacs et al., 2013). It

connects to the internet and uploads information directly to an online profile, which allows users to see graphical displays of daily and monthly steps, set goals, track calorie consumption, and connect with friends. The investigator can access this profile and the uploaded data remotely allowing the investigator to obtain an objective measure of the behavior being targeted. Furthermore, since the data can be uploaded without signing on to the profile, investigators can collect data even during the baseline phase when self-monitoring is prevented.

Surprisingly, although all of these studies included goal setting as part of the intervention component (Booth et al., 2008; Chan et al., 2004; Croteau, 2004; Donaldson & Normand, 2009; Normand, 2008; Sidman et al., 2004; Tudor-Locke et al., 2004; VanWormer, 2004), very few of them actually reported any direct measures of goal attainment (Booth et al., 2008; Sidman et al., 2004; Tudor-Locke et al., 2004). Tudor-Locke et al. (2004) indicated that participants reached goals approximately three to four days a week and Booth et al. (2008) reported that 72% of the participants in the study maintained a goal of 10,000 steps or more per day after Week 4 of the experiment. Wack et al. (2014) also reported that goals were met 75% of the time across all five participants, and a modification in procedures for three participants (changing running goals from distance/run to distance/week) led to increased goal attainment for those participants.

A few other studies provided general, indirect information which can be used to make tentative inferences about goal attainment (Donaldson & Normand, 2009; Normand, 2008). For example, Donaldson and Normand (2009) reported that one participant was discouraged by the feedback she received on days in which she did not reach her goal, and asked for a weekly rather than a daily step goal so feedback would be about progress toward the weekly goal and hopefully more positive. This request for a change in protocol implies that this participant was contacting aversive contingencies for failure to reach her goal consistently. In contrast to the results seen by

Wack et al. (2014), her step count did not improve when the goal was changed to a weekly rather than a daily goal, and she asked to have daily goals reinstated, indicating that failure to reach weekly goals was also aversive. Normand (2008) also implied that goal attainment was inconsistent for at least some participants by reporting that daily step totals did not correspond to daily goals, and that only one participant consistently reached or exceeded her daily step goal each week. Neither of these studies cited reasons that the participants did not consistently reach their goals.

Even though PA increased for a majority of the participants in these studies (Donaldson & Normand, 2009; Normand, 2008), it is important to know how often participants met their goals, and the factors that contributed to goal attainment, to determine how to improve the effectiveness of goal-setting interventions. One way to increase goal attainment is to establish individualized rather than universal goals (Sidman et al., 2004), and both Locke and Latham (2002) and Fellner and Sulzer-Azaroff (1984) state that goal setting is more effective when the individual participates in the goal-setting process by setting or suggesting the goals. Another strategy that may increase goal attainment is the formation of a specific *action plan*. Action plans were described briefly as part of the intervention procedure in the study conducted by Croteau (2004), who evaluated the Healthy Steps program. Croteau's intervention consisted of individualized goal setting, developing a personal action plan for increasing steps, recording daily steps taken in an activity log, and receiving feedback (prompting and motivational tips) from the investigator weekly via email. The experiment was conducted using a pre-test/post-test design, and although steps taken increased significantly from baseline levels, there was no control group with which to compare the results, so this outcome should be interpreted cautiously.

No detail is provided about the nature of the action plan implemented by Croteau (2004); however, it may be beneficial to make a specific plan about exactly what an individual will do to reach his or her goals. This process could involve breaking larger goals into subgoals, for instance breaking a weekly goal into daily goals, which has also been listed as one of the strategies to increase the effectiveness of goal setting (Locke & Latham, 2002). It could also involve planning ways to engage in the activities. For example, if the goal of interest was to walk a certain number of steps, one could plan lifestyle changes such as taking the stairs, parking on the far end of the parking lot, or walking during breaks at work. One could plan specific times to engage in the targeted PA as well, such as walking every day for an hour after dinner, planning exactly when to go to the gym, or how the workout will be structured. This strategy could apply to any number of fitness-related goals, including number of steps taken, distance traveled, minutes spent exercising in a gym, or calories burned as measured by a heart-rate monitor or another reliable device. If a specific plan is in place that will allow the individual to reach his or her goal, goal attainment may be more likely and more consistent. Consistent goal attainment would allow the individual to contact the reinforcing contingency associated with successfully reaching goals and likely make goal setting a more effective intervention.

Accordingly, the purpose of this study was to (1) use goal setting and self-monitoring to increase PA and (2) determine whether creating a detailed action plan would improve consistency of goal attainment. These objectives were accomplished using a Fitbit device which uploaded objective data directly to the participants' profiles and by implementing *action planning* only when goal setting did not consistently increase PA to goal levels.

CHAPTER TWO:

METHOD

Participants and Settings

Seven participants were recruited for this study, although only four completed all phases. To participate in the study, participants were required to be at least 18 years old, express a desire to increase their level of PA through a means that can be measured with a pedometer, and have consistent home internet access and a computer. All participants answered no to all questions on the Physical Activity Readiness Questionnaire (PAR-Q, Thomas, Reading, & Shephard, 1992; Appendix A) and were able to meet with the principal investigator (PI) for up to 1 hr each week. Participants were excluded from the study if they were participating in any other exercise program during recruitment, answered no on one or more questions on the PAR-Q questionnaire, or could not engage in higher levels of PA due to medical reasons not covered by the PAR-Q. Participants were dropped from the study if they chose to participate in any other exercise program while still participating in the study.

Participants were recruited through fliers posted on the University of South Florida Tampa campus and through email list-serves. Fliers and emails advertised the experiment as a study to increase PA and included contact information for the PI (Appendix B). The PI met with interested individuals to explain the risks and benefits of the study, administer the PAR-Q, determine that the participant met the stated criteria, and review the consent form. Individuals were given as much time as they needed to determine whether they would like to participate.

After 1 week, the PI emailed participants who had not informed the PI of his or her decision to ask if he or she had any questions and if he or she had reached a decision. Potential participants also filled out an additional form regarding previous PA levels, previous or existing injuries, and chronic health problems (Appendix C). This information was used to make more informed decisions during the goal-setting process. Participants were asked open-ended questions regarding their typical daily routine either via phone during baseline or immediately after signing the consent document. This was to better determine whether the participants were wearing the Fitbit the entire time they were awake.

