ASSESSING THE USE OF GOAL SETTING AND FEEDBACK TO INCREASE PHYSICAL ACTIVITY IN ADULTS

By

Amelia Grace Moorehouse

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Applied Behavior Analysis- Master of Arts

2021

ABSTRACT

ASSESSING THE USE OF GOAL SETTING AND FEEDBACK TO INCREASE PHYSICAL ACTIVITY IN ADULTS

By

Amelia Grace Moorehouse

Previous research has demonstrated the efficacy of goal setting and feedback for increasing physical activity in a variety of populations. Increased physical activity is associated with health benefits such as weight management, improved muscle strength, cardiovascular health, and longevity. The present study aimed to replicate previous goal setting and feedback research to increase the weekly walking or running distance for six adults. This study also assessed the efficacy of the intervention for promoting maintenance of physical activity in a 3-month follow-up assessment. The participants in this study were six healthy adults recruited from a Midwest university and expressed interest in increasing their overall activity levels during the COVID-19 pandemic. The study utilized a multiple baseline across participants design and revealed that all participants increased their mean weekly distance in the intervention phase following baseline. Furthermore, one participant maintained an increased weekly distance following the conclusion of the intervention. Implications and suggestions for future research are addressed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

The Centers for Disease Control and Prevention (CDC, 2018) notes inadequate physical activity as a top risk factor for death among adults in the United States. Consistent exercise promotes health benefits including weight management, improved muscle strength, cardiovascular health, and longevity (Wack et al., 2014). The CDC recommends 150 min of aerobic activity a week, in addition to two or more days a week focusing on muscle-strengthening activities (CDC, 2018). However, only 53% of adults in the United States meet the physical activity guidelines for aerobic activity, and only 23% of adults meet the guidelines for both aerobic and muscle-strengthening activity (CDC, 2018).

The COVID-19 pandemic has imposed an additional barrier to meeting these guidelines as many Americans have endured several weeks of government mandated stay-at-home orders in which gyms and other physical fitness classes and activities were no longer available to the public. The results of a recent study suggest that since the beginning of the pandemic, adults in the United States have increased their sedentary leisure behaviors and decreased their overall rates of physical activity (Flanagan et al., 2020). Further results of the study revealed reported increases in anxiety and weight gain, especially in obese individuals (Flanagan et al.).

Although research in the field of Applied Behavior Analysis has focused primarily on teaching functional skills or decreasing pervasive behaviors in individuals with developmental disabilities, behavior analytic researchers have accomplished additional success in utilizing behavioral interventions to achieve increases in physical activity and fitness behaviors (Martin et al., 2004). Goal setting, for example, is a common intervention component that has been evaluated for increasing physical activity, which involves identifying a behavioral objective that an individual would like to meet, then systematically adjusting that objective based on

responding as the individual achieves the previous objective (Zarate et al., 2019). Although useful as a stand-alone intervention, goal setting is most effective when included in a treatment package containing additional intervention components such as performance feedback, self-monitoring, and programmed reinforcement (Zarate et al.). There is rich literature supporting the use of goal setting, combined with these components, in increasing physical activity.

Research conducted by Donaldson and Normand (2009) sought to determine whether goal setting, self-monitoring, and feedback could increase the number of calories five obese adults expended each day. Data were collected on daily calories burned per participant and measured using a heartrate monitor that all participants wore throughout their time in the study. During intervention, participants set goals that were adjusted weekly based on their performance from the previous week. Participants were also instructed to monitor their own daily performance and send researchers an updated graph each night. Once researchers reviewed the graphed data, they delivered brief feedback in the form of an email. Additional feedback was provided to participants during a weekly meeting with researchers in which participants were given more details regarding progress towards their goal. Results of the study demonstrated that all five participants increased their calorie expenditure and lost weight, and four of the five participants decreased their Body Mass Index (BMI) score. However, the degree of behavior change from baseline to intervention varied across participants and responding was inconsistent following the reintroduction of baseline conditions. Furthermore, one participant increased his calorie expenditure despite very little researcher feedback while another participant's calorie expenditure was observed to be sensitive to the absence of feedback, suggesting the need for a systematic evaluation of feedback in exercise studies.

In a follow-up study, an internet program designed to increase physical activity via steps was evaluated with and without the inclusion of a behavioral coach (Valbuena et al., 2015). Seven overweight individuals participated in this study with a goal to increase physical activity and lose weight. In the "Fitbit only" intervention participants utilized the Fitbit web-based program, which included self-monitoring, goal setting, feedback, and community supports. In the "Fitbit plus behavioral coach" intervention, researchers also provided participants with feedback and praise for reaching goals and offered suggestions for increasing physical activity during weekly meetings. Three of the seven participants increased their mean step count in the "Fitbit only" intervention, while behavioral coach feedback and praise resulted in additional increases for six of the seven participants. An implication of these findings suggests that interventions in which participants have a higher dose of researcher contact result in higher degrees of behavior change.

