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BRIEF REPORT

Promoting Physical Activity Among School-Age Children Using Feedback, Goal Setting, and Rewards

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This study evaluated goal setting and rewards to increase the daily steps of 5 children. During baseline, participants wore a sealed pedometer. The intervention consisted of goal setting and rewards delivered by parents for meeting daily goals. Participants met their goals on 12%, 35%, 50%, 71%, and 76% of days, and 3 children increased their daily steps. Three children, who received a second intervention consisting of the addition of a daily text or phone call from the researcher to check progress toward the goal, increased their steps further and met their goal on 62%, 100%, and 100% of days. Two children participated in maintenance, and both maintained their increased steps.

Keywords: children, exercise, pedometers, rewards

There is a need to increase physical activity among children (Southard & Southard, 2006). Tudor-Locke et al. (2004) evaluated the daily steps taken by obese and normal weight 6- to 12-year-old boys and girls and concluded that boys need 15,000 steps and girls need 12,000 steps each day to maintain a healthy weight. Maintaining normal weight is important because obesity is associated with several potentially severe health risks (Centers for Disease Control and Prevention, 2015).

A number of researchers have evaluated reward programs for increasing children's daily steps. In Southard and Southard (2006) children accumulated steps on a pedometer and uploaded them into a computer to play a video game. The researchers found that underweight and normal weight children had a marked increase in steps from the baseline, whereas overweight children did not. Goldfield et al. (2006) evaluated the effects of feedback and rewards for increasing steps in overweight or obese children. During intervention, the control group wore unsealed pedometers, and the reinforcement group wore unsealed pedometers and earned TV time based on number of steps on the pedometers. The TV in the participant's house was activated with tokens. The reinforcement group showed a significantly greater change in steps than the control group. Additionally, Goldfield (2012) found that making access to TV contingent on physical activity increased physical activity and reduced TV viewing but did not influence the reinforcing value of TV watching.

Although this research is promising, some studies used specialized equipment to deliver the reinforcers, such as televisions modified to require tokens and computer games that required inputting activity data for access (e.g., Goldfield et al., 2006). There is a need for research to evaluate how individualized reinforcement programs, implemented by parents using available resources will affect physical activity. The purpose of this study was to evaluate feedback, goal setting, and rewards administered by parents to promote physical activity among young children. A step goal was determined for each day and rewards were delivered contingent upon reaching the goal. Parents and children choose specific reinforcers that the parents could provide on a daily basis at no cost.

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By using individualized, available reinforcers administered by the parents, the behavior change may be more likely to generalize and maintain after the research is complete.

Method

Participants and Setting

Five typically developing children, 8 to 11 years old were recruited as participants through flyers placed throughout the community. Interested parents contacted the investigators and met to receive information about the study. Informed consent was obtained from the parents or legal guardians of all participants. Children with a body mass index (BMI) of ≥23 were included in the study because children with a BMI of ≥23 are considered to be overweight or obese, according to the Centers for Disease Control and Prevention (2010) website's BMI calculator for children.

Emma, a 10-year-old girl with a BMI of 34.9, lived with her mother, and her backup reinforcers were toys and computer time. Jenny was 8 years old, had a BMI of 23.0, and her backup reinforcers were toys/activities. Jerome was 11 years old with a BMI of 30.9; his backup reinforcers were toys–activities. Jenny and Jerome were siblings living with their mother. Nicole, a 10-year-old girl with a BMI of 23.1, lived with her mother, and her backup reinforcers were Silly Bandz (Brainchild Products, Toledo, OH) and computer time. Jon, a 10-year-old with a BMI of 23.0, lived with his mother and father, and his backup reinforcer was time with his iPod touch (Apple, Cupertino, CA).

During all phases, pedometer data were collected in all settings throughout the day. Goal setting, contract preparation, pedometer checks, and delivery of rewards occurred in the home.