Bonnie was a 24-year-old female. She had a BMI of 29.5, making her the only participant in the overweight category. She was an undergraduate student at the university with little to no athletic history and no previous injuries. Clyde was a 23-year-old male undergraduate student with a BMI of 18.7. He reported that before the study he ran approximately once a week and expressed that he wanted to run more frequently. Bonnie and Clyde knew each other prior to the beginning of the study. Thelma was a 25-year-old graduate student and university employee. She had a BMI of 24.9 and reported that she used to play soccer and engage in activities like biking on the weekends. Louise was a 61-year-old woman with a BMI of 20.6 who reported that she went to the gym once a week and also practiced yoga occasionally at the time of enrollment. Louise had a diagnosis of remitting recurring multiple sclerosis, but her doctor stated that lifting weights and frequent walking is recommended and beneficial for her health. She reported that she used to run long distances, though she no longer does, and that she broke her ankle 5 years ago.

Three participants were recruited for the study but did not complete any phases past baseline. One participant moved away before the end of baseline, and two participants were

terminated after baseline because they did not wear and/or sync the Fitbit consistently even after numerous prompts from the PI.

Goal-setting meetings and action-plan meetings took place in a location convenient to the participants, such as the participant's home or a meeting room on the university campus. Participants engaged in PA in locations convenient to them throughout their daily routine.

Target Behaviors

Step totals were defined as the number of steps recorded by the Fitbit tracker after being worn at least 10 hr throughout the day. If the Fitbit tracker was not worn at least 10 hr in a day, the data were not reported for that day unless the participant attained his or her goal in the hours the Fibit was worn. Goal attainment occurred when a step total met or exceeded the goal set for that specified period of time.

Design

The experiment consisted of three phases: a baseline phase, a self-monitoring, goal setting, and feedback (SM/GS) phase, and an action plan phase. Although all participants completed the first two phases, only participants who did not consistently meet their goals completed the action plan phase. The effects of the intervention were evaluated in a multiple-baseline-across-participants design.

Data Collection and Interobserver Agreement

Data on step totals were collected and automatically uploaded wirelessly by the Fitbit tracker to an online account created for each participant and accessed remotely by the PI. These recorded totals were the primary measure of daily step totals. Data on weekly cumulative steps were collected by adding step counts from each day in the week to the step counts from the previous days. In addition, a 7-day moving average was used to assess general trends in the data.

In this process, each data point consisted of the step total for that day averaged with step totals from the previous 6 days. Data were not averaged across phases.

Participants recorded steps during SM/GS and action plan phases by inputting them into an Excel spreadsheet shared with the PI and RAs using Dropbox or Google Drive. Data also were collected on the goals set and goals attained for each participant during the SM/GS and action plan phases.

Participants were provided with incentives for complying with the data collection procedures. Participants earned $5 for every 2 weeks in which they did the following: wore their Fitbit for at least 10 hr a day for 13 out of 14 days, synced their Fitbit to the website 13 out of 14 days, and updated the graphs in their Dropbox account (during the SM/GS and action plan phases) 10 out of 14 days. Participants were informed about the progress they were making toward earning the incentives each week by email. If a participant withdrew from the study 1 week into the 2-week interval, the participant received $2.50 for that interval. The money was loaded onto a VISA gift card and given to the individuals at the end of the study or upon their withdrawal.

If a participant did not sync his or her Fitbit for 7 consecutive days, the PI emailed the participant asking him or her to sync the Fitbit as soon as possible. If the participant did not wear the Fitbit for 7 consecutive days, the PI sent the participant a text message every morning which read “Don’t forget to wear your Fitbit all day today! :)” for 14 consecutive days.

Procedure

During all phases, the participants were instructed to wear the Fitbit accelerometer throughout the day for at least 10 hr. Because the purpose of the study was to determine the success of action planning as an intervention on its own, participants did not have access to their

online Fitbit profile during any phase of the study, and were asked not to participate in any other weight loss or exercise programs for the duration of the study. At no point during the study did the PI advise participants on medical matters. The PI encouraged participants to address any medical questions regarding injury, illness, or potential health risks to a physician or other qualified health professional.

Baseline. At the beginning of this phase, the PI met with the participant to teach the participant how to use and wear the Fitbit tracker and how to upload the data to his or her online profile. The PI also explained the requirements in place during baseline to earn the biweekly incentives (wearing and syncing the tracker). During this phase, the Fitbit display was covered with at least two pieces of opaque tape. The PI signed across the seam of the tape and took pictures of each taped tracker to better determine if the tape had been removed prior to the end of the baseline phase. The participant wore the Fitbit continuously throughout the day (except when in water) to establish baseline activity levels and synced the Fitbit with the website at least once daily. The only contact between the participant and the PI occurred if the participant experienced technical difficulties and during brief, generic weekly email updates which reminded the participants of the incentives contingencies in place and informed the participants whether they earned the incentive. Baseline lasted between 5 and 21 weeks.

Self monitoring and goal setting. The PI met with each participant weekly to go over daily step total graphs and collaborated to establish a weekly step goal. The meetings were approximately 5-10 min in length. During the meeting, the PI praised goal attainment and encouraged effort toward reaching goals in the future. The PI provided the guidelines for raising, maintaining, and lowering the goals, and the participant decided on his or her step goal within the guidelines given by the PI. The weekly step goal was divided by 7 to determine the

daily step goals. The first weekly goal was based on baseline activity levels and was an increase in steps between 10% and 30% above the baseline average. The second weekly goal was based on the previous week's step counts. The goal was increased if the participant met the previous weekly goal and decreased if the goal was not met. Subsequent step goals were based on the previous 2 weeks' step counts. The weekly step goal was increased if weekly goals were reached both of the previous 2 weeks, maintained if the weekly goal was reached in only 1 of the previous 2 weeks, and decreased if the weekly goals were not reached for either of the previous 2 weeks. If the goal was changed, it was increased no less than 5% and no more than 30% above or below the previous week's step count average, and decreased between 5% and 30% of the previous goal. The participant was given the step count range for increasing or decreasing the goal during the weekly meeting. If a goal was decreased and subsequently not met that week, the goal was maintained for 1 week. If the goal was not met again the following week, the goal was decreased; it was maintained if the goal was met.