Zarate et al. (2019) conducted a similar study where adults increased their step count utilizing a goal setting and textual feedback intervention package. Participant steps were counted using a Fitbit wristwatch. Following baseline data collection, researchers established step goals for participants that were adjusted weekly based on the previous week's performance. Each week, participants were provided with neutral feedback (i.e., a brief statement on whether they met their goal or not) delivered to their phone via text message and had no additional interaction with researchers. Goal setting and textual feedback was effective in increasing the step count for three of the four participants, with one participant showing an initial increase in step count that decreased by the end of the intervention phase. These findings were significant for demonstrating increased activity levels without utilizing self-monitoring or additional reinforcement

components. However, it is unclear what specific behavioral topographies each participant engaged in to accomplish their steps.

In 2014, Wack and colleagues addressed a specific behavior topography by using a goal setting and performance feedback treatment package to increase the running distance of five healthy adults. Prior to intervention, participants met with researchers to establish a long-term goal which was defined as the distance participants strived to run by the conclusion of the study. In the initial intervention phase, participants set daily running goals with the assistance of a researcher and adjusted goals weekly based on performance. However, these methods were ineffective for three participants who consistently missed daily running goals, thus a second intervention phase with weekly running goals was implemented for all participants. The feedback portion of the study for both intervention phases involved weekly meetings where researchers provided participants with verbal feedback regarding progress towards their long-term goal and a graphical review of their data. A multiple baseline design across participants with an embedded changing criterion design was used to evaluate the efficacy of the intervention package on running distance. Results showed that all six participants increased their weekly running distance and met their long-term running goal by the conclusion of the study. However, researchers did not collect maintenance data, so it is unknown whether these behaviors would have maintained following the conclusion of the study.

Previous research has demonstrated the efficacy of goal setting when used in combination with feedback to increase exercise behaviors (Donaldson & Normand., 2009; Wack et al., 2014; Valbuena et al., 2015; Zarate et al., 2019). In addition, previous findings have shown increases in physical activity without the use of programmed self-monitoring or additional reinforcement components (Zarate et al., 2019). None of the aforementioned studies, however, collected

maintenance data in the weeks and months following the termination of the intervention. Therefore, the purpose of the present investigation was to replicate previous goal setting and feedback research (Wack et al., 2014; Zarate et al., 2019), and determine the extent to which weekly goal setting and feedback is an effective intervention for increasing walking or running distance among healthy adults. Additionally, this study aimed to extend previous research by analyzing the effectiveness of the intervention for promoting long term maintenance of the behavior. Specifically, the research questions were:

1. To what extent is long and short-term goal setting and weekly feedback, an effective intervention for influencing the distance walked or ran each week among healthy adults?
2. To what extent does the intervention package result in maintenance of the behavior over a period of time?

Method

Participants and Setting

Six females aged 22-26 years old participated in this study. All participants were enrolled in a public college located in the Midwest and were recruited through a short class presentation on the research topic. Participants were included in the study if they expressed interest in increasing their overall activity levels during the COVID-19 pandemic crisis and were in good health. Participants were also required to own a smartphone with the capability of downloading applications in addition to having access to a device with a webcam. Prior to the onset of the study, participants completed the Physical Activity Readiness Questionnaire (Thomas et al., 1992), which is a self-screening tool that can be used to highlight the potential health risks associated with increased exercise based on an individual's health history or current symptoms. If participants answered *yes* to any questions listed, they were advised to contact their physician prior to participating in the study.

Materials

To be included in the study, participants were required to own a smart phone and were instructed to download the Adidas Runtastic Running application™ (Adidas, 2009) onto their phone prior to baseline data collection. The Adidas app was utilized to track weekly distance and contained additional features such as speed, calories burned, and overall duration. Further materials included a device with a webcam, microphone, and HIPPA compliant Zoom used for feedback sessions. Microsoft OneDrive was used for secure storage of participant data. In addition, one participant (Ann) used a treadmill to complete their weekly distance.

Dependent Variable and Data Collection

The dependent measure was the distance walked or ran by a participant each week, as measured by the Adidas running app in number of miles. A walking or running episode was

defined as continuous movement of at least 5 min in duration. If a participant's walking or running episode did not meet the minimum time requirement, it did not count towards the weekly distance goal. Researchers did not set a minimum speed requirement for walking or running to encourage participants to complete their goal at whatever speed was comfortable for them and to account for several participants who inquired about completing their weekly distance by doing a combination of walking and running. The Adidas running app was utilized to record distance per walking or running episodes for each participant. If a participant chose to complete their distance on a treadmill, they took a picture of the treadmill screen that included the distance they completed during that session.

