EFFECTS OF SELF-MANAGEMENT USING FITBIT® TO INCREASE STEPS TAKEN BY ADULTS WITH INTELLECTUAL AND DEVELOPMENTAL DISABILITIES

By

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Abstract

Adults with intellectual and developmental disabilities (IDD) often have health concerns (e.g., obesity). Research suggests that one way to remedy these health concerns is to increase physical activity. Self-management is the use of techniques to change one's own behavior. Using a multiple baseline design across participants with an unplanned reversal and a changing criterion, the present study evaluated the effects of a self-management package that included wearing a Fitbit Flex®, goal-setting, feedback, and reinforcement to increase steps taken by adults with IDD. We recorded weight as a secondary dependent variable. For the first participant, goal-setting and feedback alone did not increase steps. After adding a tangible reinforcement component, steps increased for several consecutive weeks. For the second and third participants, goal-setting and feedback had modest effects on steps. Weight did not decrease with the number of steps taken. Findings suggest that for some, a Fitbit Flex® combined with self-management components may provide a modest increase in steps taken. For others, tangible reinforcement may be necessary. Additional procedures need to be developed to address weight loss. Future research should explore other determinants of health promotion for adults with IDD. The current study presents one component in improving overall health.

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Last, I would like to dedicate this finished project to my mother, Rebecca Leon, who passed away in 2014. Mom, thank you for encouraging me to apply to graduate school and for knowing that I was strong enough to finish. Thank you for believing in me and teaching me about my own bravery and resilience. I think of you all the time and I know that you would be proud of me. I could not have done any of this without your memory.

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Introduction

Physical activity for typically developing adults

Physical activity is extremely important to all people. At insufficient and inadequate levels, physical activity is one of the world's leading risk factors for death, with mortality rates as high as 3.2 million worldwide (World Health Organization [WHO], 2017). Individuals who are physically inactive have a 20%-30% increased risk of death compared to people who engage regularly in physical activity (WHO, 2017). Physical inactivity puts an individual's risk level higher for at least 35 chronic conditions as compared with individuals who engage in adequate levels of activity. Some of the conditions that physical activity can prevent include obesity, fatty liver disease, strokes, cognitive dysfunction, osteoporosis, constipation (Booth, Roberts, & Laye, 2014), multiple types of cardiovascular diseases, gestational and type 2 diabetes, and many cancer types including colon, breast, and endometrial (Centers for Disease Control and Prevention [CDC], 2017). According to the WHO, approximately 25% of adults over the age of 18 are inadequately active worldwide (2018). In the United States, 24% of adults are inadequately active (CDC, 2017). Alternatively, there are many benefits for engaging in physical activity. In addition to decreasing the risk for the conditions listed above, engaging in adequate levels of physical activity may decrease a person's risk for falls, decrease depression, and improve muscular fitness, functional health, bone health, energy levels, and help with weight control (WHO, 2017). Therefore, physical activity is considered a preventative strategy, or in some cases, at least a strategy to delay many chronic diseases (Booth et al., 2014).

Physical activity is defined as bodily movements produced by a person's muscles that requires energy expenditure (WHO, 2017). Physical activity, not to be confused or used interchangeably with "exercise," includes bodily movements that can be done naturally and

throughout a person's daily routine. For example, physical activity can occur during work, active transportation such as walking, house chores such as vacuuming or sweeping, play, recreational activities, and many other daily living activities. While exercise is a subcategory of physical activity, unlike exercise, physical activity does not have to be structured, planned, repetitive, or purposeful.

Individuals who take at least 10,000 steps per day are considered "physically active" (Tudor-Locke & Bassett, 2004). The WHO (2017) and CDC (2015) recommend that adults between the ages of 18-65 engage in moderate activity for at least 150 minutes per week to gain substantial health benefits (WHO, 2018). Moderate level activity is defined by maintaining a noticeably faster heart rate and your breathing is such that you can carry on a conversation but quicker than normal (CDC, 2015). Some activities that are considered moderate intensity include walking briskly, actively playing with children, or biking at a comfortable pace (CDC, 2015).

Physical activity for adults with intellectual and developmental disabilities (IDD)

While the need for interventions addressing physical activity within the general population is clear, perhaps the need for these interventions to address activity for individuals with intellectual and developmental disabilities (IDD) is even greater (Frey, Buchanan, & Sandt, 2005). Adults with disabilities are far less likely to be physically active than their typically developing peers (WHO, 2017). In general, they have poorer health and less access to adequate healthcare (CDC, 2017; Heller & Sorensen, 2013). In 2006, fewer than 33% of adults with IDD were adequately active (Temple, Frey, & Stanish). A more recent study found that adequate activity levels for adults with IDD was even lower, at 13.5% (Stancliffe & Anderson, 2017). This is problematic not only because individuals with IDD at higher risks for health conditions related to physical inactivity, they are also at very high risks for secondary conditions including bowel

or bladder problems, fatigue, injury, mental health issues and depression, pain, pressure sores or ulcers, and generally being more overweight and obese than the general population (CDC, 2017). Furthermore, individuals with IDD are more likely than their typically developing counterparts to have high cholesterol, cardiovascular disease, and hypertension, each of which can be a result of physical inactivity (Marks & Sisirak, 2017).

There are multiple barriers to physical activity for individuals with IDD. Some of these barriers include a lack of transportation and fewer opportunities to access community facilities, financial limitations for memberships to gyms, lack of social support, and lower levels of independence in general (Stancliffe & Anderson, 2017; Frey, 2004; Hall & Thomas, 2008). Other challenges that people with disabilities may face include a lack of healthy food options, difficulty chewing or swallowing, being on medications that contribute to weight gain, physical limitations, pain, and a lack of energy (CDC, 2015). Moreover, unfortunately, individuals with IDD are often socially excluded from activities that may promote increased levels of physical activity (Heller & Sorensen, 2013). Often, activities in which these individuals engage include passive social activities or activities that do not require social interactions or energy (Marks & Sisirak, 2017). Additionally, when individuals are living in a group home or supported living settings, some studies have found that staff or care professionals are often not trained or are unmotivated to assist individuals with IDD to engage in physical activity (Marks & Sisirak, 2017; Kupzyk, 2007). Other notable barriers that can affect individuals with IDD, as well as the general population, include a fear of violence and crime in outdoor areas, high-density traffic, and lack of parks, sidewalks, and sports/recreational facilities within the neighborhood (WHO, 2017).

Doctor's visits and hospital stays due to health-related issues as a result of physical inactivity for individuals with IDD were estimated to cost the United States over 12 million dollars annually; however, the majority of health conditions that people with IDD develop due to physical inactivity are entirely preventable with the right interventions (Heller & Sorensen, 2013). Walking is a great way for individuals with IDD to increase their physical activity (CDC, 2017) since it is a simple, convenient, and inexpensive way to be active more frequently (Kurti & Dallery, 2013).

Behavioral interventions to increase physical activity for typically developing adults

Behavioral interventions that have been successful in increasing physical activity with typically developing adults include self-monitoring, goal-setting, and feedback (Normand, 2008; Valbuena, Miltenberger, & Solley, 2015), contingency management (Cohen, Paradis, & LeMura, 2007; Kurti & Dallery, 2013; Washington, Banna, & Gibson, 2014; Washington, McMullen, & Devoto, 2016), different schedules of reinforcement and reinforcement thinning (Andrade, Barry, Litt, & Petry, 2014; Cohen, Chelland, Ball, & LeMura, 2002), activity tracker plus video conference-coaching/e-counseling (Valbuena, Miltenberger, & Solley, 2015; VanWormer, 2004), and a combinations of these procedures (Ellis, Cress, & Spellman, 1992; Lavay & McKenzie, 1991; Maki, Rudrud, Schulze, & Rapp, 2008). Both self-monitoring and contingency management research, with respect to increasing physical activity, seem to yield encouraging results (Van Camp & Hayes, 2012).

One of the most common interventions used with the typically developing population to increase physical activity is contingency management. This is a process that allows individuals to earn preferable consequences after meeting a set goal or engaging in a target behavior. These procedures have been successful in recent studies to increase levels of physical activity and other

adaptive behaviors (Cohen, Paradis, & LeMura, 2007; Dallery & Raiff, 2011; Kurti & Dallery, 2013; Washington, Banna, & Gibson, 2014; Washington, McMullen, & Devoto, 2016). Contingency management strategies utilize three components: (a) specifying a target behavior, (b) providing reinforcement for meeting the target behavior, and (c) withholding reinforcement if the target behavior is not demonstrated or a goal is unmet.

Kurti and Dallery (2013) conducted two experiments where they investigated the effects of an internet-based program using Fitbit® with sedentary adults, over the age of 50, to increase walking. The general procedure for both of these experiments was conducted with participants in the natural environment (as opposed to a controlled laboratory setting conditions) and began with researchers asking participants to wear the device during all waking hours except while they were engaging in water-related activities. When the device was placed on the charger, data were automatically uploaded to the device's website where researchers could access it. During baseline, the participants' access to this website was restricted, however, until the end of the study to prevent access to information that may have affected the participant's behavior (e.g., for social competitions between participants, participants' further analysis of step data). During intervention, participants were able to access their data and interact with the researcher on a different and secure website (MOtiv8). The MOtiv8 website functioned not only as a source of information for the participant but as an additional method to collect data for the researchers. At the end of each night, participants logged on to the website to review cumulative graphs of daily steps, review the amount of money they earned for meeting goals, submit a video log of step counts, and provide a brief description of the activities in which they engaged to increase their steps that day. Daily steps were evaluated for 5-day blocks. The first daily step goal was an average of the daily steps during screening. Participants were required to meet their step goal for

at least three of the five days to move to a higher step goal. New goals were determined by using either the fourth-highest step count from the previous 5-day block or a 1,000-step increase from the step goal of the previous block. According to the authors, the latter procedure was implemented for participants who had more difficulty meeting their step goals.

During intervention in the first experiment, one male and five female participants received step goals via email for each 5-day block. Participants received compensation for meeting their step goal on at least three days of each 5-day block. Compensation was $1.00 per 1,000 steps of a step goal met for at least three days. For example, a participant whose step goal was between 2,000-2,999 could earn $2.00 if he or she met the step goal for at least three days of the 5-day block; a participant whose step goal was between 3,000-3,999 could earn $3.00 if he or she met the step goal for at least three days of the 5-day block; and so on. A $3.00 bonus was earned when participants advanced to a new step goal. A changing criterion design was used to set step goals. The first experiment demonstrated that an internet-based contingency management program could be effective in increasing older adults' walking. All six participants increased their steps between 80% - 255% from screening averages to the end of intervention averages. Intervention was withdrawn after participants walked at least 10,000 steps per day for two consecutive weeks of 5-day blocks, or after two months of intervention despite whether goals were being met.

In the second experiment, one male and six females participated and were exposed to the same intervention as the first study; however, participants did not earn money for meeting step goals. Similar to the first experiment, a changing criterion design was used to set step goals. The results of the second study were that five out of six participants' steps increased from between 8% - 186%. Although goal-setting without contingency management seemed to be effective,

contingency management made the intervention somewhat more effective. Additionally, researchers noticed more variability across steps without the contingency management component.

Contingency management interventions have also increased walking for young, healthy adults. For example, Washington, Banna, and Gibson (2014) used contingency management strategies to increase walking within the natural environment in college students between the ages of 18 and 26. During baseline, participants were provided a Fitbit® device and asked to wear it during all waking hours. Participants were required to visit the research lab three times weekly so that researchers could help participants charge their device and collect data from the previous days' steps. Participants could have the opportunity to earn a prize contingent only on wearing the device. During intervention, researchers asked participants to text or email the researcher their step counts at the end of the day and researchers replied shortly thereafter with a step goal for the next day. Step goals were determined based on a percentile schedule, requiring that walking is greater than at least five of the previous seven days. More specifically, researchers ranked the previous seven days' step data from lowest to highest and set the goal to match or exceed the fifth highest day of the previous seven days' step data. The purpose of using this method to determine step goals was to create a step goal for which participants had already demonstrated the ability to reach. Each day, participants earned an opportunity to draw from the prize bowl if they met the step goal that day. They were told that half of the tickets indicated a prize was won and the other half of the tickets indicated that verbal praise alone would be given. There were at least 100 prizes available at any given time and were clearly labeled as small, medium, large, or jumbo prizes. Of all tickets available, forty-two percent of the tickets corresponded with a small prize worth up to $5, five percent corresponded with medium prizes

worth up to $15, two percent corresponded to large prizes worth up to $50, and one percent corresponded to jumbo prizes worth up to $120; the other fifty percent provided that verbal praise alone would be given. An ABA reversal design was employed to evaluate the effects of the contingency management intervention. Of the 13 participants who completed the study, five participants' data were not usable because of losing the device, failing to attend daily meetings, acquiring unrelated injuries, and corrupted data. Four participants, who showed significant treatment effects, increased their daily steps by an average of 4,387. Four other participants showed modest improvements in their daily steps by increasing their steps an average of 2,845.