During the first SM/GS meeting, the PI explained that during this phase, the participant would be working with the PI to set weekly step goals. The PI then removed the tape from the Fitbit display and showed the participant how to read the display and monitor his or her progress toward the daily step goals. The PI also set up a Dropbox account for each participant and taught him or her how to update the daily step totals in a spreadsheet program on the computer. Due to technical difficulties, one participant used a Google Drive account rather than a Dropbox account. The Dropbox folder or Google Document was shared with the PI and any RAs whose responsibilities necessitated access to the participants' reported data. The PI explained that the participant now needed to update the graph every evening before midnight in addition to wearing and syncing the Fitbit daily in order to earn the biweekly incentives.

No advice was provided about increasing step counts or how to reach the established goals. If the participants asked questions pertaining to these subjects, the PI said that the purpose of the current phase was to determine the efficacy of goal setting and self-monitoring as the sole components of the intervention, and therefore no guidance could be provided on these subjects. The SM/GS phase lasted between 11 and 13 weeks.

Action plan. A participant qualified for the action plan phase when he or she either failed to meet his or her weekly step goals for at least 3 consecutive weeks or met his or her weekly goal fewer than 3 out of 5 consecutive weeks. Similarly to the previous phase, participants met in person with the PI once a week to review graphs and set a new weekly step goal. The PI continued to provide feedback (praise or encouragement) on the previous week's performance and guidance during the goal setting process. The ultimate weekly step goal for two participants was 70,000 steps a week, or 10,000 steps a day. Two participants (Clyde and Thelma) had higher ultimate goals due to higher baseline averages and expressed interest in running. Participants also established smaller, daily subgoals.

After establishing the goals, the PI worked with the participant to make a detailed action plan about how the participant would reach his or her goals. This plan included daily lifestyle changes (e.g., taking the stairs instead of the elevator) and planned times in which he or she committed to engaging in PA for the 30 min per day at least 3 days a week recommended by the CDC (2007). Research shows that a 30-min walk is equivalent to approximately 3,000-4,000 steps (Marshall et al., 2009). Therefore, the daily goals on days with planned PA were 3,000 steps higher than the daily goals without a planned bout of PA. The participants were provided with a list of several different lifestyle changes they could make to increase their daily step count (Appendix D). The meeting also included discussing potential reasons the participant might not

engage in the planned activities and developing strategies to circumvent those reasons. During this meeting, the PI noted relevant points to the plan (changes, scheduled walking times, weekly and daily goals, etc.) on the Action Plan Form (Appendix E). The PI gave a copy to the participant for his or her records, and encouraged the participant to display the plan somewhere he or she would see it frequently. The PI also took a picture of the plan, and printed the plan for reference during the next meeting. Initial meetings lasted approximately 1 hr, and subsequent meetings were shorter as the participant became less dependent on prompts from the PI.

After the first meeting, the meetings began by reviewing the data from the previous week and discussing what parts of the action plan the participant thought worked or didn't work and why. This information was used to change the action plan and provide better contextual fit for the participant. After three action plan meetings, the investigator began to fade prompts, transferring stimulus control for making an action plan from the investigator to the participant. This transfer of control was achieved by fading questions from very specific, pointed questions (e.g., what parts of the plan didn't work on the day with the lowest PA last week), to more general questions (e.g., what didn't work last week), to an eventually general conversational prompt (e.g., Tell me about how last week went and your plan for next week). Throughout this process, the PI had a list of topics to be discussed and provided the least specific prompt necessary to cover all these topics (Appendix F). The PI noted on the Action Plan Checklist whether the participant mentioned each topic with or without a prompt. After fading prompts, the participant then completed the Action Plan Form with minimal guidance from the PI during the weekly meetings. The action plan phase lasted between 8 and 17 weeks.

CHAPTER THREE:

RESULTS

Steps during all phases and for all participants were highly variable across days (Figure 1). The SM/GS intervention alone successfully increased daily steps for three out of four participants (Clyde, Thelma, and Louise), and action planning resulted in increased PA for one participant (Clyde), and no change for two participants (Bonnie and Thelma; Figures 1 and 2, see pages 18 and 19). One participant did not complete the action plan phase due to the success of SM/GS.

During baseline, Clyde averaged 8903 steps per day. Clyde's daily steps increased during the SM/GS phase to an average of 9402, but during the second half of the phase Clyde's daily steps decreased to baseline levels (Figure 1, see page 18). Clyde's steps increased to an average of 11572 during the action plan phase, and remained at a higher level than both previous phases throughout the entire phase. Clyde's moving average data (Figure 2, see page 19) showed high variability with little change between baseline and the SM/GS phases. During the action plan phase, however, a clear increase in level and a decrease in variability were seen from both the baseline and the SM/GS phase.

Thelma's baseline step average increased from 8607 in baseline to 11169 during the SM/GS phase, and then decreased to 9773 during action planning (Figure 1, see page 18). During the SM/GS phase variability increased from baseline with more high and low days. At the beginning of the SM/GS phase the data increased from baseline but during the second half of

the SM/GS phase, Thelma's daily steps decreased to near baseline levels. During the second half of SM/GS many data points were still higher than baseline levels, but more data points fell within the baseline range than during the first half of the phase. Thelma's daily step totals during action planning maintained the same level and degree of variability as the last half of the SM/GS phase, although an increasing trend is present at the end of the phase.

Figure 2 showed that Thelma's moving average step count was decreasing slightly during baseline with very low variability. At the beginning of the SM/GS phase, there was an immediate increase in moving average level; however this level decreased to baseline levels during the last 30 data points. At the beginning of the action plan phase, Thelma's moving average step count data remained at the same level as the previous phase, with low variability.