Materials

Yamax-Digiwalker model SW-200 pedometers (Yamax-Digiwalker, Warminster, PA) were used to assess steps. This pedometer has been shown to be a valid and reliable instrument (Oliver, Schofield, Kolt, & Schluter, 2007). In addition, prior to the study we conducted a validity and reliability assessment and found high validity (99%) and reliability (95%; details are available from the authors).

Target Behavior and Data Collection

The target behavior was the number of steps recorded on the pedometer. Each morning, the parents reset the pedometer and placed it on their child's waist who wore the pedometer for the entire day. The parents recorded the number of steps at the end of the day. A research assistant e-mailed or texted the parents each night and asked for the step count.

Across all phases, unsystematic spot checks were conducted throughout the day by parents to assess if tampering, such as shaking the pedometer to increase the step count without actually engaging in exercise, had occurred. The parent wrote down the time and the step count to note whether an unusual increase in steps had occurred since the last check and identified whether the child had an opportunity to accumulate these steps through exercise.

Interobserver Agreement

The parent of the child served as the primary observer and another parent, family member, or sibling who lived in the same house served as a secondary observer. These data were reported to the investigators who calculated interobserver agreement by dividing the smaller number by the larger number of steps reported by two family members and multiplying by 100. The percentage of agreement, calculated by the investigators on 48% of days for Emma, 100% of days for Jenny and Jerome, 35% of days for Nicole, and 33% of days for Jon was 100% for all participants.

Social Validity

A social validity questionnaire completed by four of the participants' parents consisted of seven items rated on a 5-point scale (see items in Results section).

Experimental Design

A nonconcurrent multiple baseline design across participants was used to assess the effectiveness of the intervention for increasing steps. A changing criterion design was added for two participants to increase their goal in a gradual fashion.

Procedure

During the initial meetings the researcher (a) assessed each participant's BMI, (b) provided a questionnaire to the participant and parent to determine specific reinforcers for each child, and (c) provided instruction on how to use the pedometer.

Baseline. Each participant wore a pedometer that was sealed shut with tape to ensure the child was unaware of the step count throughout the day.

Feedback, goal setting and rewards (FGR). After baseline, the researcher met with the parent and child and gave them information on how many minutes of exercise produced a certain step count on the pedometer and told them the types of exercise the child might engage in to produce these steps. The parents and the children then chose a step count goal that they felt was reasonable.

After establishing the goal, the reward for achieving the goal was selected by the parent and child. Each morning the parent reminded the child what he or she could do to increase steps and what reward was available for reaching the goal. A behavioral contract was written with the parent and child at each goal level that stated the number of steps for the day and the reward the child could receive. The pedometers were unsealed during this phase giving the children open-loop feedback on their step counts.

At the end of each day, the parent showed the child the number of steps on the pedometer and told the child that (a) the goal had been reached and the reward was earned (based on the contract) or (b) the goal was not reached, how many steps were achieved, and how many more were needed to achieve the goal. The reward was delivered the following day only if the goal was met the previous day. The researcher e-mailed or texted the parents every night to ask for the data, whether the reward was delivered (if earned), and if there were any issues with spot checks.

Feedback, goal setting, rewards, and prompts (FGRP). In addition to feedback, goal setting, and rewards, the researcher added daily phone calls to the participant or the parent between 3 p.m. and 5 p.m. for Jenny, Jerome, and Nicole. The phone calls were intended to have the participants discuss with the researcher or parent current steps, how many steps remained to reach their goal, and ways to achieve the goal number of steps. If the phone call was had with the parent and not the child, it was up to the parent to relay the information to their child. The researchers had no way to ensure that this occurred.

Maintenance. Maintenance was assessed for Jerome and Jenny. The pedometers were sealed (no feedback), and the parent delivered the reward each day based on whether the parent believed the child engaged in an appropriate amount of physical activity without checking the pedometer. The parents were not given any additional instructions and made the judgment of whether the child met the goal based on their experience with the intervention. The parents reported the step data to the investigators.