Washington, McMullen, and Devoto (2016) investigated the effects of adding a deposit contract to a contingency management intervention with one of two groups of sedentary adults between the ages of 18 and 67. The purpose of this study was to examine the effects of goal-setting and monetary incentives on physical activity within the natural context. A second purpose was to assess whether participants would deposit money toward their own behavioral interventions and, if so, how that might affect their performance. During recruitment, all participants were asked about their willingness to provide $25 of their own money; all participants indicated they were willing to do so. The researchers divided the participants into two groups, one group deposited $25 and the second group did not. Researchers explained to participants in the deposit group that they would have the opportunity to earn their deposits back and even additional monetary rewards. Researchers informed the non-deposit group that they would have an opportunity to earn monetary rewards. Other than the deposit, procedures for both groups were identical. When the study began, each participant was provided a Fitbit One® accelerometer and a copy of the United States Department of Health and Human Services (USDHHS, 2008) physical activity guidelines for adults; each participant was asked to come to

the research room 2-3 days per week for approximately ten minutes or less to upload data and charge the device.

During baseline, researchers did not provide feedback to any participant. However, participants were asked to report daily step counts via text message, email, or a phone call at the end of each day. At the beginning of intervention, researchers informed the participants that they could earn $1.50 for each day that they met step goals (that were determined by the researchers) and $2.65 bonuses for meeting steps goals for three consecutive days. At the end of each day when participants sent their step count information, the researchers responded indicating how much money the participants earned (if any) and specifying a new step goal if the present goal was met. Monetary rewards were all provided, in total, at the end of the study. Step goals were determined using a percentile schedule. To do this, the researcher ranked the previous seven days of step data from lowest to highest and the step goal was set to the third highest day. According to the authors, the benefit of this schedule is that it does not require participants to exhibit higher step counts than they have previously demonstrated. Using an ABA reversal design, the results of this study showed that the monetary incentives were effective in increasing physical activity for participants. Further, the group comparison of deposit and no-deposit demonstrated that there were no significant differences between the two groups. The researchers suggested that this could be due to the small sample size since there were only nine participants in the no-deposit group and ten participants in the deposit group. Participants in both groups increased their steps and consistently met step goals. Fourteen out of 19 participants increased their step average by at least 2,500 steps.

Normand (2008) evaluated the effects of goal-setting, feedback, and New Lifestyles pedometers on the walking behavior in four healthy, typically developing adults within the

natural environment. Participants included three males and one female between the ages of 39 and 59. At the beginning of the study, each participant was provided a pedometer. During baseline, the pedometer face was covered and signed by the researcher so that participants could not access step information. When participants began intervention, the researcher uncovered the screen on the fitness tracking device so that participants would have access to the step information. Each day, the participants emailed their step counts to the researcher. The researcher responded to the email with a praise statement if the goal had been obtained, or an encouraging statement such as "Give it a bit more effort. You can do it." if the participant had not obtained his or her step goal. Additionally, the researcher held weekly meetings with each participant to (a) record the data collected by the device, (b) provide a graph showing the participant's steps to date including goal lines for step goals with face-to-face verbal feedback, and (c) calculate new step goals for the upcoming week. New step goals were determined based on the previous week's average. A goal was considered "met" if the participant matched or exceeded the step goal at least four of the seven days. When the participant met his or her step goal, the researcher calculated the new step goal for that week. If the participant did not meet the step goal, the goal remained the same for the upcoming week. The intervention was implemented using a multiple baseline design across participants with a built-in reversal. The results of this study showed that three of the four participants met or exceeded an average increase of 2,500 daily steps during intervention; however, data remained variable throughout the duration of the study. In general, when the self-monitoring intervention was in place, daily step totals were higher than when the intervention was reversed back to baseline procedures.

Although there is evidence supporting great benefits to increased physical activity, few programs are designed specifically for individuals with IDD (Heller & Sorensen, 2013). Thus,

there is a growing need for interventions that address healthy behaviors for adults with IDD, especially considering the increased disparities and lower life expectancies for these adults (Heller & Sorensen, 2013). Some interventions have been attempted with individuals with IDD in past research.

Physical activity interventions for adults with IDD

Behavioral interventions that have been used to increase physical activity in adults with IDD include goal-setting, feedback, and reinforcement (LaLonde, MacNeill, Eversole, Ragotzy, & Poling, 2014); self-monitoring, verbal cuing, and reinforcement (Todd & Reid, 2006); token economies (Croce & Horvat, 1992; Krentz, Miltenberger, & Valbuena, 2016); self-reports validated by fitness tracking devices (Frey, Buchanan, & Sandt, 2005; Ptomey et al., 2017; Speck & Looney, 2006); a treadmill walking program (Pitetti, Rendoff, Grover, & Beets, 2007); and combinations of those procedures (Lavay & McKenzie, 1991). Similar interventions have addressed exercise, measuring heart rate, blood pressure, pulse, and respiration after completing flexibility, strength, balance, coordination, and endurance training exercises (Bennett, Eisenman, French, Henderson, & Shultz, 1989; Coleman & Whitman, 1984; Combs & Jansma, 1990; Frey, McCubbin, Hannigan-Downs, Kasser, & Skaggs, 1999; Kupzyk, 2007). The focus of this literature review, however, will be on physical activity and walking in individuals with IDD.

Todd and Reid (2006) investigated the effects of a self-monitoring board, verbal prompts, and edible reinforcers on physical activity for three adolescent males between the ages of 15 and 20 with Autism Spectrum Disorder (ASD) in an adult day training center. During the wintery weeks between January and March, researchers targeted snowshoeing, and during the remainder of the months of the study, they focused on increasing walking. Researchers monitored each session, which occurred twice weekly, and sessions were carried out at a local park on a soccer

field or in the school depending on the weather. A changing-criteria design was used to evaluate the effects of the intervention. At the beginning of each session, the researcher said “Let’s go! How many laps can we do today?” During baseline (condition A), only verbal cuing was provided. Verbal cueing was made up of both directives and encouragement. Directive statements were used primarily to prompt participants back onto the track if they wandered off. Encouraging statements consisted of verbal praise statements such as "Nice job" or "You are a Rockstar." Verbal cueing was not systematically manipulated as researchers and teachers delivered these statements at their discretion. Condition B included self-monitoring, verbal cueing, and varying amounts of edible reinforcers which were slowly faded. For example, during condition B1, participants received four edibles (one at each corner of the lap); during B2, participants received three edibles, during condition B3, participants received two edibles, and during condition B4, participants received one edible. The student's teacher recommended some edible reinforcers to be used throughout the study for each participant. Condition C consisted of self-monitoring and verbal cueing alone. During conditions B and C, participants placed a happy face on their self-monitoring board per each lap completed. Results of this study demonstrated that the three components were effective in sustaining increased physical activity for all three participants. Likewise, when edible reinforcers were faded out completely, walking maintained for all three participants. A potential limitation of this study, however, was that snowshoeing may require more effort than walking. Therefore, increases in walking may have occurred as a result of the decreasing difficulty of the target behavior.

In a study investigating the effects of reinforcement in physical activity, Krentz, Miltenberger, and Valbuena (2016) examined the effects of implementing a token economy intervention to increase walking in five adults with IDD between the ages of 34 and 67.

Researchers used cones to mark a 50-m (150-ft) lap around a covered track where participants walked for 1-h (monitored) sessions. If participants requested to end the session early, they were allowed to do so. Likewise, if the participant requested a break, he or she was provided a break. During baseline, the researcher asked participants "Who wants to walk today?" Participants, who were interested, walked to the track with the researcher and began to walk. No verbal or tangible reinforcement was offered during this phase. At the start of intervention, participants were brought to the track and shown their individualized prize bags, which were composed of preferred items from their preference assessments. The researcher informed the participants that they could earn one token for each lap they walked and that they could exchange the tokens later for a high-preference item of their choice. Additionally, verbal praise was provided as participants continued to walk. The researchers determined the token exchange rate during the first intervention by using the average number of laps walked during baseline multiplied by five. The token exchange rate during the second intervention was increased for some participants based on his or her performance during the first intervention phase. At the end of each 1h session, the researcher asked the participants if they wanted to exchange their tokens or if they preferred to save them to use on a more "expensive" item later. Using an ABA reversal design, this study demonstrated that a token economy could be used to increase physical activity for adults with IDD. When the first intervention phase was introduced, the number of laps increased for four of five participants. After returning to baseline, the number of laps walked decreased for all five participants. When token reinforcement was re-introduced, the number of walked laps increased for each participant.

Researchers have also added activity trackers in interventions designed to increase physical activity in people with IDD. LaLonde and colleagues (2014) examined the effects of

goal-setting, feedback, reinforcement, and a Fitbit Zip® (worn on the waistband) on steps in young adults with ASD in a school setting. Researchers used a multiple baseline design across participants with a reversal built in for four out of five participants. During baseline, the researcher asked participants to wear the device daily while it was covered with black electrical tape and they were not taught how to use the device. Additionally, the researcher provided each participant a 5-day sticker chart on which they placed a sticker after putting on their device after his or her arrival to school and upon taking it off at the end of the day. If the participant had two stickers at the end of the school day, he or she was able to choose a small prize out of a prize box. After the participant left school, the researcher uncovered the device's face to collect data and covered it for the next school day. At the beginning of intervention, the researcher removed the tape so that the participants could see their numbers and met with each participant individually to teach him or her how the device worked. Each morning when participants met with the researcher, a data sheet was provided to each participant to fill out with the date and step goal. The initial step goal was determined by taking the average number of steps taken during baseline and then adding 10%. Step goals were considered mastered if the participant met his or her step goal for two consecutive days and subsequent goals were established by adding 10% to the previous goal. Participants had an opportunity to earn prizes each day if he or she met the step goal, as chosen by participants the week prior to beginning intervention. Thirty minutes before the end of the school day, researchers asked participants if they wanted to write the number of steps they had taken and whether they earned a prize on their data sheet. If the step goal was met, he or she typically wanted to record the number of steps that were taken and write "yes" in the "prize" column. If he or she had not reached the step goal, the researcher said that there were thirty more minutes to reach the step goal. Because students had free time at the end

of the day, those who had not met their step goal yet almost always chose to walk up and down the hallway until the goal was reached so that they could earn a prize. This phase was continued until participants were walking over 10,000 for several days. During the return to baseline, conditions were the exact same as the first baseline condition except the device was not covered with electrical tape. Lower rates of steps were observed for all participants who returned to baseline. When participants returned to the treatment phase, the step goal for all participants was at least 10,000 steps and rates of steps increased once again, but in some cases, rates were not as high with the second intervention phase in comparison to the first. This could be due to the short length of the second treatment phase which was two or three days, depending on the participant, as compared to the range of nine to twenty days in the first intervention phase. The results of this study indicated that steps for young adult students with ASD attending school for a 6-h day were increased using a goal-setting and reinforcement treatment package with a fitness tracking device. Step averages were increased by between 2,689 and 5,275 for five participants during the first exposure to intervention.

Although physical activity research has become popular within the last decade for both the typically developing and IDD population, among all age groups, some limitations in the literature remain. With respect to individuals with IDD, physical activity research has often been conducted in staff- and researcher-supervised settings where participants' behavior can be monitored moment-to-moment. Additionally, researchers or staff have often provided continual prompts throughout sessions. This may be more intrusive than what is necessary in an intervention for participants with IDD. Therefore, the purpose of this study was to increase physical activity for individuals with IDD in an unsupervised setting and without continual

prompts. Specifically, we examined the effects of goal-setting, feedback, and reinforcement using an activity tracker on steps taken by adults with IDD within their natural environments.

Method

Participants

Participants were recruited from a not-for-profit organization that served individuals with IDD in a midwestern town. Selection criteria were limited to individuals who (a) had a diagnosis of mild or moderate IDD, (b) were receiving residential or day services from the agency, (c) had receptive and expressive language, (d) were ambulatory and able to walk without the assistance of another person, and (e) were considered overweight or obese by their primary care physician. The researcher provided a list of these criteria and informational packets to each case manager in the organization (see Appendix A). The case manager then sent the packets to relevant legal guardians. Approvals were obtained from the university, the organization, guardians, and primary care physicians. Assent was also obtained from each participant (see Appendix B).