Experimental Design

A multiple baseline across participants design was utilized to analyze the efficacy of the intervention (Ledford & Gast, 2018). The authors chose this specific design in order to best evaluate the effects of the intervention for the six participants and control for threats to internal validity. The multiple baseline was divided into two separate groups of three participants in each group, and the participants were assigned to their group using a computer randomizer. All participants started in baseline simultaneously in their respective group, and the intervention was implemented for the first participant once stable responding was observed. Once the target behavior reached a predetermined criterion of one session above baseline responding, the intervention was implemented for the next participant. A low criterion was established to ensure participants would not remain in baseline for extended periods of time and could begin intervention as soon as possible. Mastery criterion was set at the distance the participant selected as their long-term goal for 2 consecutive weeks.

Pre-Intervention Meeting

Prior to baseline data collection, the head researcher met with each participant separately via Zoom to give a general overview of the study, identify their physical activity topography, teach the participant the relevant features of the Adidas app, show the participant how to upload their data to the secure storage system, and answer any questions regarding the study. Participants were informed that they could choose any exercise method that could be completed in miles (walking, running, biking, rowing, etc.) depending on what equipment they had access to in their home. Four participants selected walking as their exercise method, and two participants (Ann and Bailee) selected a combination of walking and running.

Baseline

During baseline, participants were asked to turn on their running app during any walking or running episode completed outside but did not set goals or receive any feedback. Following each walking or running episode, participants took a screenshot of their Adidas running app "summary page" which contained the date, distance, and average speed of their episode. If participants chose to use a treadmill, they were instructed to take a picture of the treadmill screen instead. Participants then uploaded this information by the end of each week to a secure folder. Baseline lasted 3 weeks for the first participant in each group and 7 weeks for the final two participants.

Intervention

Following baseline, participants met virtually with the head researcher to set their individual long-term goal for the study. A long-term goal was defined as the distance participants aimed to complete weekly by the end of the study (Wack et al., 2014). Participants could choose

any distance for their long-term goal as long as it exceeded their mean baseline distance. If a participant had difficulty setting a long-term goal, the head researcher suggested a goal of double that of the participant's mean baseline distance. In addition to setting a long-term goal prior to intervention, the researchers set the initial short-term goals for participants. Short-term goals consisted of a predetermined distance participants aimed to complete during that week. In order for a participant to increase their goal, they had to meet or exceed the set criterion for the current week. If the participant did not meet or exceed the set criterion, they were required to stay at the set criterion or decrease their goal for the following week (Wack et al., 2014).

An initial weekly goal was set at 20% higher than participants' mean baseline distance (Zarate et al., 2019). For example, if a participant's mean baseline distance was 1 mi per week, their first weekly short-term goal was set at 1.2 mi (20% higher). Participants would then gradually increase their weekly distance by 20% as they continued to meet or exceed short-term goals. For example, if a participant's initial short-term goal was 1.2 mi, and they met their goal each week, they would increase their distance and complete 1.4, 1.7, 2.0, 2.4, and 2.9 mi a week, respectively. This would continue until the participant met their long-term goal for 2 consecutive weeks.

Participants met with the head researcher weekly (i.e., prior to starting data collection for the coming week) and feedback sessions lasted approximately 10 min. All feedback sessions occurred virtually via Zoom, and were based off of the weekly feedback sessions described in Wack et al. (2014). Feedback sessions began with the head researcher checking in to ask the participant how the previous week had gone and answering any questions or concerns that the participant had regarding the study. Following this initial check-in with the participant, the researcher would share their screen and pull up the participant's graphed data to review together.

When providing the participant with their graphed data for the week, the researcher would begin by describing the X and Y axes of the graph to ensure the participant understood how the data were displayed. The researcher would then direct the participants attention to the data points in baseline while reminding them of their mean baseline distance. Next, the researcher would give a verbal statement reminding the participant of the long-term goal they had set prior to the onset of the intervention. The participant's long-term goal was denoted on the graph by a red triangle with "Long-Term Goal" labeled directly above it. This was included in the graph so participants had a visual display of their intervention data points in relation to the long-term goal they strived to reach by the end of the study. Next, the researcher reminded the participant of the short-term goal that was set for the previous week and gave a verbal statement on whether or not the participant met that goal. Verbal statements remained neutral and did not include specific praise or corrective feedback. For example, if a participant met their goal for the week the researcher would say "Your goal for last week was two miles, which you did meet, so we will set a new goal for this week." Finally, participants worked with the researcher to set a new short-term goal for the upcoming week. Short-term goals were set at 20% higher than the previous goal (Zarate et al., 2019) and all values were expressed to the participant in miles. If the participant did not meet their goal, they had the option to decrease their goal by 20% or keep it the same. Following the meeting, graphed data was uploaded to a secure folder for participants to access should they chose to do so.

Maintenance

A 3-month post intervention maintenance probe was conducted with all participants. Procedures for this probe were identical to baseline procedures in that participants were instructed to turn their Adidas running app on to record distance during any walking or running

episode completed outside, or take a picture for any distances completed on a treadmill. Participants did not set goals or receive any feedback on their data.