Bonnie's step average decreased slightly from 7141 in baseline to 6667 during the SM/GS phase. During action planning, Bonnie's step count average increased to 7346, approximately baseline levels (Figure 1, see page 18). Figure 1 showed an increasing trend from SM/GS levels during action planning. Bonnie's moving average showed high variability and a slight decreasing trend during baseline (Figure 2, see page 19). Although steps increased initially during the SM/GS phase, this effect was temporary and steps decrease in the second half of the phase. Moving average step count levels were maintained initially, with a sharp increase in level during the last half of the action plan phase.

Louise's step average increased from 4197 in baseline to 7808 during the SM/GS phase with a mean of 9195 in the last third of the phase (Figure 1, see page 18). Due to the continued success of the SM/GS phase, Louise did not participate in the action plan phase. Figure 2 shows a very stable baseline moving average with little variability (see page 19). At the beginning of

the SM/GS phase, there was an immediate level increase and an increasing trend throughout the phase.

Participants met their daily and weekly goals more often during the action plan phase than during the SM/GS phase. Bonnie met her goals 48% of days during the SM/GS phase and 62% of days during the action plan phase. She met her goal 33% of weeks during the SM/GS phase and 75% during the action plan phase (Figure 3, see page 20). Clyde made his daily goal 56% of days during the SM/GS phase and 64% of days during the action plan phase. He met his weekly goal 45% of weeks during SM/GS and 65% of weeks during the action plan phase. Thelma achieved her daily goal 55% of days during the SM/GS phase and 77% days during the action plan phase. She met her weekly goal 38% of weeks during the SM/GS phase and 80% of weeks during the action plan phase. Louise achieved her goals 80% of days and 71% of weeks.

Participants self monitored their steps by updating their shared spreadsheet an average of 67% of opportunities. Compliance of self-monitoring ranged from 22% (Louise) to 96% across participants. Compliance for Louise was low due to technical difficulties with updating the spreadsheet.

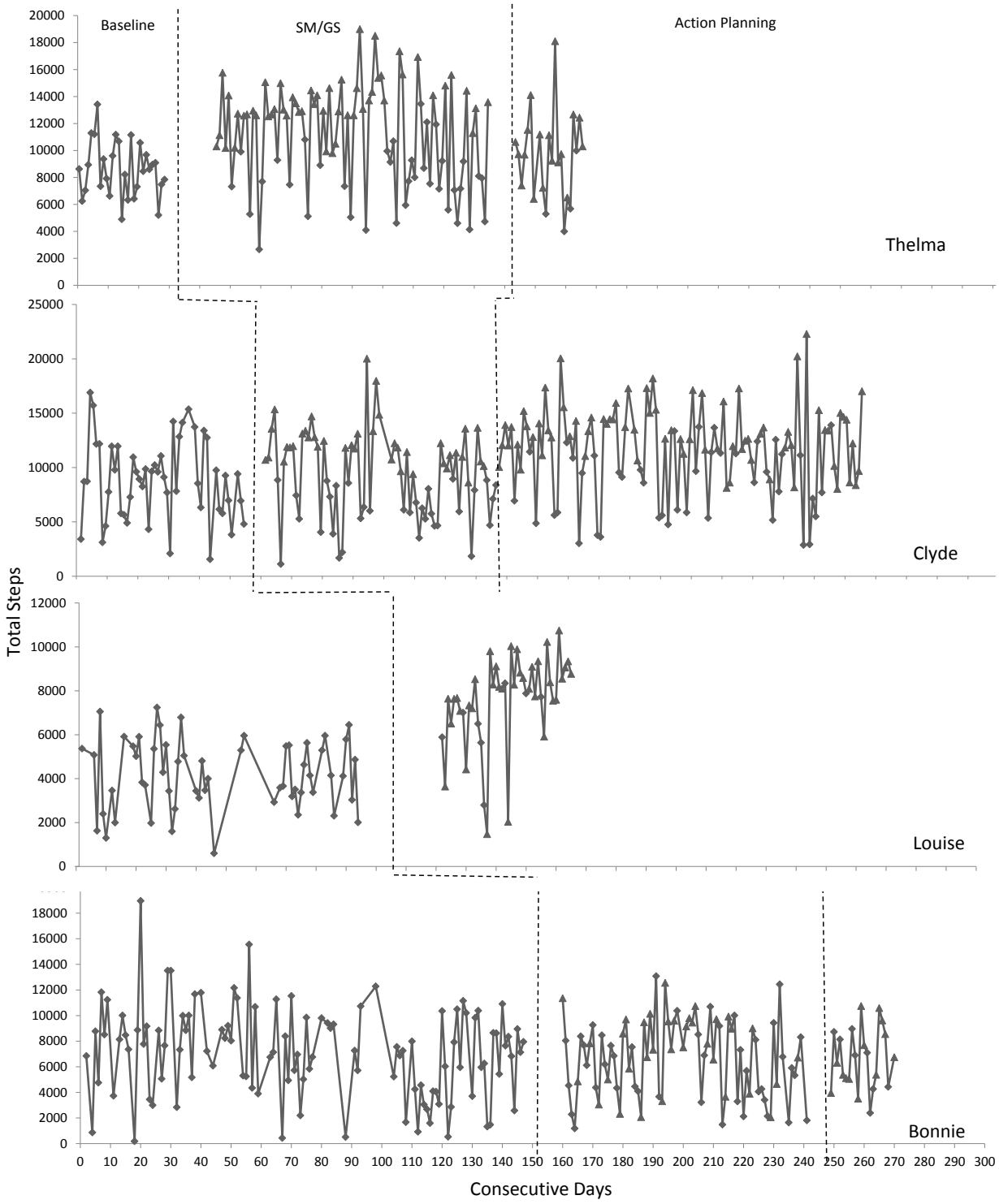

Figure 1. Total steps taken across consecutive days for all participants and all phases. Triangles during SM/GS and action planning phases represent met goals.