At the beginning of the study, Carol was a 38-year old female with a diagnosis of mild IDD, ASD, cerebral palsy, generalized anxiety disorder, obsessive-compulsive disorder, attention deficit hyperactive disorder, and obesity. Carol's initial weight was 195 lbs and taken during the first weekly meeting during baseline. According to a Body Mass Index (BMI), her BMI was 38.1 and her recommended weight range was 120 - 129 lbs. Carol lived in a duplex that was considered an independent living placement serving her and two other consumers on one side and three consumers on the other side of the home. The home functioned on shift staff who worked twelve-hour shifts. For day services, Carol attended a farm, owned by the agency, where other adults with IDD attended services. At the farm, she could engage in helpful activities such

as gathering eggs from the chicken coop or grooming horses. Additionally, she took day service classes at the farm with her peers such as yoga sessions, pottery class, walking club, karaoke hour, and art class.

Glenn was a 31-year old male with a diagnosis of ASD, cerebral palsy, and obesity. At the beginning of the study, Glenn's weight was 258 lbs. His BMI was 41.6 and his recommended weight range was 160 - 169 lbs. Glenn lived in an adult foster care setting as the sole consumer residing in the home. He lived with one middle-aged woman and her two grandchildren who were adolescents. During the day, Glenn attended an adult day center with other adults with IDD. At the day center, he participated in volunteer activities such as delivering meals to older adults (i.e., Meals-on-Wheels program) or helping the recycling crew. On days Glenn did not attend day services, he worked at his business. Glenn owned a multi-product company where local-consumers could purchase homemade personal care and bakery products.

Laurie was a 49-year old female with a diagnosis of mild IDD, depression, diabetes, high blood pressure, high cholesterol, and obesity. Laurie lived in an apartment, a semi-independent living arrangement, shared with one roommate. Staff were available virtually through a video teleconference program if she needed verbal guidance with a task, and in the mornings and evenings to pass medications. During the day, Laurie attended day services at a farm where she engaged in similar classes and activities as Carol. On days Laurie did not attend day services at the farm, Laurie worked in a retirement community as a dishwasher. Laurie often engaged in other activities such as acting class and recreational or Special Olympic sports. Laurie's initial weight was 209 lbs. Her BMI was 37 and her recommended weight range, according to the BMI scale, was 140 - 149 lbs.

Setting

Weekly sessions took place at a location chosen by the participant at the beginning of the study and remained consistent throughout except on occasions when the participants requested to meet at a different site. Carol's sessions were primarily conducted either at her home or her day services. Glenn's sessions were conducted primarily in his office area within the organization's day service building. During the daily meeting phase, however, Glenn's sessions were conducted at his office, home, and place of work at his request. Laurie's meetings were initially conducted in her residential management team's office at the apartment building where she lived. When the office was closed, the meetings occurred at Laurie's home. Because participants were asked to wear the Fitbit Flex® during all waking hours except when engaging in water-related activities (e.g., taking showers, baths), step data was collected by the device throughout the participant's day in the natural environment at home and outside of the home.

Dependent measures

Steps. The investigator chose steps as a dependent variable because it is a measure of physical activity that can be monitored using a tracking device. While direct observation remains the gold standard in behavior analysis, tracking devices, such as Fitbit Flex®, have proved moderately reliable and valid for tracking one's physical activity throughout the day.

Weight. Weight (in full pounds) was selected a secondary measure to determine whether increased steps correlated with decreased weight. A digital scale was used for all participants. Carol and Glenn used a scale provided by the researcher. Laurie used her home scale.

Procedures

Fitbit Flex®. According to the Fitbit® website, the Fitbit® model used in the present research was a wristband device designed to measure steps taken, calories burned, distance

traveled, active minutes, and several statistics related to sleep. However, for the purposes of this study, the researcher used the device solely to measure steps. This device is very simple and features a small, rectangular screen with light emitting diode (LED) indicators in the shape of small circles. Each circle represents 20%-increments of an individual's step goal. If the light indicator is solid, it means that the person wearing it has met 20%, 40%, 60%, 80%, or 100% of the step goal if one, two, three, four, or five indicators are lit, respectively. A blinking light indicates the segment of the goal that the person is working on but has not completed thus far. When 100% of the individual's step goal is met, the device vibrates and flashes the LED indicators across the screen. It should be noted that the face of the device never shows the exact number of steps taken.

When the primary researcher programmed the device for each participant, the individual's height, weight, sex, and wrist (dominant or non-dominant) was entered into the device's database. To do this, the researcher logged into the website or phone application, to which only she had access and linked each participant's device. Each participant's device was paired with a separate email address log-in and password. By having access to each participant's account, the researcher was able to adjust step goals as needed throughout the study. Finally, because Fitbit® sets the default step goal to 10,000 (for a 24-hour period) and to prevent the device from providing sensory and visual feedback when that step goal was met, the researcher adjusted the step goal so that it was unattainably high, at 500,000 steps, until the intervention phase.

Baseline. At the start of baseline, the researcher provided a device and charger to each participant and instructed the participant to wear it during all waking hours except during times when the device would be submerged in water. Additionally, participants were instructed to

charge it two or three times weekly. The researcher began holding weekly meetings with participants to complete a weekly weigh-in and to sync the device with the phone application. For weigh-ins, the researcher placed the scale on the floor and the participant stepped on the scale. The researcher then recorded the whole number (i.e., not including decimals) on the digital scale. This continued throughout the duration of the study on the same day and at the same time each week with minimal deviation from the schedule.

Intervention Package Components. Several components (i.e., feedback, goal-setting, and reinforcement) were used in this intervention. Each one will be described separately before describing the components used in each phase. Please see Appendices C, D, and E for a flow chart describing components and conditions for Carol, Glenn, and Laurie respectively.

Rationale and List of Indoor Walking Options with Map. The researcher provided a rationale to help the participant understand why physical activity is important by stating the following: "You have been diagnosed with obesity. This may be related to having a lack of physical activity and remaining sedentary throughout the day. If you increase your physical activity, you may begin to lose weight and improve your overall health. Walking is a form of exercise that your doctor agrees is a safe way to help you improve your health and weight. The recommended weight for a person of your height and age is ___ lbs." In addition to providing a rationale during the first intervention meeting, the researcher provided the participant with a list of places in town that had indoor walking tracks accompanied by a map that indicated trails and outdoor/indoor parks. The researcher encouraged the participant to use the indoor track locations if they preferred to walk indoors or in the case of inclement weather conditions.

Goal-Setting. Goal-setting occurred weekly on the day and time consistent with weekly weigh-ins and took place after the feedback portion of the intervention on weeks when the

current goal was met. A step goal was considered "met" when the daily step goal was reached at least five out of seven days during the week. Determining the initial step goal was based on an average number of daily steps the participant took during baseline phases. The researcher stated how many more steps the participant needed to achieve a 2% or 3% increase in steps. The researcher referred to these increases as the "smaller increase" and the "larger increase" for the 2% and 3% increases respectively. Considering these numbers, the participant chose between either a 2% or 3% increase for the upcoming week. For example, if the average number of steps during baseline was 9,000, the step goal would be based on the following calculation: 9,000 x .02 = 180 (for a 2% goal) or 9,000 x .03 = 270 (for a 3% goal). Depending on which percentage increase the participant chose, the step goal would be either 9,180 or 9,270. Each week the participant achieved his or her goal, the researcher asked the participant to choose between a 2% or 3% increase for next week. Not meeting a step goal was defined as meeting the daily step goal four or fewer times during the previous seven days. In these cases, the researcher informed that his or her step goal would remain the same for the following week.

Feedback. Four types of feedback were provided during intervention: (a) daily visual feedback from the device, (b) daily sensory feedback (i.e., vibration) from the device, (c) weekly verbal feedback from the researcher, and (d) weekly visual feedback from the researcher. The device provided daily visual feedback during all intervention phases in the form of the LED lights as discussed previously. As the participant met 20%-increments of his or her step goal, when he or she tapped on the device, LED indicators lit up on the screen. The device also provided sensory feedback (i.e., vibration) on days during intervention if and when the participant met his or her daily step goal. The researcher provided verbal feedback during weekly meetings. The researcher made positive comments (e.g., "You did such a nice job meeting your

step goal on Monday, Tuesday, Thursday, and Friday!") regarding days when the step goal was met and corrective feedback (e.g., "It looks like you didn't quite meet your step goal on Wednesday, Saturday, or Sunday. You were close, but you didn't quite make your goal.") for days when the step goal was not met. The researcher provided visual feedback during weekly meetings in the form of a printed bar graph indicating the daily steps taken, the current step goal, and the new step goal (if applicable) (see Appendix F for an example). Additionally, the researcher prompted the participant to color in the bar graph with colored pencils or markers. Participants often drew smiley faces, stars, or checkmarks to indicate days when the step goal was met although the researcher did not prompt them to do so. Finally, the researcher provided each participant with a binder for the safe-keeping of his or her graphs.

Preference Assessment and Treasure Box. The researcher conducted an informal preference assessment through a staff-interview at the beginning of the first condition associated with the treasure box by asking staff what they thought the participant might like to work for. Any item identified by the staff was added to the treasure box. The researcher then conducted a preference selection (i.e., asked participants what items they would like to work for) with the participant and continued these preference selections with the participants at each meeting throughout the conditions associated with the treasure box so that they could request additional items. Any item that the participant requested was added to the treasure box. The treasure box was a 1 ft x 3 ft box with decorative fabric which contained prizes such as gift cards (e.g., Walmart, Target, Petco, Bath and Body Works, Hobby Lobby, and Office Depot), and actual items (e.g., crayons, coloring books, markers, colored pencils, decorative coffee mugs, stickers, decorative writing utensil bags, colorful cardstock, stationary, and gum). If the participant did

not meet his or her step goal, the prizes in the prize box, though visible, were unavailable during the meeting.

Experimental Design and Conditions

The current study utilized a concurrent multiple baseline design replicated across three participants, with an unplanned reversal, and a changing criterion, to evaluate the effects of a self-management package using Fitbit Flex® on steps taken by adults with IDD. Conditions in this study include baseline (BL); second baseline (BL2); unplanned reversal (UR); goal-setting plus feedback (GS+F); goal-setting, feedback, plus weekly treasure box (WTB); delayed goal-setting plus feedback plus weekly treasure box (WTB2); goal-setting, feedback, plus daily treasure box (DTB); and finally delayed goal-setting, feedback, plus daily treasure box (DTB2).

Initially, the primary researcher intended for this study to evaluate the effects of GS+F and Fitbit Flex® on steps taken by adults with IDD. Therefore, it was originally designed as a multiple baseline design across participants with the BL condition and the GS+F condition. When the initial intervention did not have an effect with Carol, the WTB condition was implemented. This condition increased steps slightly. However, the primary researcher then wanted to test the effects of the treasure box with a more immediate opportunity to access a reinforcer. Thus, the researcher designed the DTB condition. A UR occurred when the participant or researcher was out of town or when a participant refused to wear the device.

Due to the availability of the participants, delayed conditions were also implemented. The WTB2 condition was created for Laurie because, during her first three weeks that she would have been in the WTB condition, she left town for the holidays and got sick shortly thereafter and was unable to meet. The WTB2 condition procedures were identical to the WTB procedures

except the meeting was delayed by 1-2 days. Feedback and access to the reinforcer (if earned) were delayed until Laurie could meet. Additionally, the DTB2 condition was implemented for Glenn because he was unable to meet daily due to his work responsibilities. The procedures in this condition were identical to the DTB condition except meetings were sometimes delayed by 1-3 days. Instead of providing feedback and the opportunity to earn a $1 prize from the treasure box, the researcher provided the opportunity for Glenn to earn items from the treasure box for the previous day and an additional $1 prize for days when he met step goals since the previous meeting.

Finally, Laurie obtained a new job during her BL condition. Due to the dress code at the agency, she was unable to wear her device on her wrist during working hours. Therefore, a new baseline (i.e., BL2) was taken, during which she wore the device on her wrist until she started her shift, at which point she should put her device in her pocket. Laurie worked five times weekly for four hours. The researcher instructed Laurie to put her device back on her wrist at the completion of her shift. These procedures were carried out for the remainder of the study.

To move from BL (or BL2, for Laurie) to the first intervention phase, GS+F, a participant's step data needed to be stable or decreasing and weight could not be decreasing. Furthermore, using multiple baseline design logic, Glenn's GS+F condition did not occur until the researcher observed a change in Carol's behavior and Laurie's GS+F condition did not occur until the researcher observed a change in Glenn's behavior.

Participants entered the WTB condition from the GS+F condition when they had four consecutive weeks of unmet step goals. During the WTB condition, items available each week depended on whether the participant chose and met a 2% or 3% increase in his or her step goal. If the participant chose and met a 2% increase in his or her step goal, the participant earned a

prize(s) worth $5. If the participant chose and met a 3% increase in his or her step goal, the participant earned a prize(s) worth $7. If a participant chose a 3% step goal but met a 2% step goal, the participant still did not earn a prize because he or she identified the higher step goal.