Procedural Fidelity

Procedural fidelity measures were taken to ensure that the intervention was implemented as stated, and was assessed on 47% of treatment implementation across all participants. A task analysis was utilized to track the head researcher's behavior during all weekly feedback sessions (Table 1). Feedback sessions were then video recorded and analyzed by a graduate student trained to code procedural fidelity data. Procedural fidelity was calculated by dividing the number of observed behaviors by the number of planned behaviors multiplied by 100 (Ledford & Gast, 2018). Results demonstrated 99% fidelity across all participants.

Social Validity

Following the completion of the study, a social validity questionnaire based off of the questionnaire described in Zarate et al. (2019) was delivered to assess the usefulness and potential applicability of the intervention. Five questions were answered using a five-point Likert scale (see Table 2).

Results

General Results

All participants increased their mean distance in the goal-setting and feedback intervention phase following baseline (Table 3). Results for Kendall, Ann, and Bailee are depicted in Figure 1. Kendall's mean distance was 0.2 mi per week during baseline and 6 mi per week during the last 2 weeks of intervention, achieving an average increase of 5.8 mi. Kendall set her long-term goal at 4 mi per week and exceeded her weekly short-term goal during all 3 weeks of intervention. Ann completed a mean distance of 0.7 mi per week during baseline and 3.2 mi per week during the last 2 weeks of intervention, with an average increase of 2.5 mi. Ann set her initial long-term goal at 9.6 mi a week but changed her long-term goal to 3.2 mi during week 4 of intervention after reporting that she felt overwhelmed by her initial long-term goal. Ann met her weekly short-term goals during 7 out of 8 weeks of intervention. Bailee increased her mean distance from 7.4 mi per week during baseline, to 10.7 mi per week during intervention with an average increase of 3.3 mi. Bailee set a long-term goal of 10 mi per week and achieved her weekly short-term goals during 4 out of 5 weeks of intervention.

Figure 2 depicts the results for Gia, Erin, and Talia. Gia's mean distance was 0 mi per week in baseline and 3.4 mi per week during the last 2 weeks of intervention, achieving an average increase of 3.4 mi. Gia set her long-term goal at 3 mi per week and met her weekly short-term goal during all 7 weeks of intervention. Erin completed an average distance of 2.4 mi per week in baseline and 5.2 mi per week during the final 2 weeks of intervention, with an average increase of 2.8 mi. She set her long-term goal at 5 mi a week and met her weekly short-term goals during all 4 weeks of intervention. Talia completed a mean distance of 6.1 mi per week during baseline and 15.5 mi per week during the last 2 weeks of intervention,

accomplishing an average increase of 9.4 mi. Talia set her long-term goal at 10 mi per week and met her weekly short-term goals during 3 of 4 weeks of intervention.

Maintenance

Results of the 3-month maintenance probe following conclusion of the intervention revealed that one participant (Erin) maintained her weekly distance. All other participants either completed a distance of 0 mi, or a distance that was less than their mean distance in the final 2 weeks of intervention. In the first multiple baseline group, both Kendall and Ann completed 0 mi during the maintenance probe. Bailee completed 3.8 mi, which was a 6.9 mi decrease from Bailee's mean distance during the last 2 weeks of intervention. In the second multiple baseline group, Gia completed 0 mi and Talia completed 4.9 mi, which was 10.6 mi less than her mean distance during the last 2 weeks of intervention. Erin was the only participant whose behavior maintained as she completed 5.4 mi during the probe, which was 0.2 mi more than her mean distance during the last 2 weeks of intervention.

Social Validity

Following completion of the intervention, all participants completed a social validity questionnaire using a five-point Likert scale (Table 2). The average score and range of scores taken from the social validity questionnaire are as follows: I enjoyed participating in this study = 4.5 (range: 3 to 5); I was fond of the procedures used in this study = 4.5 (range: 3 to 5); I would continue using these procedures to increase my overall walking or running distance= 4.5 (range: 4 to 5); I increased my overall activity levels during this study = 4.8 (range: 4 to 5); I would recommend this study to others= 4.7 (range: 4 to 5). These findings would suggest that overall, participants found the study to be enjoyable, increased their activity levels, and would continue to use these procedures in the future.

Discussion

The results of the present investigation indicate that long and short-term goal setting and feedback was an effective intervention package for increasing the walking and/or running distance of all six participants. The CDC recommends that adults engage in 150 min of moderate-intensity aerobic activity each week (CDC, 2018). Although data on time engaged in physical activity was not collected for this study, it can be inferred that all participants increased overall duration of aerobic activity while completing their weekly distance goals. Additionally, all participants achieved their long-term goals in less than 8 weeks of intervention, with Kendall and Talia accomplishing their long-term goals in only 3 weeks. Collectively, the participants met their weekly short-term goals on 90% of occasions, with only three total goals missed throughout the course of the study across three participants. Ann, one of the participants who missed a short-term goal, reported feeling ill on the week in which she did not accomplish her goal. Likewise, Bailee was unable to complete a short-term goal in order to abide by medical guidance established by state and federal governing bodies. Finally, Talia missed her first short-term goal due to reported travel obligations but accomplished the next two goals thereafter.

