

USING TOKEN REINFORCEMENT TO INCREASE WALKING
FOR ADULTS WITH INTELLECTUAL DISABILITIES

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The purpose of this study was to evaluate the effectiveness of token reinforcement, using an ABAB reversal design, for increasing distance walked for adults with mild to moderate intellectual disabilities at an adult day-training center. Five participants earned tokens for walking 50-m laps and exchanged tokens for back-up reinforcers that had been identified through preference assessments. Token reinforcement resulted in a substantial increase from baseline in laps walked for 4 participants.

Key words: adults, intellectual disability, physical activity, token reinforcement, walking

Physical inactivity can contribute to serious health problems, including cardiovascular disease, cancers, diabetes, hypertension, and stroke (Centers for Disease Control and Prevention [CDC], 2015b). In the United States, only about one in five adults meets physical activity guidelines. Furthermore, a majority of adults with intellectual disabilities (ID) do not meet physical activity recommendations (Peterson, Janz, & Lowe, 2008). Consequently, increasing physical activity in individuals with ID is an important class of behavior to target.

Several studies have used token reinforcement to increase exercise with this population. Bennett, Eisenman, French, Henderson, and Shultz (1989) administered tokens for pedaling a predetermined number of rotations on a stationary bike; tokens were exchanged later for back-up reinforcers. Pedaling increased with the intervention and decreased when the token economy was withdrawn. Croce and Horvat (1992) delivered tokens at the end of each experimental session contingent on meeting the duration or frequency of an exercise from the previous

session, with additional tokens provided for exceeding the performance of the previous session. Although no baseline data were collected, this study showed increases in exercise during intervention. Todd and Reid (2006) used self-monitoring, verbal cueing, encouragement, and edible reinforcement to increase snowshoeing, walking, and jogging. This multicomponent intervention resulted in an increase in laps for all participants; however, the authors failed to establish a functional relation between the intervention and physical activity because they did not use an adequate experimental design.

Although a few studies suggest that token reinforcement can increase physical activity in adults with ID, only one study demonstrated adequate experimental control. Therefore, the purpose of this study was to assess the effectiveness of token reinforcement for increasing distance walked for adults with ID who attended an adult day-training center.

METHOD

Participants and Setting

Five men, ages 34 to 67 years with mild to moderate ID, participated in the study. No participants had any physical disabilities that prevented walking. Each participant's body mass index was used to categorize him as

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overweight or obese according to standardized criteria (CDC, 2015a). John, a 67-year-old with moderate ID, was obese and diabetic. Paul, a 53-year-old with mild ID, was overweight, diabetic, and had a doctor's recommendation to engage in physical activity each day. Jerry, a 37-year-old with mild ID, was obese and a heavy smoker. Elton, a 46-year-old with mild ID, had previously participated in a walking group. Frank, a 34-year-old with moderate ID, worked mowing lawns on a crew two mornings per week. All participants completed the Physical Activity Readiness Questionnaire (Thomas, Reading, & Shephard, 1992) to confirm that they had no health risks associated with engaging in walking. All participants were their own legal representatives, provided written consent, and vocally stated they wanted to participate. The participants were told that they could leave the study at any time.

This study was conducted at an adult day-training center in Florida, where adults with varying disabilities learned functional skills and engaged in work activities with staff supervision. Participants arrived at the center at 8:30 a.m. and left at 2:30 p.m.

Materials

Cones were used to mark a 50-m lap around which the participants walked. The lap was in the same location for all sessions in an outside, covered corridor where staff provided constant supervision. One personalized gift bag for each participant was hung on a fence near one end of the lap so earned tokens could be deposited after each lap. The backup reinforcers earned throughout the study are listed in Table 1.

Response Measurement, Interobserver Agreement, and Treatment Integrity

The dependent measure was the number of 50-m laps walked in 1 hr, tallied by the researchers on a data sheet. A lap was defined

as walking from one cone around the other cone and back. For 38% of the sessions, the researcher and an independent observer (first and third authors) recorded the number of laps. Interobserver agreement was calculated by dividing the smaller number of laps by the larger number of laps and converting the result to a percentage. Agreement was 99.6% (range, 96% to 100%) for John, 99.6% (range, 96% to 100%) for Paul, 100% for Jerry, 99.8% (range, 97% to 100%) for Elton, and 99.9% (range, 99% to 100%) for Frank.

Procedure

All sessions occurred from 9:00 a.m. to 10:00 a.m. on weekdays. An ABAB design was used to evaluate the effectiveness of token reinforcement for increasing distance walked.

Baseline. At 9:00 a.m., the researcher asked, "Who wants to walk today?" The participants who said they wanted to walk followed the researcher to the walking lap. Sessions lasted for 1 hr or until the participant said he was done walking for the day. Participants were allowed to take a break at any time during the session. No tokens or praise was delivered for walking. The researcher stayed at the start of the lap and said the lap number each participant started (e.g., "This is your third lap.") in a neutral tone of voice.