After four consecutive weeks of not meeting step goals in the WTB condition, the DTB condition was implemented. To determine if more immediate access to the treasure box items improved the performance of participants, during this condition, the participant could earn a prize worth $1 (e.g., gum, Chapstick, and stickers) or just a $1 bill. Though items were limited, preferences continued to be based on a preference selection conducted at the end of each meeting to ensure that items available were preferred. Because the prizes that were available in previous conditions were too expensive to provide on a daily basis, those items were removed from the treasure box. Each participant had the opportunity to earn up to $7 in a week during this condition, whether he or she was working toward a 2% or 3% step goal. Further, the researcher continued to provide verbal and visual feedback during daily meetings. However, instead of printing the bar graph, the researcher only provided a visual of the graph on the computer for daily meetings. On weekly meeting days, the researcher provided a printed bar graph. Because Laurie had been participating for 645 days and periodically indicated that she was uninterested in continuing, after meeting the 4-week criteria to move to the DTB phase, the researcher offered her the option of continuing to the next phase or terminating her participation. She chose to terminate her participation in the project. (For a flow chart of the order in which each participant engaged with each intervention phase, see Appendices C, D, and E).

Data Collection and Inter-Observer Agreement

As previously stated, the participant's Fitbit Flex® device collected the number of steps taken within a 24-hour period. Data was synced to the researcher's cellphone device and online

account each week. The frequency of steps was collected and transferred onto a monthly data sheet. Additionally, weekly weigh-ins were conducted using a digital scale for each participant. These weights were also recorded on the monthly data sheet in full pounds.

To assess the inter-observer agreement (IOA), each participant's step counts were retrieved from personalized accounts online. A second observer independently recorded the frequency of each of the participant's steps on a separate data sheet for all days in all phases (See Appendix G). The participant's daily steps recorded by the independent observer were then compared to the daily data collected by the primary researcher. To be considered an agreement, the number of step recorded by the observer had to match exactly the number of steps recorded by the primary researcher. If the number of steps recorded differed by one or more steps, a disagreement was recorded. The number of agreements were then divided by the number of disagreements plus agreements for each phase. IOA overall results were 99.34%, 99.61%, and 100% for Carol, Glenn, and Laurie respectively (see Tables 1, 2, and 3 for phase-and participant-specific reliability). Additionally, IOA was calculated for 34.7%, 23.2%, and 40.2% of weigh-ins for Carol, Glenn, and Laurie respectively across the entire study. To be considered an agreement, the weight in full pounds recorded by the secondary observer had to be an exact match with the weight recorded by the primary researcher. Overall reliability was 100% for both Carol and Glenn and 96.9% for Laurie.

Treatment Integrity

A secondary observer recorded the researcher's implementation of intervention steps and calculated treatment integrity. Observing the intervention, the secondary observer scored whether the primary researcher engaged in an intervention step ("Yes") or not ("No). To calculate the data, the number of "Yes" marked were divided by the number of "Yes" and "No". (To see the

quiz provided to second observer before data collection began, see Appendix H). These data were collected in-vivo for a percentage of sessions for Glenn and Laurie in some conditions. Treatment integrity scores were collected for 40% of Glenn's WTB condition and 39.2% of the DTB2 condition. Likewise, treatment integrity scores were collected for 55% of Laurie's GS+F condition, 66.6% of the WTB condition, and 75% of the WTB2 condition. Treatment integrity scores, across all phases and two participants, were 100% (See Tables 7 and 8 for Glenn and Laurie's treatment integrity results respectively). (See Appendices I and J to review treatment integrity data sheets for weekly and daily meetings).

Results

Cumulative weekly steps for each participant are displayed in Figure 1. Weeks are represented on the x-axis. Cumulative weekly steps are represented on the y-axis. The cumulative weekly step mean is represented by the blue horizontal line. Daily step averages per week are displayed in Figure 2. Weeks are represented on the x-axis. The daily average of steps per week are represented on the y-axis. After the initial introduction of GS+F, conditions were in varying orders for each participant.

Carol's average number of steps taken across the entire BL phase was 60,064 steps per week. Her GS+F average across the course of the phase increased slightly to 62,498. During the WTB condition, Carol's average number of steps taken across the course of the phase increased to her all-time high, 82,652 per week. During the UR phase, Carol took an average of 22,485 weekly steps. When returning to the WTB phase, Carol took an average of 61,728 steps, each week, which was slightly above her BL average. The primary researcher made one last attempt to increase steps by implementing the DTB phase to provide more immediate access to reinforcement to address the potential that the delay of reinforcement may have contributed to

Carol failing to meet step goals. During the DTB phase, the weekly average number of steps across that condition was 48,179. Finally, the primary researcher implemented a final UR condition where Carol's weekly step average across the phase was only 3,571.

Glenn's average number of steps taken across his first BL phase was 47,549 steps per week. During Glenn's first UR phase, the average number of weekly steps taken was slightly lower than baseline at 46,175. During the return to BL, Glenn took an average of 56,738 weekly steps. During the GS+F phase, Glenn took an average of 63,335 weekly steps. Glenn walked an average of 3,612 weekly steps during his second UR phase, which was markedly lower than any other previous phase. Glenn returned to the GS+F phase after the UR and walked an average of 44,434 weekly steps. Similar to Carol, Glenn's weekly steps when he returned to the intervention phase, after his UR condition, were noticeably lower than the average number of weekly steps across the phase before the UR. During the WTB phase, Glenn walked an average of 55,536 weekly steps, which was an increase from his second GS+F phase, but did not exceed his highest phase average, which was his first exposure to the GS+F phase. Finally, Glenn engaged in a weekly average of 57,930 steps during the DTB2 phase, which increased just slightly from his second WTB condition.

Laurie's average number of weekly steps taken across her first BL phase was 54,743 steps. Laurie's first UR phase of average weekly steps was a significantly lower average at 1,640 steps weekly. When Laurie returned to BL, her weekly step average was 39,058. Laurie's BL2 phase weekly step average was 29,765. Laurie's second UR phase average weekly steps was 38,775. During the return to BL2, she took an average of 26,502 weekly steps. During Laurie's GS+F phase, Laurie took an average of 51,322 weekly steps, which was her highest step average in any phase. Laurie moved into the WTB2 where her average number of weekly steps was

36,734. Finally, Laurie moved to the WTB phase where her weekly step average across the phase was 49,886.

Carol, Glenn, and Laurie's weights are displayed in Figures 3, 4, and 5 respectively. Weeks is represented on the x-axis. Weights are represented on the y-axis. Carol's initial weight was 195 lbs and her final weight was 198 lbs. Carol's weight varied throughout the study ranging from 184-199 lbs. Glenn's initial weight was 258 lbs and final weight was 283 lbs. Glenn's weight varied over the course of the study ranging from 252-284 lbs. Finally, Laurie's initial weight was 209 lbs and her final weight was 204 lbs. Laurie's weight varied across the course of the study ranging from 196-209 lbs.

The percentage of each participant's daily step goals met per phase are displayed in Figures 6, 7, and 8 for Carol, Glenn, and Laurie respectively. Intervention phases are represented on the x-axis. The percentage of daily step goals met are represented on the y-axis. Carol was in the GS+F phase for a total of 28 days. She met 42.85% of her daily step goals. Carol spent 98 days in the first and second WTB phases combined. She met 62.24% of her daily step goals within those phases. Carol spent 35 days in the UR phase, total, where she met 8.57% of her daily step goals. Finally, Carol was in the DTB phase for a total of 21 days and she met 33.33% of her daily step goals. Therefore, Carol had the most success during the WTB condition.

Glenn was in the GS+F phase for 147 days. He met his daily step goal 54.42% of the time during that phase. He was in the UR phase for a total of 21 days, and during this time, he did not ever meet a daily step goal. Glenn was in the WTB phase for a total of 70 days and met his step goal 41.42% of the time. Finally, Glenn spent 42 days in the DTB2 phase and met his daily steps goals 35.71% of the time. This revealed that Glenn had the most success meeting his daily step goals during the GS+F condition.

Laurie was in the GS+F phase for 140 days. She met her daily step goal 59.28% of the time during that phase. She was in the WTB2 phase for 21 days and met her daily step goals 9.52% within that phase. Finally, she was in the WTB phase for 28 days and met her daily step goals 25% of the time. Laurie had the most success in the GS+F condition.

Discussion

The present study extends previous research in several ways. Researchers aimed to increase physical activity for individuals with IDD in an unsupervised setting and without continual prompts. Specifically, we investigated the effects of feedback, goal-setting, and reinforcement using a Fitbit Flex® on steps taken by adults with IDD within their natural environments. Previous behavioral interventions using the aforementioned components have been effective for typically developing adults and somewhat effective for adults with IDD. The present study yielded similar results. Researchers found the self-management package to be somewhat effective, temporarily, for all three participants. Although steps taken for all three participants increased slightly, two participants had greater success meeting weekly step goals in the GS+F condition than in the WTB condition. For one participant, weekly step goals were only met during the WTB condition.

Previous research found that adults with IDD increased their physical activity using components of a self-management package, especially interventions that included reinforcement. However, a limitation of previous studies is that they have been conducted in staff- and researcher-supervised settings. The results of this study suggest that adults with IDD may be able to increase their physical activity in less contrived settings often seen in previous research. Thus, the effects in the natural setting could be observed in this study.

Studies in previous research have often used continual prompting during structured walking sessions which limits the individual's opportunity to engage in physical activity independently and without prompts. Although the frequency and consistency of the prompts provided throughout sessions in past research have varied, this study provided participants the opportunity to engage in increased physical activity more independently. The data in this study suggest that adults with IDD may not need continual prompting to engage in increased physical activity.

Although the current study was effective in increasing steps taken by adults with IDD, there were several notable limitations. The researchers were unable to obtain baseline data without the device. Thus, it is possible that participants were engaging in different rates of steps before wearing the Fitbit Flex®. Similar to the issue of not having a true measure for baseline, daily steps were not measured before participants wore the device, nor were steps measured after the device was removed.

There were several difficulties throughout the study with participants not wearing their devices as instructed. For example, participants occasionally forgot to wear their device for the entire day or for several hours. Further, participants occasionally forgot to charge the device, thus wearing it while it was almost dead (or completely dead), causing the device to die in the middle of the day. All participants experienced technical difficulties (e.g., failure to hold a charge, complete malfunction) with their devices at some point during the study. Therefore, the researcher had to re-order devices multiple times for all participants. Furthermore, because the devices were an older model, the researcher could not access a new in-store device but instead had to order it online, sometimes taking as long as three weeks to arrive.

As expected from working in the natural environment with adults who have IDD, there were several competing contingencies that the researcher could not control. For example, after five consecutive weeks of meeting step goals and maintaining increased levels of steps, Carol and her mother reacquainted themselves after many years without contact. Their first visit together occurred during the last week that Carol met her weekly step goal. At this time, her mother began offering her $75 per month, noncontingently. Although a causal relationship cannot be shown, Carol's decline in steps and sudden halt in meeting weekly step goals correlates temporally with access to her mother's provision of money. Consequently, it is possible that the $5-$7 prizes offered by the researcher lost their reinforcing effects. Additionally, Glenn and Laurie both had steady sources of income from their jobs. Although the amount of money earned from their jobs is unknown, this may have affected the potency of the reinforcers when these participants were in phases that included the treasure box.

The data suggest that UR phases, though unavoidable due to participants' schedules, may have caused some extinction effects. Participants who experienced UR conditions during intervention were never able to re-establish similar rates of steps after returning to intervention. This can be observed with both Carol, in the WTB phase, and Glenn in the GS+F phase. After consistently and successfully meeting weekly step goals and increasing overall cumulative weekly steps, Carol and Glenn both entered a UR condition. After returning to intervention, decreasing steps (for Carol) and increased variability in steps (for Glenn) were observed.

Finally, researchers did not address eating habits with participants in this study. Physical activity is only one contributing factor to weight. A person's eating habits, medications, and genetic conditions may also play roles in a person's weight. The researcher chose to target steps because it is an easy and convenient way to increase physical activity, a step toward improving

one's overall health, and a simpler to target within the natural environment of adults with IDD than eating habits. Improved outcomes related to weight may have been demonstrated if other factors of weight were addressed, for example, eating habits.

Given the limited number of studies aimed to increase physical activity for adults with IDD, the limitations of this study and noteworthy barriers from previous studies provide many suggestions for future research. Researchers should explore interventions that could be implemented with varying levels of supervision. This study was effective in increasing steps for adults with IDD in the natural environment with less supervision than previous studies. However, there may be a moderate-level of supervision that could yield greater effects than those observed in this study without the need for providing continual prompts in contrived sessions similar to procedures carried out in previous studies.