Despite occasionally missed short-term goals, overall weekly goal attainment was higher than previously reported studies (see Wack, et al., 2014; Zarate, et al., 2019). Although it is unknown why this variation in goal attainment was observed, it could be the result of several methodological adjustments from previous research. In accordance with best practice from the findings of Wack et al. (2014), participants in the current study completed goals based on weekly, instead of daily, distance. Unlike Wack et al. or Zarate et al. (2019), however, participants in this study were not given a minimum speed requirement or intensity threshold to complete their weekly distance and could choose to complete their distance at a speed of their

choosing, so long as they moved continuously for at least 5 min. Friman and Poling (1995) note that the more effort required, the less likely it is for an individual to perform a desired response. Thus, this change may have contributed to participants' goal attainment if allowing participants to complete their distance at any speed reduced the response effort. Future research should systematically analyze the effects of walking and running speed requirements on short-term goal attainment. Furthermore, participants were given the option to complete their distance either outside, on a treadmill, or a combination of both. It is unclear whether participants in the aforementioned studies were also given this option, but it is reasonable to suggest the opportunity to use a treadmill may have increased the motivation for participants to complete their weekly goal, as exercise on a treadmill eliminates some of the aversive properties of being outside in the elements (e.g., cold weather, rain, and snow). However, only one participant (Ann) in the present investigation utilized a treadmill to complete her weekly distance, so this remains an open question for future researchers to explore.

Two participants (Kendall and Talia) met mastery criterion at a faster rate than others in the study. For example, Kendall exceeded her long-term goal of 4 mi during all 3 weeks in intervention, completing a distance of 4.5, 7.3, and 4.9 mi, respectively, and thereby reaching mastery criterion in a relatively short length of time. Similarly, Talia only took 3 weeks in intervention to meet mastery criterion and in the final 2 weeks she well exceeded her long-term goal of 10 mi by completing 16.4 mi and 14.6 mi. The remaining participants (Gia, Erin, Bailee, and Ann), were observed to approach their long-term goal in a more incremental manner, and therefore took more sessions to reach mastery criterion because short-term goals only increased by 20% each week they were met. For example, Ann took 8 weeks in intervention to reach mastery criterion and rarely exceeded weekly short-term goals.

The specific variables responsible for the variations in participant response patterns are unclear, however, one explanation could be the difference between each participant's long-term goal and their baseline average. Kendall and Talia had the largest difference in number of miles from baseline to their long-term goal. Kendall completed an average distance of 0.2 mi in baseline and set a long-term goal of 4 mi with an overall difference of 3.8 mi. Likewise, Talia completed an average distance of 6.1 mi in baseline and set her long-term goal at 10 mi for a difference of 3.9 mi. For the remaining participants, Gia had a difference of 3 mi, Erin and Bailee had a difference of 2.6 mi, and Ann had the smallest difference of 2.5 mi. Based off of these findings, perhaps a larger difference altered the motivating operation (Michael, 2001) for some participants to reach mastery criterion at a faster rate. All of the participants were informed of mastery criterion prior to implementation of the intervention. Therefore, participants with a larger difference between their baseline and long-term goal mileage may have found it more motivating to reach their long-term goal within the first few weeks of intervention rather than slowly increasing distance week by week, thus keeping them in the study longer. To further support this hypothesis, one participant commented in the free response portion of the social validity questionnaire that the long-term goal was more motivating for her because reaching the mastery criterion resulted in completion of the study. Future research should analyze the relationship between the magnitude of long-term goals and participant responding.

The results of this study are consistent with and extend previous research. Consistent with previous research (Wack et al., 2014; Valbuena et al., 2015; Zarate et al., 2019), goal setting and feedback was an effective intervention package for increasing physical activity. These findings could be due to several methodological similarities to previous research, specifically, the research conducted by Wack and colleges in 2014. Participants in the current study set a long-

term goal prior to the onset of the intervention, in addition to short-term goals that were adjusted weekly based on participant performance (Wack et al.). Feedback sessions were also similar in that they occurred weekly and included a graphical review of the data and feedback regarding progress towards long-term goals. It is unclear, however, how researchers in the Wack et al. study adjusted short-term goals for participants. Furthermore, participants in that study were all runners, and therefore were required to maintain a speed above a predetermined criterion for it to count towards their distance for the week. In the present investigation, short-term goals were adjusted by 20% as they were met, and participants could complete their weekly distance at any given speed.

The results of this study also support previous findings that increases in physical activity are achievable without the use of programmed self-monitoring or additional reinforcement components (Zarate, et al., 2019). Participants in the current study were not required to graph their own data or self-monitor their behavior in any way and researcher feedback was delivered neutrally and objectively, reducing the probability that it functioned as a reinforcer for participants. Furthermore, increases in overall distance were obtained with relative ease of implementation. Researchers met with participants for brief meetings weekly, however, participants were otherwise free to complete their required distance on their own time, offering a practical and cost sensitive intervention.