Results

Figure 1 depicts the daily steps for all participants across all phases. There was substantial variability in daily steps within phases and overlapping data points across phases. However, there was an increase in the mean steps from baseline for Emma, Jerome, and Nicole during FGR and no change for Jenny and Jon. The three participants exposed to FGRP showed a further mean increase from baseline. Although Emma increased her steps during FGR, the mean was substantially increased by 2 days with unrepresentatively high step counts, which occurred while playing with her cousins during Christmas break. Excluding these 2 days, the increase in steps during intervention is not noticeable. The mean during each phase, percentage change from BL, the initial goals, and the percentage of goals attained in each phase for all participants are displayed in Table 1.

The social validity results suggest that parents found the intervention effortful to very effortful to implement (4.5/5); it was not very disruptive on their child's routine (1.75/5); it worked somewhat well (4/5); their child enjoyed participating very much (5/5); they enjoyed participating very much (4.75/5); their children were not very resistant to completing the daily step count (2.25/5); their children received the reward even if they did not complete the step count somewhat often (4.0/5); and two of the four parents followed through on consequences 50%–75% of the time and the other two 75%–100%.

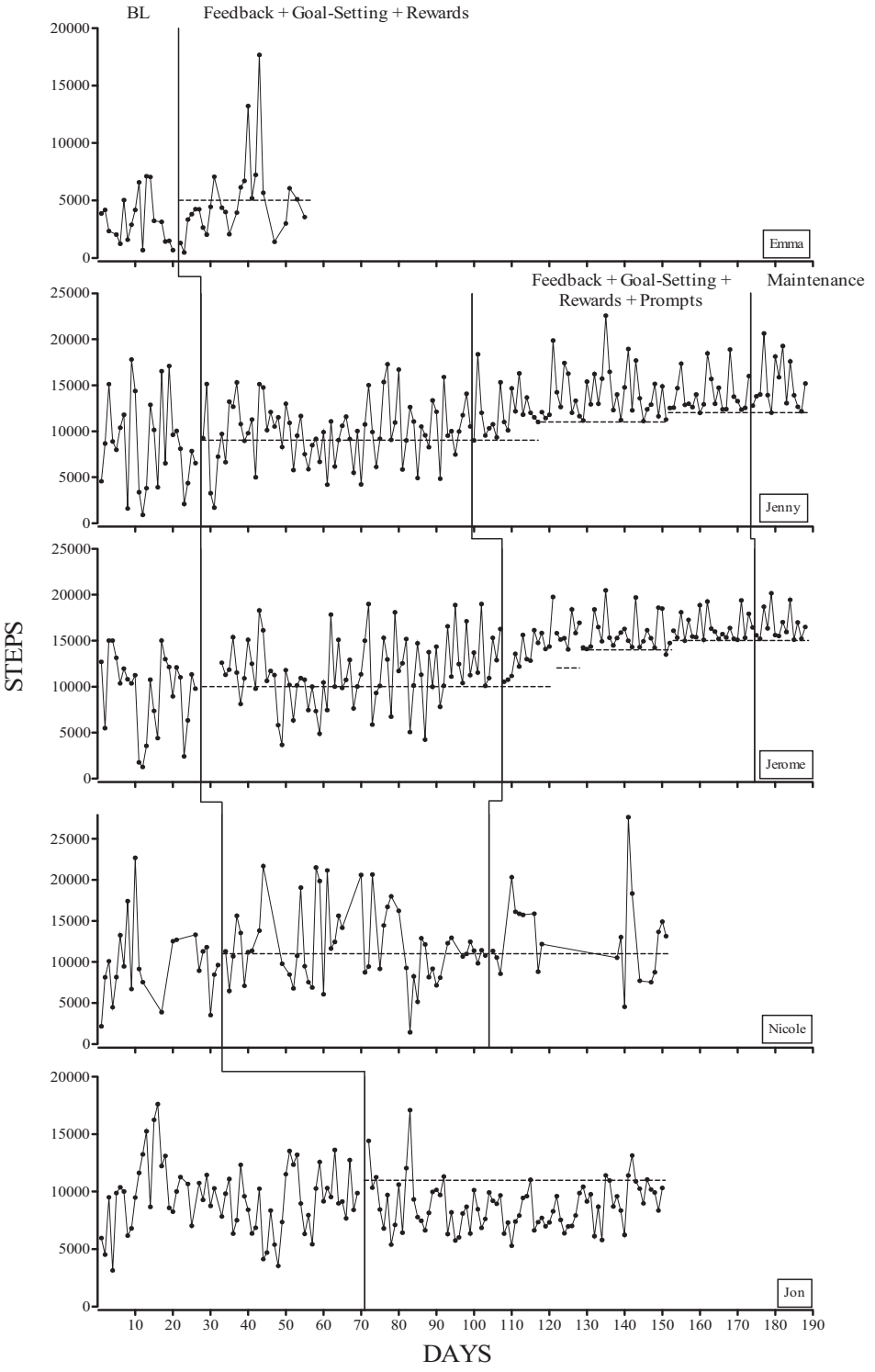

Figure 1. Daily steps for all participants with goals depicted by horizontal lines.

Table 1
Mean Steps, Initial Goals, and Goal Attainment Across All Phases for All Participants

Participant	BL *M* steps	Feedback, goal-setting & rewards *M* steps (% increase)	Initial goal	Feedback, goal-setting & rewards goals attained	Feedback, goal-setting, rewards, & prompts *M* steps (% increase)	Goal-setting, rewards, & prompts goals attained	Maintenance goals attained
Emma	3,267	4,963 (+52%)	5,000	35%	N/A		
Jerome	9,515	11,476 (+21%)	10,000	76%	15,579 (+64%)	100%	100%
Jenny	9,767	10,391 (+6%)	9,000	71%	13,338 (+37%)	100%	100%
Nicole	9,796	11,906 (+21%)	11,000	50%	13,111 (+34%)	62%	
Jon	9,327	8,933 (−4%)	11,000	12%			

Note. N/A = not applicable.

Discussion

For three participants, goal setting and rewards increased steps; however, prompts were required to further increase steps to the goal levels identified by Tudor-Locke et al. (2004). The three participants that received the daily prompts showed a marked increase in steps, with two of them reaching their goal on 100% of days. The two participants that continued the study into maintenance continued to achieve their goal on 100% of days.