Next, researchers might also examine physical activity using social contingencies. For example, Fitbit® has a feature that individuals can use to engage in social competitions with friends. The Fitbit® phone application allows individuals to follow the progress and compete with peers' steps, throughout the day by clicking on the "competitions" feature on the phone application. Anecdotally, participants in this study often asked the researcher about other participants' progress with step goals. The competition feature of the Fitbit® could be used as an independent variable to increase steps for participants with IDD. Furthermore, researchers might explore the effects of peers to increase physical activity for adults with IDD. Studies have examined physical activity using partners (Knoll et al., 2017) peer-delivered interventions (Martin Ginis, Nigg, & Smith, 2013), and the feasibility of using social networking (Pinkerton, Tobin, Querfurth, Pena, & Wilson, 2017; Van Kessel, Kavanagh, & Maher, 2016). Thus, there

are many paths that could be taken by future researchers who are interested in expanding literature on the effects of peers on physical activity in adults with IDD.

Additional research could investigate using different shaping and fading procedures in physical activity studies. While this study used a changing criterion, shaping the number of steps taken by adults with IDD, other shaping procedures could be examined. For example, researchers could begin to make reinforcers contingent on meeting a step goal one day, followed by two days, three days, and so forth until the participant is meeting a desired step goal for five days weekly. From there, researchers could begin to increase steps slowly, continuing to use a shaping procedure. Moreover, a fading procedure could be used to fade, not only reinforcement, but the researcher's feedback and presence. This might be done by fading face-to-face contact to less frequent emails or text messages.

Future research also could investigate the effects of varying strengths of sensory feedback. For example, the Fitbit Flex® had LED light indicators as visual feedback and a vibration of the device when step goals were met. Adults with IDD may have different sensory needs with respect to feedback. A device with stronger vibration and a larger screen with more colorful visual effects may be more effective to help individuals with IDD track their daily progress with step goals.

Finally, physical activity is just one component of overall health. Because there are many variables that affect one's health, a comprehensive approach to health improvement should be implemented. For example, Glenn gained 25 lbs over the course of the study. Therefore, eating habits, medication control, and other health indicators should be targeted in conjunction with physical activity to enhance each participant's ability to achieve health-related goals. Placing contingencies on physical activity and weight-loss together, for example, may assist participants

in improving a variety of health outcomes (e.g., cholesterol levels, blood pressure) using measures such as heart rate and physical activity intensity-levels. While steps and weight are often selected as dependent variables, the health indicators mentioned above could also have great clinical significance.

The present study addressed important limitations in previous research with respect to physical activity for adults with IDD. Findings of this study are consistent with previous research in that goal-setting, feedback, and reinforcement are effective in increasing steps for adults with IDD. However, the degree to which the intervention was effective varied across participants. This indicates that, for some participants, goal-setting and feedback may be enough to increase steps whereas, for other participants, tangible reinforcers may be necessary to do so. Moreover, conducting research in the natural environment of adults with IDD presents many unique challenges. Therefore, more research needs to be conducted to find the least intrusive and most effective intervention to increase steps taken by adults with IDD. This study is one step toward building a foundation for improving the overall health of individuals with IDD.

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Table 1

Participant Demographics

	Age	Diagnoses	Height	Initial Weight	Recommended Weight (based on BMI)	Living Arrangement
Carol	38	mild IDD, autism spectrum disorder (ASD), cerebral palsy (CP), obesity, generalized anxiety disorder, obsessive compulsive disorder, attention deficit hyperactive disorder	5'0"	195 lbs	120-129 lbs	Group home
Glenn	31	ASD, CP, obesity	5'6"	258 lbs	160-169 lbs	Adult foster care
Laurie	49	mild IDD, obesity, diabetes, high blood pressure, high cholesterol, depression	5'3"	209 lbs	140-149 lbs	Apartment

Table 2

Reliability Results for Carol's Steps

Baseline		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**99.34%**
Intervention (Goal-Setting+Feedback)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Weekly Treasure Box)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Unplanned Reversal		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Daily Treasure Box)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**

Table 3
Reliability Results for Glenn's Steps

Baseline		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**99.61%**
Unplanned Reversal		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Goal-Setting+Feedback)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Weekly Treasure Box)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Daily Treasure Box Delayed)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**

Table 4

Reliability Results for Laurie's Steps

Baseline		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Unplanned Reversal		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Baseline 2		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Goal Setting+Feedback)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Weekly Treasure Box Delayed)		
	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**
Intervention (Weekly Treasure Box)	Percentage of days scored	100%
	Percentage of Interobserver Agreement	**100%**

Table 5

Reliability Results for Participant Weights Across All Phases

Carol		
	Percentage of weigh-ins scored	34.70%
	Percentage of Interobserver Agreement	**100.00%**
Glenn		
	Percentage of weigh-ins scored	23.20%
	Percentage of Interobserver Agreement	**100.00%**
Laurie		
	Percentage of weigh-ins scored	40.20%
	Percentage of Interobserver Agreement	**96.90%**

Table 6

Treatment Integrity Results for Glenn

Intervention (Weekly Treasure Box)	
Percentage of sessions scored	40%
Percentage of Treatment Integrity	**100%**
Intervention (Daily Treasure Box Delayed)	
Percentage of sessions scored	39.20%
Percentage of Treatment Integrity	**100%**

Table 7

Treatment Integrity Results for Laurie

Intervention (Feedback and Goal Setting)	
Percentage of sessions scored	55%
Percentage of Treatment Integrity	**100%**
Intervention (Weekly Treasure Box)	
Percentage of sessions scored	66.60%
Percentage of Treatment Integrity	**100%**
Intervention (Weekly Treasure Box Delayed)	
Percentage of sessions scored	75%
Percentage of Treatment Integrity	**100%**

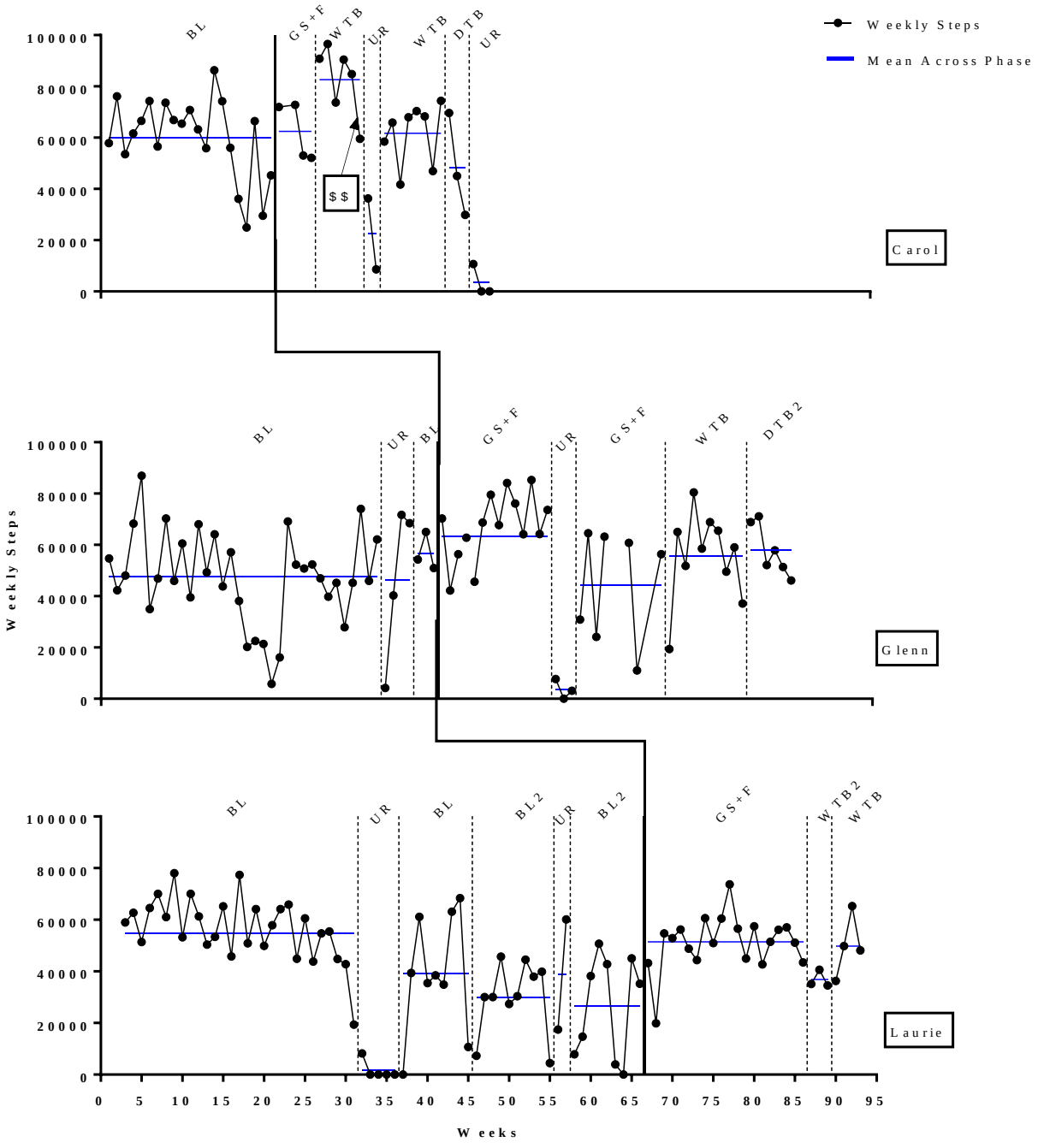


Figure 1. Results of the sum of weekly steps taken by each participant during each phase of the study.

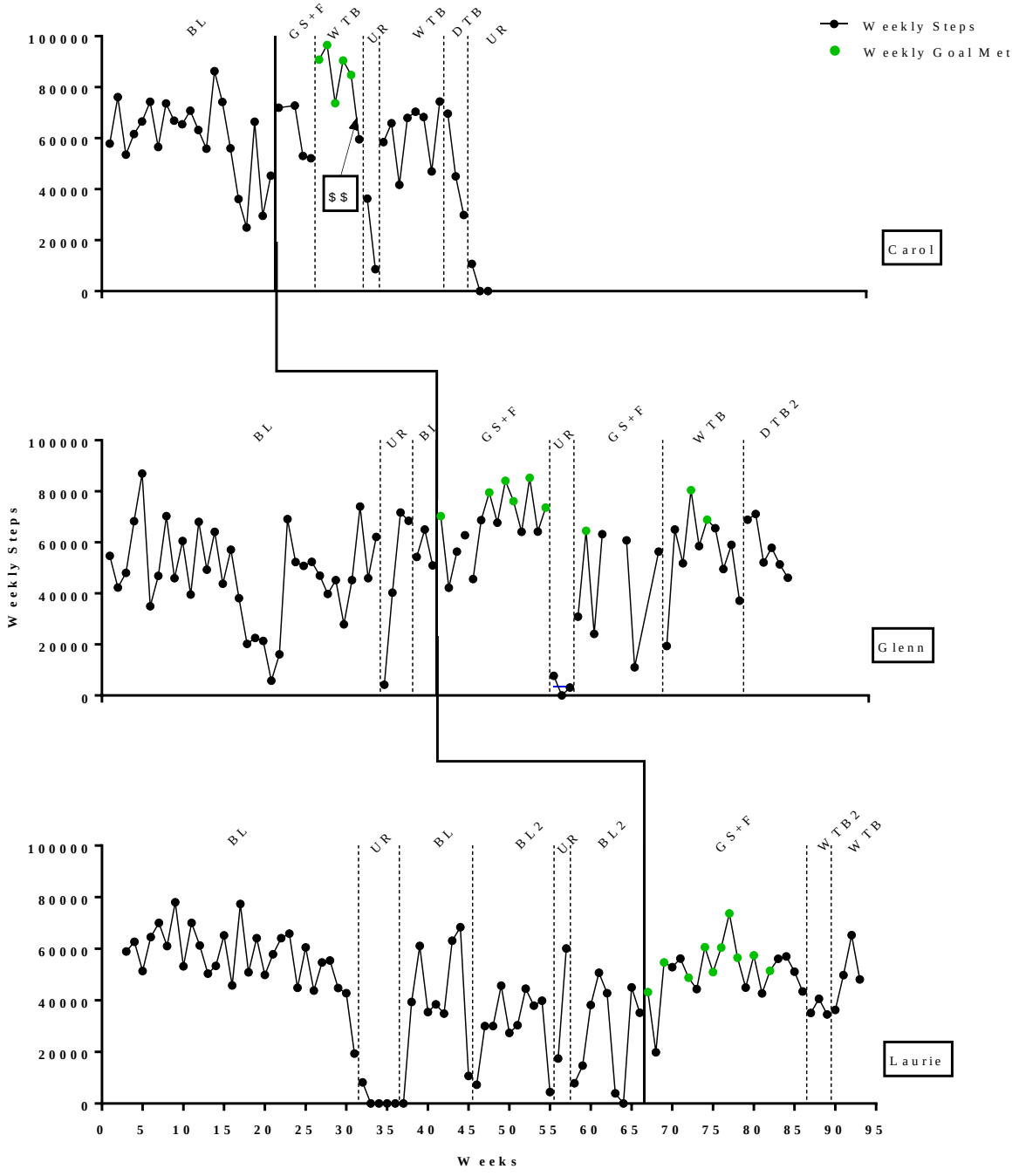


Figure 2. Results of the sum of weekly steps taken by each participant indicating weeks with met weekly step goals during each phase of the study.