Extending previous research, these results demonstrate that the intervention package was ineffective for maintaining the behavior over a period of time for five out of six participants. Although it is unknown why a decrease in the behavior was observed in the months following the conclusion of the intervention, one potential reason could be a failure to fade the goal setting and feedback intervention package. Once participants in the current study reached their long-

term goal for 2 consecutive weeks, the intervention immediately ended. Estrapala and Reed (2018) stress the importance of systematically fading interventions to promote sustained behavior change. Perhaps if time spent meeting with the head researcher for feedback was faded so participants met bi-weekly, then monthly for feedback sessions, the behavior would have maintained for additional participants. Future research should explore this possibility by systematically fading goal setting and feedback intervention components then testing for maintenance of the dependent variable in the months following.

A secondary reason for the lack of maintenance could be that the intervention package did not include a self-monitoring component. Laitner and colleagues (2016) found that the participants in their study who were taught to self-monitor their food intake and continued to self-monitor in the months following the intervention, were more likely to maintain weight loss than participants who stopped self-monitoring after initial weight loss was achieved. From this finding, we can infer that an individual's ability to track their own behavior may facilitate sustained behavior change as it does not require the participation of anyone else. Thus, it is possible that although self-monitoring may not be a crucial intervention component for increasing initial activity levels (Zarate et al., 2019), it could promote long-term behavior change following the termination of a goal setting and feedback intervention package. Future research should explore this question further by assessing for maintenance of behavior with and without the addition of a self-monitoring component.

There are several limitations to the current study. The first one being the lack of systematic evaluation of the Adidas running app. Researchers did not test for the validity or reliability of the distance recording app and therefore reported distances could have been inaccurate or incomplete. Future research in this domain should test the accuracy of their

measurement devices to ensure veracious data collection. Another limitation was the possibility that participants completed distances that they did not record using their app, and therefore were not counted in their overall completed distance for the week. To address this limitation, future research could seek out measurement devices that record distance of a certain duration automatically, without the additional response requirement of the participant to turn the device on and off. Finally, because there was not a minimum speed requirement for participants to maintain while completing their distance, other more vigorous forms of exercise may have been more beneficial to the participant's overall health. The CDC recommends that adults need to engage in both aerobic and muscle strengthening activity weekly to improve their health (CDC, 2018). Although it is noted that any activity is better than none (CDC, 2018), future research should consider evaluating interventions for increasing both aerobic and muscle strengthening activities to promote the greatest possible health benefits.

APPENDIX

Table 1

Procedural Fidelity Task Analysis

Task	Score
Log onto Zoom at least 2 min prior to scheduled meeting	+/-/Na
Greet participant	+/-/Na
Check in with participant and ask how the week is going	+/-/Na
Ask participant if they have any questions or concerns	+/-/Na
Answer any questions	+/-/Na
Pull up graphed participant data and share screen	+/-/Na
Provide participant with basic overview of the graph	+/-/Na
Remind participant of baseline average	+/-/Na
Remind participant of previous weeks goal	+/-/Na
Verbally state whether or not participant met their goal for that week	+/-/Na
Make a verbal statement regarding progression towards long term goal	+/-/Na
Ask participant if they have any questions regarding graphed data	+/-/Na
Answer any questions	+/-/Na
Set new short-term goal with participant based on previous weeks data	+/-/Na
Ask participant if they have any final questions or concerns	+/-/Na
Remind participant to continue to record data	+/-/Na
Thank participant for their time	+/-/Na
Verbally inform participant that their graph will be available to them	+/-/Na
Remind participant about meeting time for following week	+/-/Na

Note. + = Correctly implemented; - = Incorrectly implemented; Na = Not applicable

Table 2

Social Validity Questions and Scores Per Participant

Question	Mean Score
I enjoyed participating in this study	4.5
I was fond of the procedures used in this study	4.5
I would continue using these procedures to increase my overall walking or running distance	4.5
I increased my overall activity levels during this study	4.8
I would recommend this study to others	4.7

Note. Questions answered on a 5-point Likert scale. 1=Strongly Disagree; 2=Disagree; 3= Neutral; 4= Agree; 5= Strongly Agree