The results of the current study mirrored results from Goldfield et al. (2006) showing that goal setting plus rewards can increase physical activity among overweight and obese children. However, the children in the current study were not as responsive to the intervention until the daily phone call was added. The phone call from the researcher could have functioned as a prompt for the child to initiate some physical activity or as an establishing operation to engage in exercise to meet the daily goal; the reminder may have generated verbal behavior that was aversive (e.g., "If I don't go for a walk I won't get to play video games tomorrow"), and the aversiveness could only be escaped once the child engaged in exercise and achieved the step count for the day.

One challenge we encountered was that parents rarely sent data on a daily basis. We gave daily prompts for parents to send the data, but the data were collected mostly in weekly sets. This delay in receiving data made it difficult to make phase changes according to the data. Another challenge was that if parents did not review the contingency with their children on a daily basis, the children could potentially meet their step goals and not receive the reinforcer, resulting in an extinction effect. Another potential limitation is that goals may have been set too high (e.g., Emma's goal was a 35% increase from baseline), preventing participants from coming in contact with reinforcement. Another major limitation of this study is that data were not collected on the fidelity of parents' implementation of the intervention. Considering that most parents said on the social validity survey that they implemented the procedure only 50% to 75% of the time, future research may focus on parent training to increase fidelity of implementation for pedometer-based interventions for children.

This study added to the literature by showing that an intervention for increasing children's exercise habits, in which parents were required to deliver rewards to their children for reaching a specific step count, can be somewhat effective. However, the study also showed that increases in steps were modest and highly variable during FGR. FGRP, when the researcher took an active role and contacted participants daily, it resulted in higher step counts for each child. Therefore, it seems that daily reminders may be critical for interventions aiming to increase children's steps to recommended levels.

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