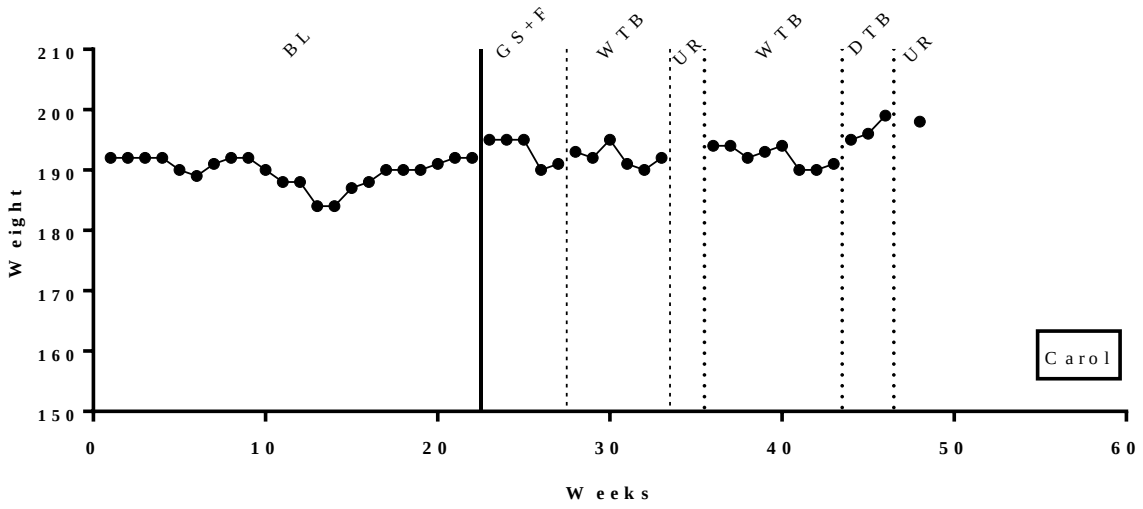


Figure 3. Results of Carol's weekly weigh-ins for each week during each phase of the study.

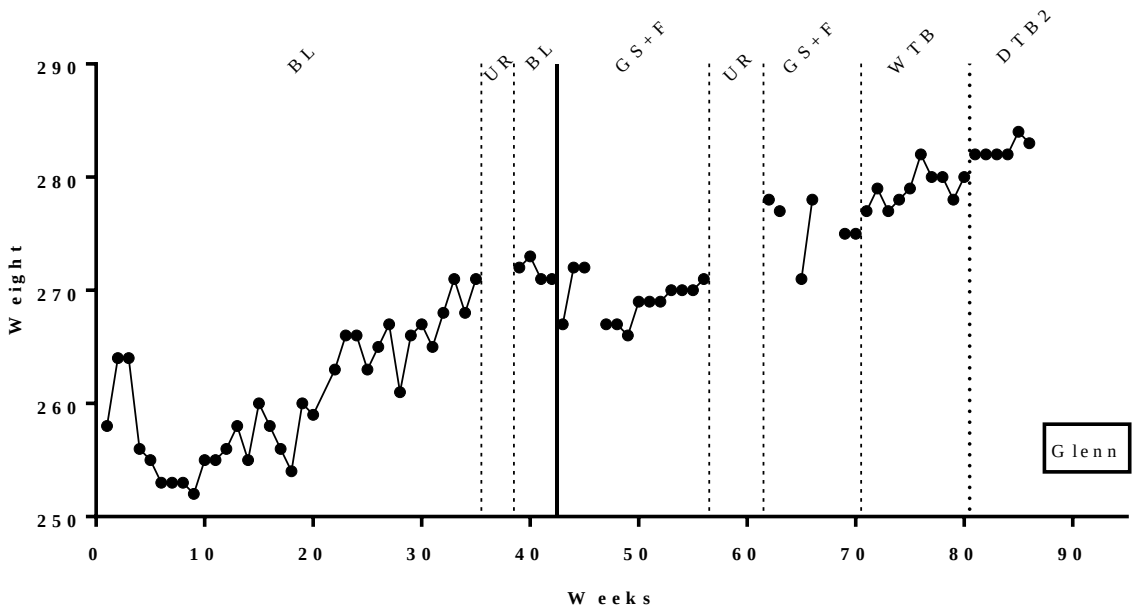


Figure 4. Results of Glenn's weekly weigh-ins for each week during each phase of the study.

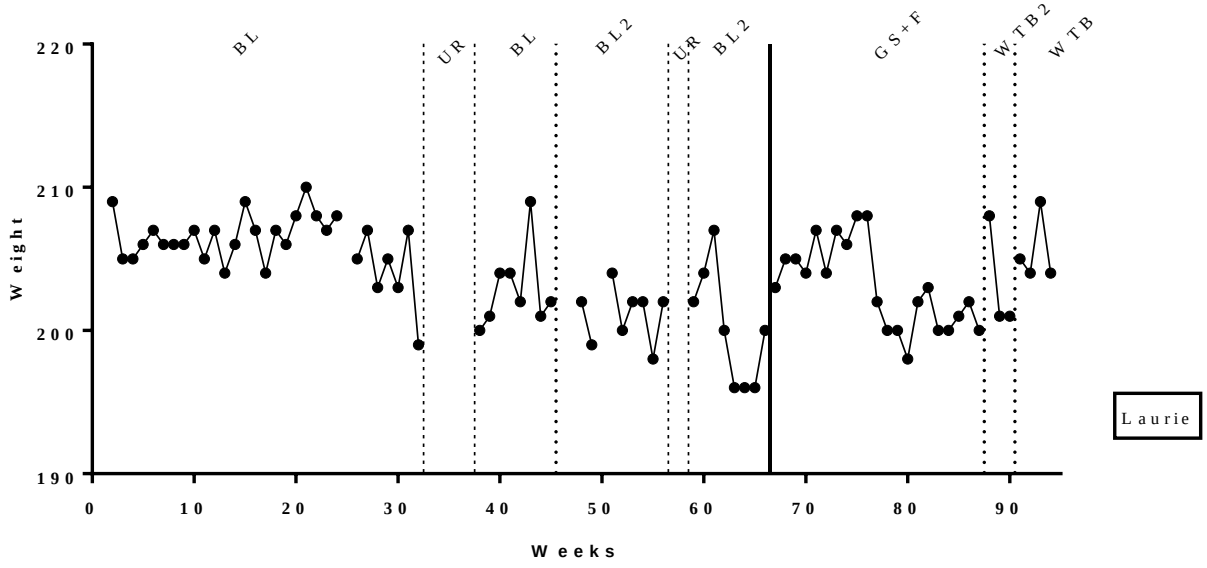


Figure 5. Results of Laurie's weekly weigh-ins for each week during each phase of the study.

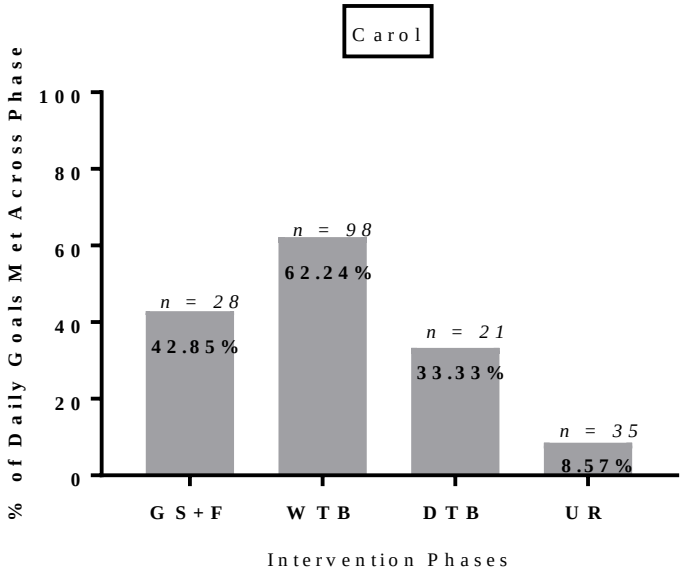


Figure 6. Percentage of daily goals met across each intervention phase for Carol.

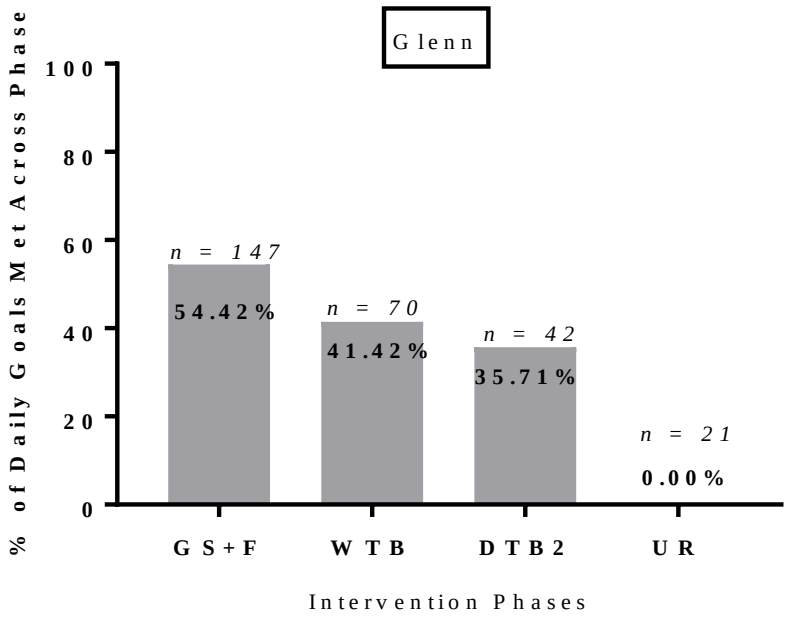


Figure 7. Percentage of daily goals met across each intervention phase for Glenn.

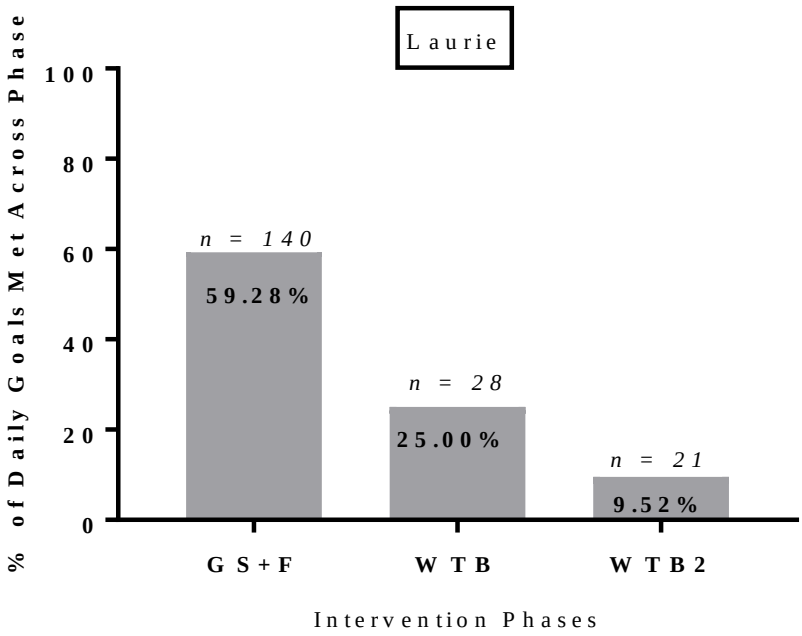


Figure 8. Percentage of daily goals met across each intervention phase for Laurie.

Appendix A – Recruitment Materials

Email to Case Managers

Hello Case Managers,

I am currently working on my Master's thesis project as a second year graduate student in The Department of Applied Behavioral Science at the University of Kansas. I am interested in learning more about the effects of self-management using a fitness tracking device to encourage physical activity for adults with intellectual and developmental disabilities (IDD).

I am seeking your help to nominate potential participants who might benefit from participating in my study. The potential participant must be:

- an adult with mild or moderate IDD or autism,
- receiving day service or residential placement from this agency,
- able to communicate receptively and expressively,
- ambulatory and able to walk without assistance,
- considered overweight or obese by his or her primary care physician.

I have prepared an information packet for the parents and guardians of the candidates that you nominate. I am seeking your help to send the packets to them. Please let me know how many information packets you will need. I know how busy you all are, so the packets will be completely prepared, sealed, stamped, and ready to go. All you will need to do is put the address of the parent/ guardian on the envelope and put them in the mail.