Table 3

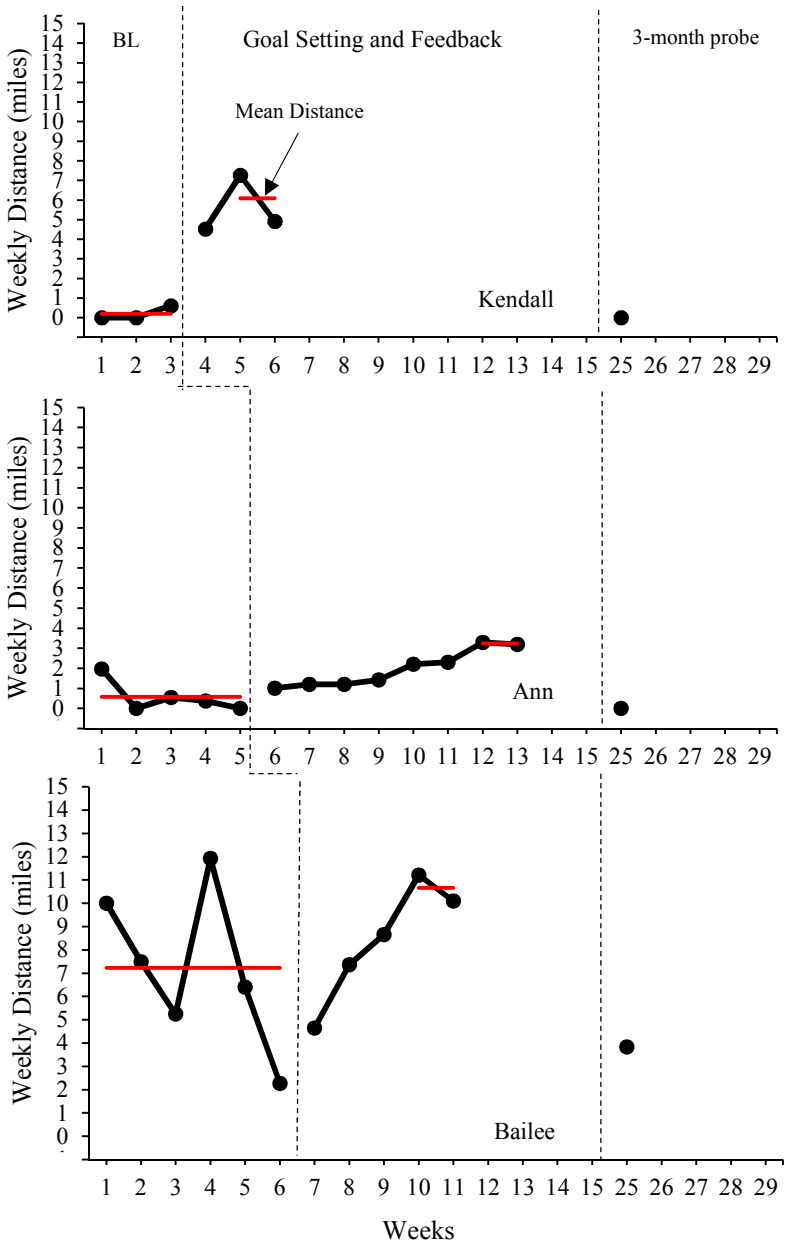
Participant Results

Participant	Mean Baseline Distance	Long-term goal	Mean Intervention Distance (final 2 weeks)	Average Increase
Kendall	0.2 mi	4 mi	6.0 mi	5.8 mi
Ann	0.7 mi	3.2 mi	3.2 mi	2.5 mi
Bailee	7.4 mi	10 mi	10.7 mi	3.3 mi
Gia	0 mi	3 mi	3.4 mi	3.4 mi
Erin	2.4 mi	5 mi	5.2 mi	2.8 mi
Talia	6.1 mi	10 mi	15.5 mi	9.4 mi

Note. Summarized general results for all participants.