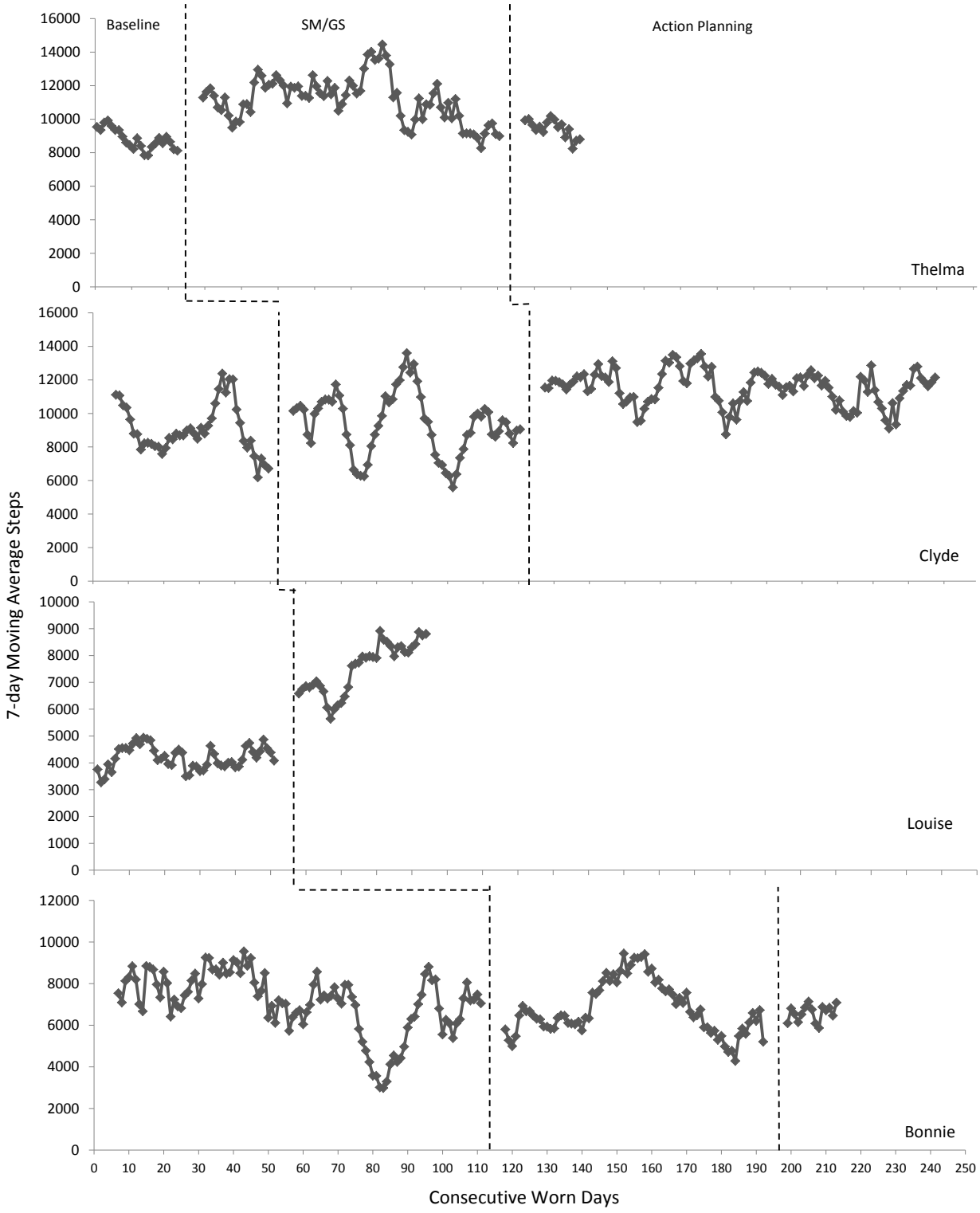

Figure 2. 7-day moving average steps for all participants on consecutive worn days across all phases. Each point is the step total for that day averaged with step totals for the previous 6 days.