Thank you all so much for your time; it is deeply appreciated.

Marren Leon-Barajas

Coach/ Consultant Phone Script

Hello (parent/ guardian's name),

This is (manager's name) and I want to inform you that I have nominated (consumer's name) to participate in a research study with a student from The Department of Applied Behavioral Sciences at The University of Kansas. I have mailed an information packet to you about the research study. If you are interested in (consumer's name) participating in this study, please review the documents in the packet. There are consent documents in the packet with a stamped envelope if you would like to consent for (consumer's name) to be considered for participation.

Thank you.

Appendix B – Informational Packet with Consent/Assent

Introductory Letter

To whom it may concern:

I am a graduate student in The Department of Applied Behavioral Science at The University of Kansas. I am interested in learning more about the effects of self-management using a fitness tracking device to encourage physical activity for adults with intellectual and developmental disabilities (IDD).

Your son/daughter/ward has been nominated to participate in this study. You will find the following documents located in this packet:

- an informational sheet explaining the purpose and procedures of this study,
- two consent forms
    - one for your records if you should choose to allow your son/daughter/ward to participate;
    - and one to send back to me in the addressed envelope with paid postage;
- and an assent form that I will read to your son/daughter/ward so that he/she can better understand the purpose and procedures.

I am looking forward to hearing from you. Should you have any questions, please feel free to contact me. Thank you for your consideration.

Sincerely,

Marren Leon-Barajas
(phone number)
(email address)

Informational Letter

Effects of Self-Management Using Fitbit® to Increase Steps Taken by Adults with Intellectual and Developmental Disabilities

Purpose

The purpose of this study is to increase walking in adults with intellectual and developmental disabilities (IDD).

Procedures

The researcher intends to work with individuals who (a) have mild or moderate IDD, (b) are receiving services from an agency in a midwestern town, (c) have receptive and expressive communication, (d) are ambulatory and can walk without the assistance of another person, and (e) are considered overweight or obese by their primary care physician.

Initially, the participants will be given a Fitbit Flex® to wear to track their daily steps. At this point, they will be asked to charge it overnight at least twice weekly. Additionally, the first weight will be taken.

The researcher will then have an initial meeting with the participants. Topics to be discussed during this meeting are the name of health diagnoses, how the diagnoses are related to being overweight, and how physical activity might improve their overall health. The locations and times of any meetings will vary based on what is convenient for the participant.

The researcher will eventually begin having weekly meetings with the participants to set daily step goals. At this point, the researcher will adjust each week's goal on the Fitbit® device to give the participant a visual reminder of where they are in meeting their daily goal. Additionally, printed graphs of the participant's daily progress will be provided weekly.

If the participant completes the study in its entirety, they will keep their Fitbit® and be awarded a $100 gift card.

Combined Consents

Effects of Self-Management Using Fitbit® to Increase Steps Taken by Adults with Intellectual and Developmental Disabilities

INTRODUCTION

The Department of Applied Behavioral Sciences at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You may refuse to sign this form and not participate in this study. You should be aware that even if you agree to participate, you are free to withdraw at any time. If you do withdraw from this study, it will not affect your relationship with this unit, the services it may provide to you, or the University of Kansas.

PURPOSE OF THE STUDY

The purpose of this study is to evaluate the effects of a self-management package using activity tracking software to encourage walking in adults with intellectual and developmental disabilities (IDD).

PROCEDURES

1. After receiving proper approvals from university and organizational human rights review boards, obtaining signed consent documents from legal guardians, gaining assent from the participants themselves, and obtaining a doctor's note for approval for the individual's participation, the baseline phase will begin.
2. The primary investigator will provide the participant with a fitness tracking device and instruct them to wear it every day and to charge it overnight at least twice weekly. An initial weight will be taken at this time and will continue weekly from this point forward.
3. The primary investigator will have an initial meeting with the participant to review the importance of physical activity for the person's health. During this meeting, the primary investigator will discuss obesity with respect to weight.
4. The primary investigator will eventually begin to meet weekly with the participant to set a step goal for the upcoming week. The locations and times of these meetings will vary based on what is convenient for the participant. Meetings will occur on the same day of the week each week and take approximately twenty minutes. The initial step goal will be determined by looking at baseline, averaging the number of steps, and then adding 2% or 3% to that averaged number. In subsequent weeks, goals will be determined by looking at whether or not the goal was met at least five of seven days.
5. The primary investigator will begin to adjust each week's goal on the fitness tracking device, by using the phone application, to begin to allow the participant to experience visual feedback on their device when they reach certain percentages of their step goals.

Additionally, the primary investigator will provide printed graphs that are generated by the device once weekly. The participant will be given a binder in which to keep their graphs so that they can access them when they would like to do so.

RISKS

There are no serious risks anticipated in this study. The participant or the participant's guard can withdraw, no questions asked, at any time.

BENEFITS

Potential benefits of this study include an increase in walking for physical activity. Additionally, the participant may be more interested in their health. Individuals with intellectual and developmental disabilities have a long history of having issues with their weight and this study may help them to address some of those issues.

PAYMENT TO PARTICIPANTS

Upon completion of the study, participants will be awarded a $100 gift card if (a) they still have their fitness tracker and (b) it is still in working condition. Investigators may ask for your social security number in order to comply with federal and state tax and accounting regulations.

INFORMATION TO BE COLLECTED

To perform this study, researchers will collect information about your guard. Your guard's medical diagnoses will be collected from a health tracking database that is password protected. The primary investigator will also ask for a doctor's note in order to ensure the primary care physician approves of the participation of your son/daughter/ward in this study. Also, information will be collected from the study activities that are listed in the Procedures section of this consent form. Your guard's name will not be associated in any way with the information collected about you or with the research findings from this study. Instead, the primary investigator will use a number instead of name, for example, "participant 1" instead of "Ashley."

The information collected about you will be used by Marren Leon-Barajas, Dr. Jan Sheldon and Dr. James Sherman and other lab mates. Again, your guard's name would not be associated with the information disclosed to these individuals. Some persons or groups that receive your guard's health information as described above may not be required to comply with the Health Insurance Portability and Accountability Act's privacy regulations, and your health information may lose this federal protection if those persons or groups disclose it.

Your guard's identifiable information will not be shared unless (a) it is required by law of university policy, or (b) you give written permission.

Permission granted on this date to use and disclose your information remains in effect indefinitely. By signing this form you give permission for the use and disclosure of your information for purposes of this study at any time in the future.

REFUSAL TO SIGN CONSENT AND AUTHORIZATION

You are not required to sign this Consent and Authorization form and you may refuse to do so without affecting your guard's right to any services he/she is receiving or may receive from the University of Kansas or to participate in any programs or events of the University of Kansas; or Community Living Opportunities (CLO) and participation in any programs or events of CLO. However, if you refuse to sign, your guard cannot participate in this study.

CANCELLING THIS CONSENT AND AUTHORIZATION

You may withdraw your consent for your guard to participate in this study at any time. You also have the right to cancel your permission to use and disclose information collected about your guard, in writing, at any time, by sending your written request to: Marren Leon-Barajas at 1000 Sunnyside Ave. Room 4001 Lawrence, KS 66045. Please write "Attention: Marren Leon-Barajas" on the envelope. If you cancel permission to use your guard's information, the researchers will stop collecting additional information about your guard. However, the research team may use and disclose information that was gathered before they received your cancellation, as described above.

QUESTIONS ABOUT PARTICIPATION

Questions about procedures should be directed to the primary investigator listed at the end of this consent form.

PARTICIPANT CERTIFICATION:

I have read this Consent and Authorization form. I have had the opportunity to ask, and I have received answers to, any questions I had regarding the study and the use and disclosure of information about my guard for the study. I understand that if I have any additional questions about my rights as a research participant, I may call (785) 864-7429 or write the Human Subjects Committee Lawrence Campus (HSCL), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563, email irb@ku.edu.

I agree to allow my guard to take part in this study as a research participant. I further agree to the uses and disclosures of my information as described above. By my signature I affirm that I am at least 18 years old and that I have received a copy of this Consent and Authorization form.

_____ _____

Type/Print Participant's Name Relationship to Participant

_____ _____

Parent/ Guardian's Signature Date

Researcher Contact Information:

Marren Leon-Barajas

Primary Researcher

(phone number)

(address)

Assent Script

My name is Marren. I am interested learning about physical activity because I want to see whether a Fitbit® can help motivate you to walk. If you would like, you can be in my study. I would like you to (a) wear a Fitbit®, (b) let me tell you the importance of walking for your health, (c) meet with me about your progress with your step goals, and (d) allow me to show you graphs of your daily steps.

If you decide you want to be in my study, you will start wearing the Fitbit®. After that, we will meet to talk about your health with respect to physical activity. This meeting will take about twenty minutes. After that meeting, I want to help you set step goals for the upcoming week each week. After setting a goal each week, eventually, we will use graphs so that you can have a visual of how much you are walking.

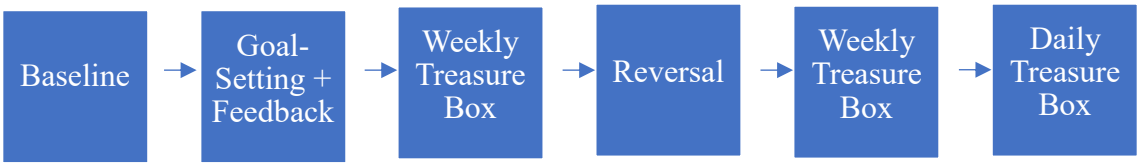
There aren't any major risks involved in this study.

Other people will not know whether you are in my study. I will put things I learn about you together with things I learn about other people so that no one will know which things are yours. Instead of using your name, I will assign you a fake name so that no one will know I am talking about you.

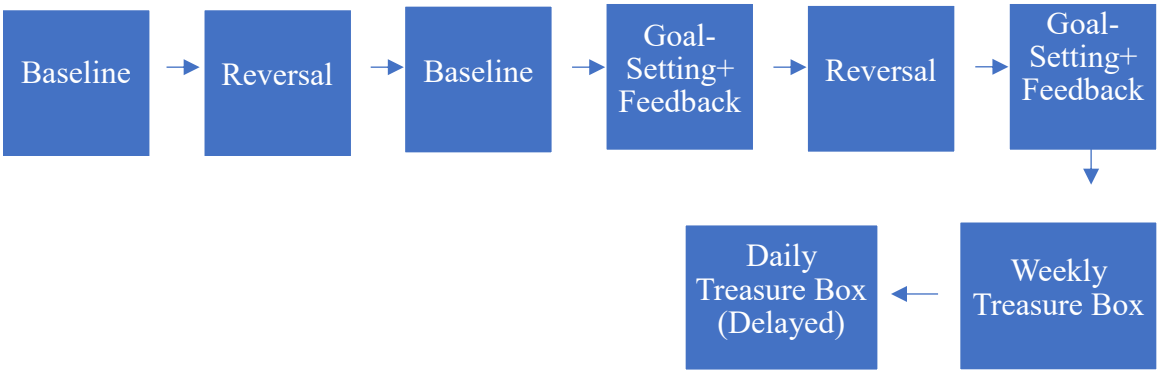
Since I talked to your parent/ guardian first, they have already given the "okay" for you to participate. So, you can be a part if you would like. If you complete the study, you can keep the Fitbit® that I let you borrow, but only if you finish the whole study. I will also help you keep up your healthy habits by giving you a $100 gift card if you finish the whole study. However, if you don't want to be in the study, no one will be mad at you. Even if you want to be in the study now and change your mind later, that is okay too. You can stop at any time. Just let me know that you no longer want to be in my study.

If you don't feel like asking any questions, you don't have to, and you can stop speaking with me anytime and that will be okay. I will be happy to answer any questions you may have now or later, or any time. Do you want to take part in this project?" If you want to think about it, that is okay too.