Figure 1

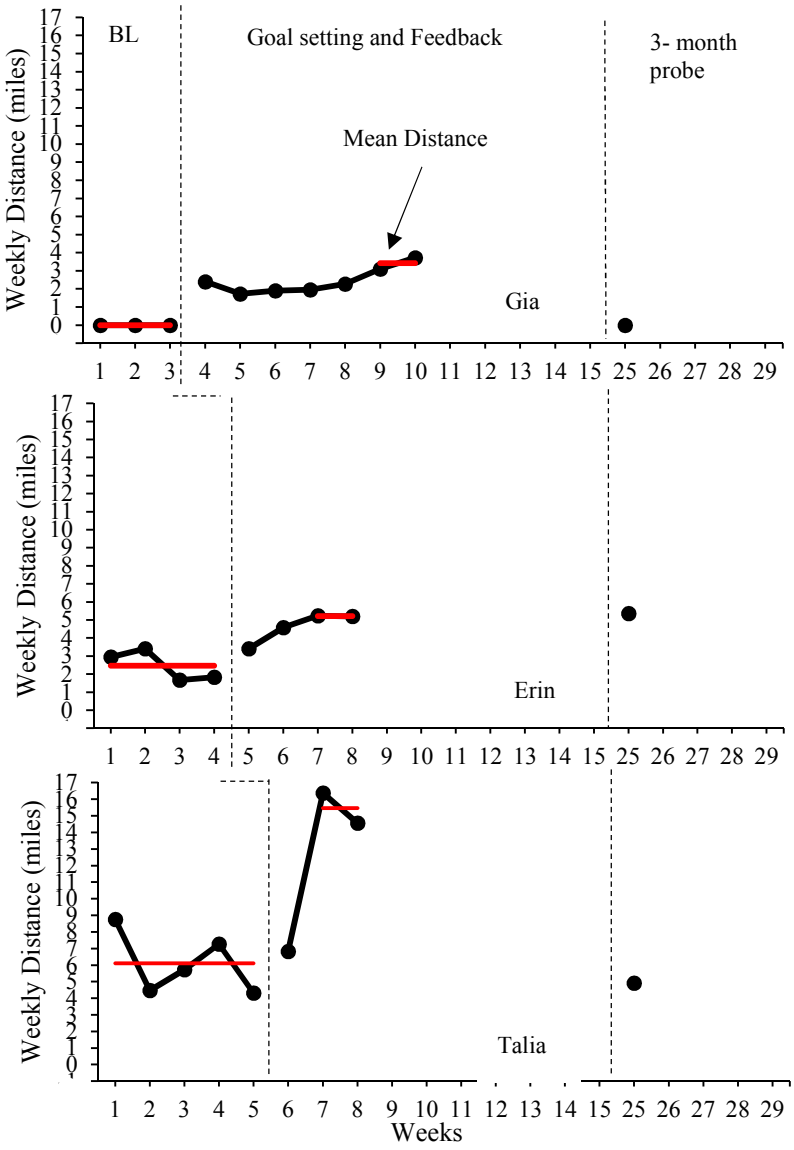
Results for Kendall, Ann, and Bailee



Note. Intervention results for Kendall, Ann, and Bailee. Red lines represent average distance completed in baseline and the final two weeks of intervention.

Figure 2

Results for Gia, Erin, and Talia



Note. Intervention results for Gia, Erin, and Talia. Red lines represent average distance completed in baseline and the final two weeks of intervention.

REFERENCES

REFERENCES

Adidas. (2009). *Adidas Running App Runtastic* (Version 11.19.1) [Mobile app]. Google Play Store. https://play.google.com/store/apps/details?id=com.runtastic.android&hl=en_US&gl=US

Centers for Disease Control and Prevention (2018). *Physical Activity Guidelines for Americans 2nd edition*. https://www.cdc.gov/physicalactivity/basics/adults/index.htm

Donaldson, J.M., & Normand, M. P. (2009). Using goal setting, self-monitoring, and feedback to increase calorie expenditure in obese adults. *Behavioral Interventions, 24*(2), 73-83. https://doi.org/10.1002/bin.277

Estrapala, S., & Reed, D. K. (2018). Goal-setting instruction: a step-by-step guide for high school students. *Intervention in School and Clinic, 55*(5), 286-293. https://doi.org/10.1177/1053451219881717

Flanagan, E. W., Beyl, R. A., Fearnbach, S. N., Altazan, A. D., Martin, C. K., & Redman, L. M. (2020). The impact of COVID-19 stay-at-home orders on health behaviors in adults. *Obesity, 29*(2), 438-445. https://doi.org/10.1002/oby.23066

Friman, P. C., & Poling, A. (1995). Making life easier with effort: basic findings and applied research on response effort. *Journal of Applied Behavior Analysis, 28*(4), 583-590. https://doi.org/10.1901/jaba.1995.28-583

Latiner, M. H., Minski, S. A., Perri, M. G. (2016). The role of self-monitoring in the maintenance of weight loss success. *Eating Behaviors, 21*(1), 193-197. https://doi.org/10.1016/j.eatbeh.2016.03.005

Ledford, J. R., & Gast, D. L. (2018). Single case research methodology: Applications in special education and behavioral sciences. New York, NY: Routledge.

Martin, G. L., Thompson, K., Regehr, K. (2004). Studies using single-subject designs in sport psychology: 30 years of research. *Behavior Analysis, 27*(2), 263-280. https://doi.org/10.1007/BF03393185

Michael, S. C. (2001). The extent, motivation, and effect of tying in franchise contracts. *Managerial and Decision Economics, 21*(5), 191-201. https://doi.org/10.1002/mde.982

Thomas, S., Reading, J., Shephard, R. J. (1992). Revision of the physical activity readiness questionnaire (PAR-Q). *Can J Sport Sci.,17*(4), 338-45.

Valbuena, D., Miltenberger, R., & Solley, E. (2015). Evaluating an internet -based program and behavioral coach for increasing physical activity. *Behavior Analysis: Research and Practice, 15*(2), 122-138. https://doi.org/10.1037/bar0000013

Wack, S. R., Crosland, K. A., & Miltenberger, R. G. (2014). Using goal setting and feedback to increase weekly running distance. *Journal of Applied Behavior Analysis, 47*(1), 181-5. https://doi.org/10.1002/jaba.108

Zarate, M., Miltenberger, R., & Valbuena, D. (2019). Evaluating the effectiveness of goal setting and textual feedback for increasing moderate-intensity physical activity in adults. *Behavioral Interventions, 34*(4), 553-563. https://doi.org/10.1002/bin.1679