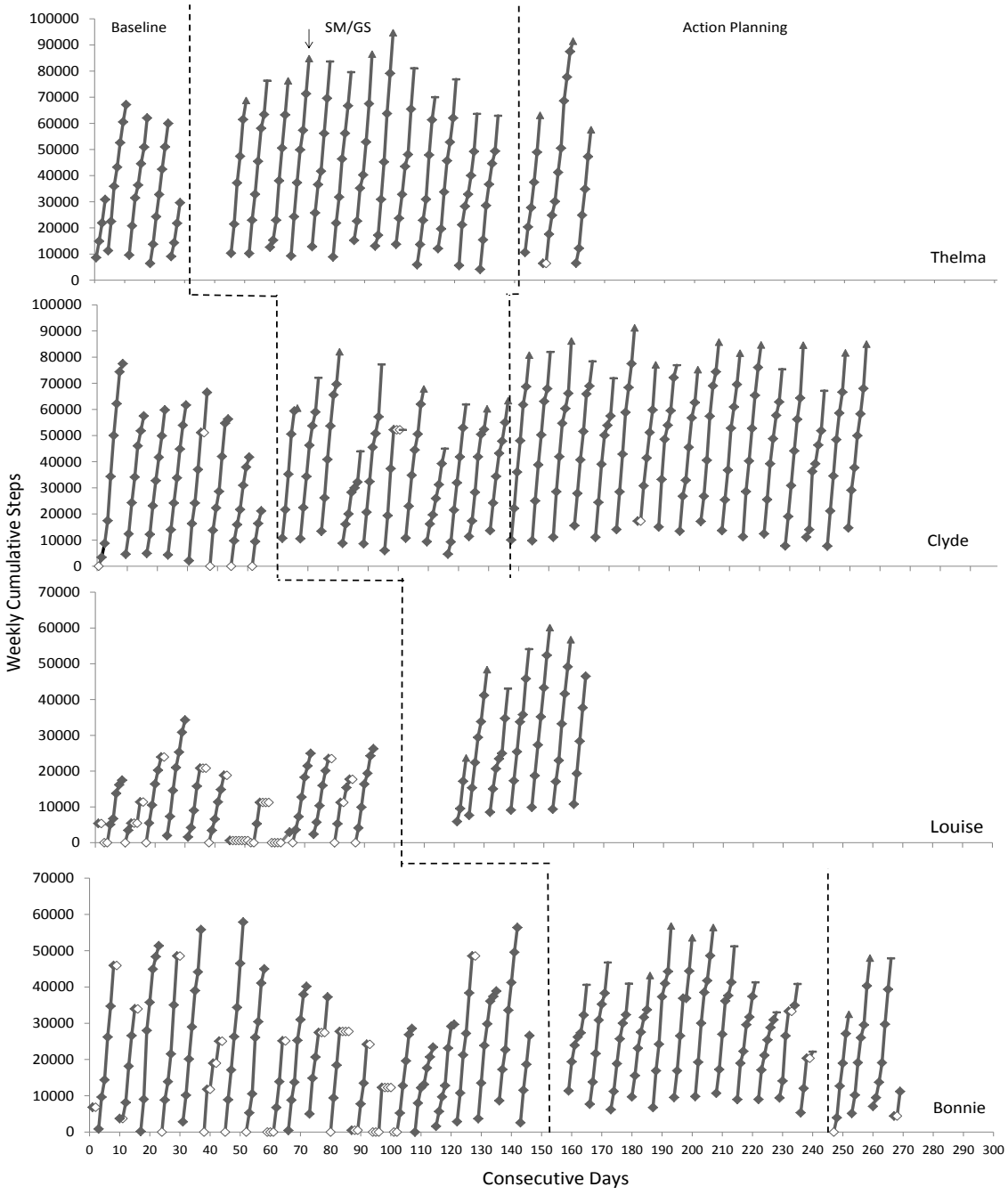

Figure 3. Weekly cumulative steps for each participant on consecutive days throughout all phases. White data points represent days in which the Fitbit was not worn. Triangles represent a met weekly goal, and horizontal dashes represent a weekly goal that was not met. The arrow indicates a weekly goal that was treated as met because the participant was within 100 steps of the goal.

CHAPTER FOUR:

DISCUSSION

The results of this study extend the literature about the efficacy of goal setting and self-monitoring as an intervention to increase PA and the potential for action planning to improve the success of this intervention. The SM/GS intervention increased PA for three out of four participants, which is consistent with previous literature (Booth et al., 2008; Chan et al., 2004; Croteau, 2004; Donaldson & Normand, 2009; Normand, 2008; Sidman et al., 2004; Tudor-Locke et al., 2004; VanWormer, 2004; Wack et al., 2014). Furthermore, these results indicate that action planning increases the consistency with which goals are met. However, there are mixed results about the extent to which action planning increases PA itself. Though action planning did not result in PA at baseline levels, only one participant showed increases above SM/GS levels, while two participants maintained SM/GS levels.

A replication of this study is highly warranted due to mixed results of the PA of individuals during the action plan phase. Because the ultimate goal of this intervention was to increase PA, it is important to understand the extent to which action planning works to achieve this goal. If action planning does not increase PA over levels achieved by SM/GS, the overall efficiency (10-min meetings rather than 60-min meetings) and simplicity of SM/GS alone highly favor the use this intervention to increase target behaviors of interest.

One potential reason that steps may not have increased above SM/GS levels during action planning is the reasonably high baseline step counts for participants. The three participants who

received the action planning intervention all had baseline step averages between 7000 and 9000 steps per day. These relatively high baseline levels could have created a ceiling effect which prevented individuals from substantially and continually increasing their daily activity. Louise, the participant who did not participate in action planning, had a relatively low baseline average step count of approximately 4000 steps, allowing for much more room for improvement. Future replications could have a maximum step count inclusion requirement to prevent ceiling effects during interventions.

A major strength of this study was that it provided the participants with control over their goals and their plan. As mentioned previously, goal setting has been shown to be more effective if the individual participates in the goal-setting process (Fellner & Sulzer-Azaroff, 1984; Locke & Latham, 2002). During this study, not only did the participant get to choose his or her own weekly goal, he or she also picked the daily goals based on his or her schedule for that particular week. Participants chose daily behavioral changes that fit with their own lifestyles, and had the options to add or remove strategies as they discovered what worked for them. The built-in fading process also allowed for minimal necessary prompts when the participants began filling out the action plan form on their own, indicating that the participants may easily be able to complete the process without a PI after the study. Participants would have even more control of the process if provided access to their online Fitbit profile. A study by Valbuena (2013) determined that using the Fitbit website resulted in modest increases in PA in some individuals, and that the addition of a behavioral coach resulted in further increases in step counts for all participants. Further investigations could examine whether access to the online profile enhances the success of the interventions addressed in the present study.

Another strength of the study was the use of a moving average to analyze step data. Daily step totals varied widely across days in this study, which is commonly observed in literature targeting physical activity (Donaldson & Normand, 2009; Normand, 2008; VanWormer, 2004; Wack et al., 2014). Extreme variability makes it difficult to recognize changes in level or trends in the data and therefore difficult to make informed decisions about phase changes. The use of the moving average allowed for better interpretation of the data by maintaining overall trends in behavior while decreasing the variability. This method of data analysis is useful tool which could vastly improve the way we analyze and interpret data with inherently high levels of variability.

One limitation of this study was that sequence effects made it impossible to determine whether action planning would work to increase PA if SM/GS is not introduced first. Future research should examine this by introducing action planning immediately after baseline to determine whether increases in PA occur under these conditions.

Another limitation of this study was the poor compliance during baseline for several participants. Four participants had very low compliance during baseline both with wearing and syncing the Fitbit consistently, and two of these participants were eventually dropped when prompts to wear the Fitbit were not successful. Though compliance improved after baseline for two participants (Bonnie and Louise), it still remained lower than the other two participants in the study (Clyde and Thelma). This low compliance in baseline is surprising because participants earned money contingent upon compliance; however the money seemed not to function as a powerful enough reinforcer for these participants to influence their behavior. Future research could examine other potential methods to improve consistency of wearing and syncing these data collection devices. This line of research is critical because every day the

tracker is not worn is an entire day of data lost, and if the tracker is not synced consistently, although no data are lost, the investigators cannot make accurate data-based decisions in a timely manner.