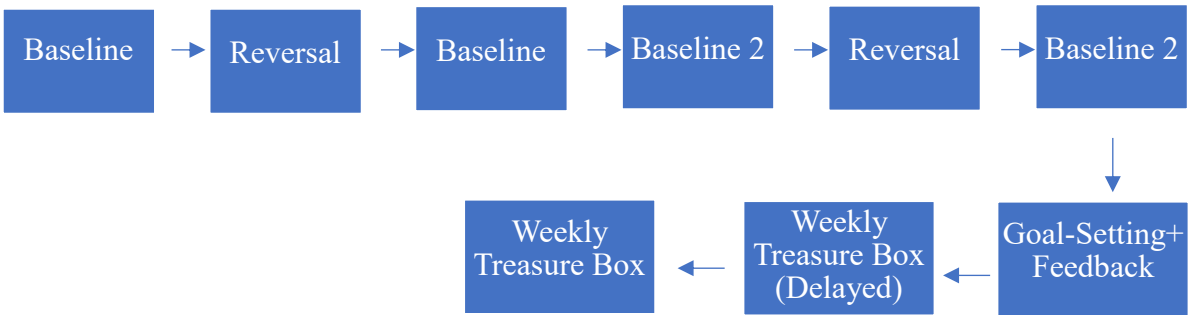
Appendix C – Carol's Flow Chart of Interventions



Appendix D – Glenn's Flow Chart of Interventions

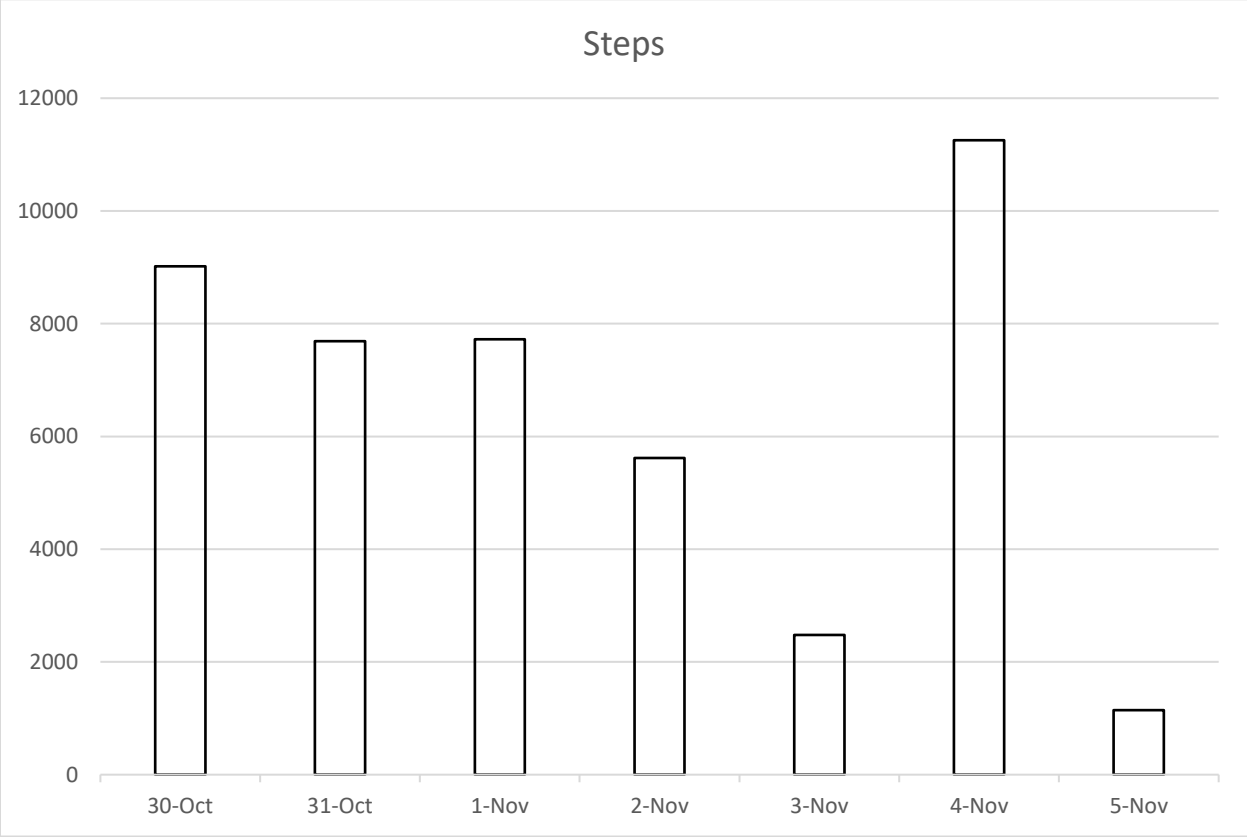


Appendix E – Laurie's Flow Chart



Appendix F – Visual Feedback Graph Example

Current Goal:



Appendix G – Monthly Data Sheet

Date	Days	Steps	Weight	Step Goal	Goal Met?	Notes
					Y N	
					Y N	
					Y N	
					Y N	
					Y N	
					Y N	
					Y N	
					Y N	
					Y N	
					Y N	
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					Y N	
					Y N	
					Y N	
					Y N	

Appendix H – Treatment Integrity Quiz

Training Quiz

Name: _____ Date: _____

1. How many days does the participant need to meet his or her step goal for it to be considered "met"? Circle one.
   A. All 7
   B. 3 or more
   C. 4 or more
   D. 5 or more

2. Give an example of the type of feedback that the researcher could provide the participant if he or she lost weight since the last meeting? Circle one.
   A. It looks like you lost weight, great job!
   B. The researcher should not provide any feedback on weight.
   C. You lost weight, so your earned your prize!
   D. The researcher doesn't have to weigh the participant.

3. Do participants in the WTB phase earn access to the treasure box if he or she met his or her step goal 4 days?

4. Give an example of feedback on graphs that the researcher may provide if the participant met his or her step goal for all seven days of the previous week. Circle one.
   A. You met your step goal all seven days.
   B. You did a fantastic job meeting your step goal all seven days!!
   C. You met your step goal all seven days, but you could have walked even more.
   D. You barely met your step goal.

5. What days are participant meetings?

6. Participants increase their step goals by 2% each week no matter what. Circle one.

   True False

7. Participants have a choice between a 2% and 3% increase in steps goals from their baseline data if they met their step goal from the previous week. Circle one.

True False

8. Participants in the WTB phase must lose weight and meet their step goals to earn access to the treasure box. Circle one.

True False

9. The researcher does not need to prompt the participants to color their graph because they will do so independently. Circle one.

True False

10. What reminder does the researcher need to provide participants who did not meet their step goal regarding their goal for the upcoming week?

Appendix I – Treatment Integrity Sheet (Weekly Meetings)

Treatment Integrity Data Sheet

Researcher: MLB/ Research Assistant: _____ Participant #:_____ / Phase: _____

Date of session: _____/ Day #: _____

Steps:	Circle one
1. Researcher completes participant's weigh-in	Y N
2. Researcher provides feedback on weight (Old: _____/ New: _____)	Y N
3. Researcher provides correct type of feedback based on participant weight	Y N
4. Researcher provides a graph to participant	Y N
5. Researcher prompts participant to color graph (colored/ marks/ both)	Y N
6. Researcher provides feedback on steps for previous week, referring to participant's graph	Y N
• Did the participant *meet the step goal at least 5/7 days of previous week? • How many days did the participant meet the step goal? _____	Y N
7. Researcher provides correct type of feedback based on the number of days participants met step goals	Y N
8. Researcher provides goal setting options (if Y on grayed question above) OR a reminder that the step goal will remain the same (if N on grayed question above)	Y N
FOR PARTICIPANTS IN WTB or DTB phase on weekly meeting day WHO HAVE MET STEP GOAL 5/7 (OR MORE) DAYS	
9. Treasure box offered	Y N N/A
10. Researcher will ask participant if there are any additional prizes that he or she would like to see in the treasure box.	Y N N/A

Scoring instructions: One point will be awarded for each "Y" circled except the grayed step. If in GS+F phase, the denominator is 8. If in WTB or phase and goal is unmet, denominator remains 8. If in WTB phase and goal is met, denominator is 10. If it is weekly meeting day in DTB phase, and goal is unmet, denominator is 8. If in DTB phase and goal is met on weekly meeting day, denominator is 10. Total steps completed for session/ total steps within respective phase. _____/ _____	% of Integrity for session: _____%

*****A step goal is considered "**met**" for the week if the participant matched or exceeded his or her step goal for five or more of the previous seven days. A step goal is considered "**unmet**" for the week if the participant matched or exceeded his or her step goal 4 days or fewer of the previous seven days.

Phases
BL/ BL2 – Baseline
GS+F – Goal setting + Feedback
WTB/ WTB2 – Goal setting + Feedback + Weekly Treasure Box
UR – Unplanned Reversal
DTB/DTB2 – Goal Setting + Feedback + Daily Treasure Box

Key
Y – Yes
N – No
N/A – Not Applicable

	Treatment Integrity Steps	Examples of acceptable researcher behaviors
1	Researcher completes participant's weigh-in	• Researcher asks participant to step on the scale and documents weight
2	Researcher provides feedback on weight	• Researcher makes comments about weight
3	Researcher provides correct type of feedback based on participant weight	• If participant lost weight, researcher makes praise statement about weight (e.g., "Fantastic job losing weight this week!"). • If participant gained weight, researcher provides corrective feedback (e.g., "Uh-oh, it looks like you gained weight this week. That's not good."). • If participant's weight remained the same, researcher makes a neutral statement (e.g., "Your weight is the same this week as it was last week.").
4	Researcher provides a graph to participant	• Researcher hands the participant's graph to him or her, or places it in front of where the participant is sitting
5	Researcher prompts participant to color graph	• Researcher instructs the participant to color his or her graph (e.g.,"Go ahead and color your graph.")
6	Researcher provides feedback on steps for previous week, referring to participant's graph	• Researcher makes comments about the number of steps participant walked.
7	Researcher provides correct type of feedback based on the number of days participants met step goals	• If participant met the step goal some of the days, researcher makes praise statements (e.g., "Tuesday, Thursday, Friday, and Saturday, you met your step goal; fantastic job!") about steps for those days. • If participant did not meet the step goal some of the days, researcher provides corrective feedback (e.g., "Monday, Wednesday, and Sunday, it looks like you would have had to walk some more to meet your goal.") about steps for those days. • If participant met step goal for 5/7 days or more, provide praise statement regarding having met the step goal for the whole week. (e.g., I love how you walked so much on at least 5 days this week! That is so cool! Nice job meeting your goal!").
8	Goal setting choice provided (if Y on grayed question above) OR reminder that step goal will remain the same (if N on grayed question above)	• Researcher asks whether the participant would like to do the 2% or 3% increase in his or her step goal • Researcher may refer to the exact numbers, or as the "smaller" or "bigger" increase.
FOR PARTICIPANTS IN WTB or DTB phase on weekly meeting day WHO HAVE MET STEP GOAL 5/7 (OR MORE) DAYS:		
9	Treasure box offered	• Researcher tells participant that because he or she met his or her step goal, a prize can be selected from the treasure box.
10	Researcher will ask participant if there are any additional prizes that he or she would like to see in the treasure box.	• Researcher asks participant if there is something new that he or she would like to work for during the upcoming week that is not already in the treasure box.

Appendix J – Treatment Integrity Sheet (Daily Meetings)

Treatment Integrity Data Sheet

Researcher: MLB/ Research Assistant: _____ Participant #:_____ / Phase: _____

Date of session: _____/ Day #: _____

Steps:	Circle one
11. Researcher provides visual of cumulative step graph to participant for that week	Y N
12. Researcher provides feedback on steps for previous day	Y N
• Did the participant *meet the step goal yesterday?	Y N
13. Researcher provides correct type of feedback based on whether to step goal was met	Y N
FOR PARTICIPANTS IN DTB PHASE WHO HAVE MET STEP GOAL	
14. Treasure box offered	Y N N/A
15. Researcher asks participant if there are any additional prizes that he or she would like to see in the treasure box (up to 3 new items).	Y N N/A

Scoring instructions: One point will be awarded for each "Y" circled except the grayed step. If goal is unmet, denominator is 3. If goal is met, denominator is 5. Total steps completed for session/ total steps within respective phase. _____/ _____	% of Integrity for session: _____%

*****A step goal is considered "**met**" for the week if the participant matched or exceeded his or her step goal for five or more of the previous seven days.

A step goal is considered "**unmet**" for the week if the participant matched or exceeded his or her step goal 4 days or fewer of the previous seven days.

Phases
BL/BL2 – Baseline
GS+F – Goal setting + Feedback
WTB/WTB2 – Goal setting + Feedback + Weekly Treasure Box
UR– Unplanned Reversal
DTB/DTB2– Goal Setting + Feedback + Daily Treasure Box

Key
Y – Yes
N – No
N/A – Not Applicable

	Treatment Integrity Steps	Examples of acceptable researcher behaviors
1	Researcher provides visual of cumulative step graph to participant for that week	• Researcher shows participant his or her graph on the computer
2	Researcher provides feedback on steps for previous day	• Researcher makes comments about the number of steps participant walked.
3	Researcher provides correct type of feedback based on whether to step goal was met	• If participant met the step goal, researcher makes praise statement • If participant did not meet the step goal, researcher provides corrective feedback.
	FOR PARTICIPANTS IN PHASE C WHO HAVE MET STEP GOAL 5/7 (OR MORE) DAYS:	
4	Treasure box offered	• Researcher tells participant that because he or she met his or her step goal, a prize can be selected.
5	Researcher will ask participant if there are any additional prizes that he or she would like to see in the treasure box.	• Researcher asks participant if there is something new that he or she would like to work for during the upcoming week that is not already in the treasure box.