One potential variable that may affect compliance, as well as the success of these interventions, is motivation to change. Though in these terms motivation is often not spoken of behaviorally, it can be thought of as the presence of a strong establishing operation which makes the consequences of increased activity more reinforcing. One participant with low compliance and little to no effect during intervention (Bonnie) joined the study at the request of a friend who was also participating (Clyde), rather than because she independently decided to participate. Another individual who was dropped for low compliance during baseline told the PI that she wanted to participate because she liked helping with research, but did not state initially that she was interested in increasing her PA. Both these participants' statements and actions showed that increasing PA may not necessarily have functioned as a reinforcer for them. Because there were no additional contingencies in place for increased PA (other than brief positive feedback from the PI), this lack of motivation may explain the lack of behavior change and/or compliance. This issue has important implications for the success of behavioral interventions to increase PA and speaks to the need for an accurate assessment of the participant's motivation to increase PA.

Nonbehavioral research on the transtheoretical model indicates that individuals who are found to be motivated are more likely to respond successfully to interventions for exercise, eating disorders, and substance abuse, and that tailoring interventions to the state of change the participant is in yields the greatest results (Spencer, Adams, Malone, Roy, & Yost, 2006). Several processes have been developed that claim to determine a potential participant's motivation to change, such as the Stage of Exercise Behavior Change (SEBC) algorithm (Marcus

& Simkin, 1993) and the Stages of Exercise Scale (SOES) by Cardinal (1995). Future research could seek to validate these scales using single-subject designs to determine whether individuals who are assessed by the scales to be in the action stage are more likely to increase PA in response to an intervention and/or comply with protocols such as by wearing and syncing a tracker frequently and consistently.

Future research could also determine whether the action-planning process works to increase goal attainment and measures of success (like increased PA) for other target behaviors. This application can easily be applied to a wide variety of target behaviors, such as different measures of PA (e.g., distance), measures of work performance (e.g., sales numbers and items manufactured), or study behaviors (e.g. pages read or typed). If action planning is found to be effective when extended to these areas, it could further increase gains that are already being made with goal setting alone.

Most importantly, research in the area of goal setting should focus on factors that can make it more successful. Action planning may be one potential way to increase the consistency of goal attainment, whether or not it improves the behavior related to the goal itself. Though it should follow that consistent goal attainment should lead to improved performance, the results of this study tentatively indicate that this may not be the case. Researchers should focus on different ways to make goal setting a more successful intervention, as it is a relatively simple intervention that can easily applied to many different behaviors and areas of performance.

REFERENCES

Booth, A. O., Nowson, C. A., & Matters, H. (2008). Evaluation of an interactive, internet-based weight loss program: A pilot study. *Health Education Research, 23,* 371-381.

Cardinal, B. H. (1995). The stages of exercise scale and stages of exercise behavior in female adults. *The Journal of Sports Medicine and Physical Fitness, 35,* 87-92.

Centers for Disease Control and Prevention. (2007). Prevalence of physical activity among adults—United States, 2001 and 2005. *Morbidity and Mortality Weekly Report, 56,* 1209-1212.

Chan, C. B., Ryan, D. A. J., & Tudor-Locke, C. (2004). Health benefits of a pedometer-based physical activity intervention in sedentary workers. *Preventative Medicine, 39,* 1215-1222.

Croteau, K. A. (2004). A preliminary study on the impact of a pedometer-based intervention on daily steps. *American Journal of Health Promotion, 18,* 217-220.

Donaldson, J. M., & Normand, M. P. (2009). Using goal setting, self-monitoring, and feedback to increase calorie expenditure in obese adults. *Behavioral Interventions, 24,* 73-83.

Fellner, D. J., & Sulzer-Azaroff, B. (1984). A behavioral analysis of goal setting. *Journal of Organizational Behavior Management, 6,* 33-51.

Fitbit Inc. (2013). *Fitbit ® Zip™*. Retrieved from http://www.fitbit.com/zip

Lee, J.-M. (2013). *Validity of consumer-based physical activity monitors and calibration of smartphone for prediction of physical activity energy expenditure* (Doctoral dissertation). Retrieved from http://lib.dr.iastate.edu/

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57,* 705-717.

Marcus, B. H., & Simkin, L. R. (1993). The stages of exercise behavior. *The Journal of Sports Medicine and Physical Fitness, 33,* 83-88.

Marshall, S. J., Levy, S. S., Tudor-Locke, C. E., Kolkhorst, F. W., Wooten, K. M., Ji, M., … Ainsworth, B. E. (2009). Translating physical activity recommendations into a pedometer-based step goal. *American Journal of Preventative Medicine, 36,* 410-415.

Normand, M. P. (2008). Increasing physical activity through self-monitoring, goal setting, and feedback. *Behavioral Interventions, 23,* 227-236.

Sidman, C. L., Corbin, C. B., & Le Masurier, G. (2004). Promoting physical activity among sedentary women using pedometers. *Research Quarterly for Exercise and Sport, 75,* 122-129.

Spencer, L., Adams, A. B., Malone, S., Roy, L., & Yost, E. (2006). Applying the transtheoretical model to exercise: A systematic and comprehensive review of the literature. *Health Promotion Practice, 7,* 428-443.

Takacs, J., Pollock, C. L., Guenther, J. R., Bahar, M., Napier, C., & Hunt, M. A. (2013). Validation of the Fitbit One activity monitor device during treadmill walking. *Journal of Science and Medicine in Sport.* Advance online publication. doi: 10.1016/j.jsams.2013.10.241

Thomas, S., Reading, J., & Shephard, R. J. (1992). Revision of the physical activity readiness questionnaire (PAR-Q). *Canadian Journal of Sport Sciences, 17,* 338-345.

Tudor-Locke, C., Bell, R. C., Myers, A. M., Harris, S. B., Ecclestone, N. A., Lauzon, N., & Rodger, N. W. (2004). Controlled outcome evaluation of the First Step Program: A daily physical activity intervention for individuals with type II diabetes. *International Journal of Obesity, 28,* 113-119.

Valbuena, D. A. (2013). *Evaluating the effectiveness of an internet-based behavioral program for increasing physical activity with and without a behavioral coach* (Master's thesis). Retrieved from http://scholarcommons.usf.edu/etd

VanWormer, J. J. (2004). Pedometers and brief e-counseling: Increasing physical activity for overweight adults. *Journal of Applied Behavior Analysis, 37,* 421-425.

Wack, S. R., Crosland, K. A., & Miltenberger, R. J. (2014). Using goal-setting and feedback to increase weekly running distance. *Journal of Applied Behavior Analysis, 47,* 181-185.

APPENDICES

Appendix A: The Physical Activity Readiness Questionnaire – PAR-Q

Please read the questions carefully and answer each one honestly by circling YES or NO.

YES	**NO**	1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
YES	**NO**	2. Do you feel pain in your chest when you do physical activity?
YES	**NO**	3. In the past month, have you had chest pain when you were not doing physical activity?
YES	**NO**	4. Do you lose your balance because of dizziness or do you ever lose consciousness?
YES	**NO**	5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?
YES	**NO**	6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
YES	**NO**	7. Do you know of any other reason why you should not do physical activity?

If you answered YES to one or more questions:

- Talk with your doctor BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.
- You may be able to do any activity you want – as long as you start slowly and build up gradually. Or, you may need to restrict you your activities to those that are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- Start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- Take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively.

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

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

_____

Name

_____

Signature Date

Appendix B: Recruitment Flyer

Do you want to increase your physical activity levels?

If you:

- **are 18 or older**
- **have a home computer and internet access**

You may be eligible to be in this research study!

Call (XXX) XXX-XXXX or email XXXXX@mail.usf.edu for more information.

Appendix C: Physical Activity History Form

Describe any athletic activities you currently engage in:

_____
_____
_____

Describe any athletic activities you participated in while in high school or college:

_____
_____
_____

List any injuries sustained during physical activity, especially injuries to the feet, ankle, leg, knee, or hip:

_____
_____
_____

Do you have any other health concerns that may impact your level of physical activity? If so, please describe and explain why they may impact your activity levels:

_____
_____
_____

Appendix D: Daily Lifestyle Changes

- Use the Get Up and Go App or set a timer to remind you to take a quick walk break every hour
- Take the stairs instead of the elevator
- Park at the other end of the parking lot and walk, or if it is raining, park at a different parking lot and walk through the building
- Pace instead of stand when waiting for something (e.g. the elevator, the bus)
- Walk around during commercials while watching TV
- Don't use the drive through, walk into the restaurant instead
- Instead of emailing or calling coworkers, go visit them in person
- When you talk on the phone, walk around outside or in the house
- Walk on your smoke breaks, while you drink your tea or coffee, or when you need a quick break from work.
- Put on some music and dance in your living room
- Walk your dog instead of letting them out in the back yard
- Take laps around (inside or out) your local mall in between store visits
- Walk to the mailbox instead of stopping with the car
- Leave a needed item (car keys, your purse or wallet, etc) on the other side of the house or on the second floor
- Write your grocery list out of order and follow it as written
- Walk on the treadmill during your favorite TV shows (in the gym or at home)
- Leave the remote on the other side of the room from where you sit to watch
- Pack a lunch that you can eat while walking, walk *to* lunch if you go out, or take a quick walk after you finish lunch until it's time to go back to work.
- Consider investing in a standing desk or do your work standing up when you can
- Buy an audiobook and only let yourself listen to the book while you are walking
- Visit a museum instead of going to see the a movie
- Walk on the beach instead of lying or sitting

Appendix E: Action Plan Form

Date of Meeting: _____ Dates for Week:_____ Participant:_____

Weekly Goal:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Greatest SUCCESS last week
Potential Obstacles this week
Daily Lifestyle Changes
Other Changes Made

Appendix F: Action Plan Checklist

Participant: _____ Investigator: _____ Date: _____

Talked About	PI Prompted	
		Describe what happened on the day with the lowest number of steps.
		Describe what happened on the day with the highest number of steps.
		What was your greatest success last week?
		What obstacles (work commitments, competing motivations, social commitments, etc.) did you run into last week, and if you overcame these obstacles, how?
		Talk about last week's action plan. What worked and what didn't work?
		Are there any parts of the action plan that you definitely **do** want to change for next week?
		When do you want to schedule your workout days?
		List a replacement time, place, and/or activity in case rain or something else prevents you from working out on the desired day.
		What obstacles do you foresee running into this coming week? How will you overcome these obstacles?

Appendix G: SM/GS Treatment Fidelity Checklist

Participant:_____ Investigator:_____ Date of Meeting: _____

	The investigator reviewed the participant's daily step totals and average total for the previous week
	The investigator and the participant chose a weekly or a daily step goal
	The investigator told the participant what the daily step goal is given the weekly step goal or the weekly step goal given the daily goal
	The investigator did not provide advice to the participant about how to reach his or her goals

Appendix H: Action Plan Treatment Fidelity Checklist

Participant:_____ Investigator:_____ Date of Meeting: _____

	The participant and the experimenter set a weekly goal
	The participant and the experimenter talked about the daily subgoals
	The participant and the experimenter discussed all the items on the action plan checklist
	The participant and the experimenter scheduled at least three 30-min walks for the following week
	The daily subgoals are at least 3,000 steps higher on the days in which walks are scheduled
	The investigator provided the list of potential lifestyle changes to the participant and/or discussed current lifestyle changes the participant is making

Appendix I: Social-Validity Questionnaire

Please rate the following:

I enjoyed participating in this study:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

I feel that I am more active compared to when I started this study:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

The goal setting procedure helped motivate me to increase my physical activity levels:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

The action planning procedure helped motivate me to increase my physical activity levels:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

The action plans helped me to better reach my physical activity goals:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

I feel that I could now make an action plan without the help of the investigator:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

The Fitbit was a good way to track my daily physical activity levels:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

I plan to continue using goal setting and making action plans in the future:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments: _____

What did you like MOST about this study?

_____

_____

What did you like LEAST about this study?

_____

_____

Other Comments:

_____

_____