Preference assessment. During baseline, the researcher interviewed the staff and participants to identify what tangible or edible items the participants preferred. A multiple-stimulus-without-replacement preference assessment was conducted using the stimuli identified in the interviews to establish a hierarchy of preference for these items (DeLeon & Iwata, 1996). This assessment was repeated three times for each participant, with at least 5 min between each assessment. The token exchange rate was based on each individual's baseline levels of walking to ensure that each participant had a similar opportunity to earn reinforcers. The exchange

Table 1
 Items Selected in the Preference Assessment, Percentages of Reinforcers Chosen, and Total Cost of Reinforcers Across Participants

Participant	Items chosen in preference assessment with token exchange rates (TP 1, TP 2)	% of reinforcer selection in TP 1	% of reinforcer selection in TP 2	Total cost of reinforcers
John	Book (75, 75) CD (65, 65) Nutella sticks (60, 50) Uno (45, 45) Word search (35, 35) Diet soda (20, 25) Gatorade (15, 25)	Diet soda: 75 Gatorade: 16.7 Uno: 8.3	Gatorade: 96 Diet soda: 4	\$29 (\$0.91 per day)
Paul	CD (125, 135) Coffee mug (100, 110) Diet soda (75, 70) Gatorade (25, 50) Gatorade chews (50, 25)	Gatorade: 81.8 CD: 9 Gatorade chews: 9	Gatorade: 75 Gatorade chews: 25	\$10 (\$0.59 per day)
Jerry	CD (100, 110) Pokémon card pack (TP 2 only, 110) Coffee mug (90, 105) Light-up ball (85, 100) Bracelets (60, 80) Uno (50, 75) Pokémon card (TP 2 only, 60) Gatorade chews (30, 50) Nutella sticks (25, 35) Wildberry bar (20, 25)	CD: 40 Uno: 20 Light-up ball: 20 Coffee mug: 20	Pokémon card pack: 18.8 Pokémon card: 6.3 Ball: 6.3 Nutella sticks: 43.8 Wildberry bar: 25	\$30 (\$0.94 per day)
Elton	Book (320, 320) Water bottle (256, 250) Light-up ball (192, 200) Word search (128, 130) Flavored water (64, 65)	Book: 50 Ball: 50	Book: 100	\$52 (\$1.63 per day)
Frank	CD (125, 320) Book (100, 300) WWE (TP 2 only, 200) Water bottle (120, 200) Gatorade (75, 175) Light-up ball (50, 100) Cards (25, 65)	Book: 50 CD: 50	Book: 16.7 WWE: 50 Water bottle: 16.7 Light-up ball: 16.7	\$40 (\$1.74 per day)

Note. TP = token phase.

rate used in the first token-reinforcement phase for the high-preference item was the average number of laps walked during baseline (excluding days with zero laps walked) multiplied by five; the exchange rate for the low-preference item was the baseline average for laps walked. During the second token-reinforcement phase, the prices were increased for some participants based on performance in the first intervention phase. The potential reinforcers were unavailable to the participants at the center during the intervention phase; however, they could access them outside the center.

Token reinforcement. After participants completed the preference assessments, the researcher brought them to the start of the lap and showed them their individualized bags. The researcher then demonstrated a lap and placed a token in the bag. Each participant rehearsed a lap by walking around the lap and placing his token in his bag.

The start of each session was identical to baseline, except that the researcher told the participants that they would be given a token after completing each lap and that the tokens could be exchanged for their preferred items. The

researcher then announced, "You guys can start walking now!" The researcher handed tokens to participants one by one as they completed a lap, and participants then placed them in their personalized bags. In addition, the researcher and staff member made encouraging statements (e.g., "Great job! You are walking for [reinforcer]! Keep up the hard work!") for 5 s after participants placed a token in the bag at the end of a lap and every other time the participant reached the opposite side of the lap. At the end of the hour, the researcher and staff member counted the tokens and told the participants how many laps they had walked. The participants chose to either exchange tokens each day after the walk or accumulate the tokens to earn a more costly item at a later time.

Social Validity

A questionnaire was administered to participants and the staff at the center to assess their opinions of the walking program (available from the second author). The questionnaires consisted of questions about activity levels before and after participating in the program and about the program's acceptability.

RESULTS

Preference assessment results are displayed in Table 1. Items selected in the preference assessment, percentage of reinforcers chosen in the token-reinforcement phases, and the cost of reinforcers per participant are shown.

Figure 1 depicts laps walked per session across all phases for all participants. The first token-reinforcement phase resulted in a noticeable increase in laps for four of the five participants (John, Paul, Jerry, and Frank). After the return to baseline, the laps decreased for all five participants to around previous baseline levels or below (for Elton). When token reinforcement was implemented again, all five participants substantially increased their laps. Days in

which the participants were at the center but chose not to walk are depicted as 0 laps for that day.

Participants and a staff member completed the social validity questionnaire on the last day of the study. Questions were scored on a 5-point rating scale on which 1 = *strongly disagree* and 5 = *strongly agree*. The participants' mean scores were 4.8 (I walk more now than before), 4.6 (The walking program was enjoyable), 4.8 (I feel more physically active now than before), and 4.6 (I will continue walking). The staff members' mean scores were 5 (feasibility), 4 (ease of implementation), 5 (valuable for participants), and 5 (would continue the program).

DISCUSSION

This study demonstrated that the token-reinforcement program (consisting of tokens, praise, and back-up reinforcers) increased distance walked for adults with ID. Despite some overlap in data between phases, treatment effects are clear, and experimental control is demonstrated with the replication of these effects with four of the five participants (John, Paul, Jerry, and Frank). Although participants reported in the social validity survey that they would continue to walk, the decrease in activity during the return to baseline suggests that the increased activity did not maintain in the absence of token reinforcement.

The results of this study are consistent with research from Bennett *et al.* (1989), Croce and Horvat (1992), and Todd and Reid (2006) indicating that providing token reinforcers contingent on exercising increases physical activity for adults with ID. The current study adds to the literature by using a stronger experimental design and longer exercise sessions (1 hr), assessing social validity of the intervention, collecting treatment-integrity data, conducting a preference assessment to identify potential reinforcers and to set the

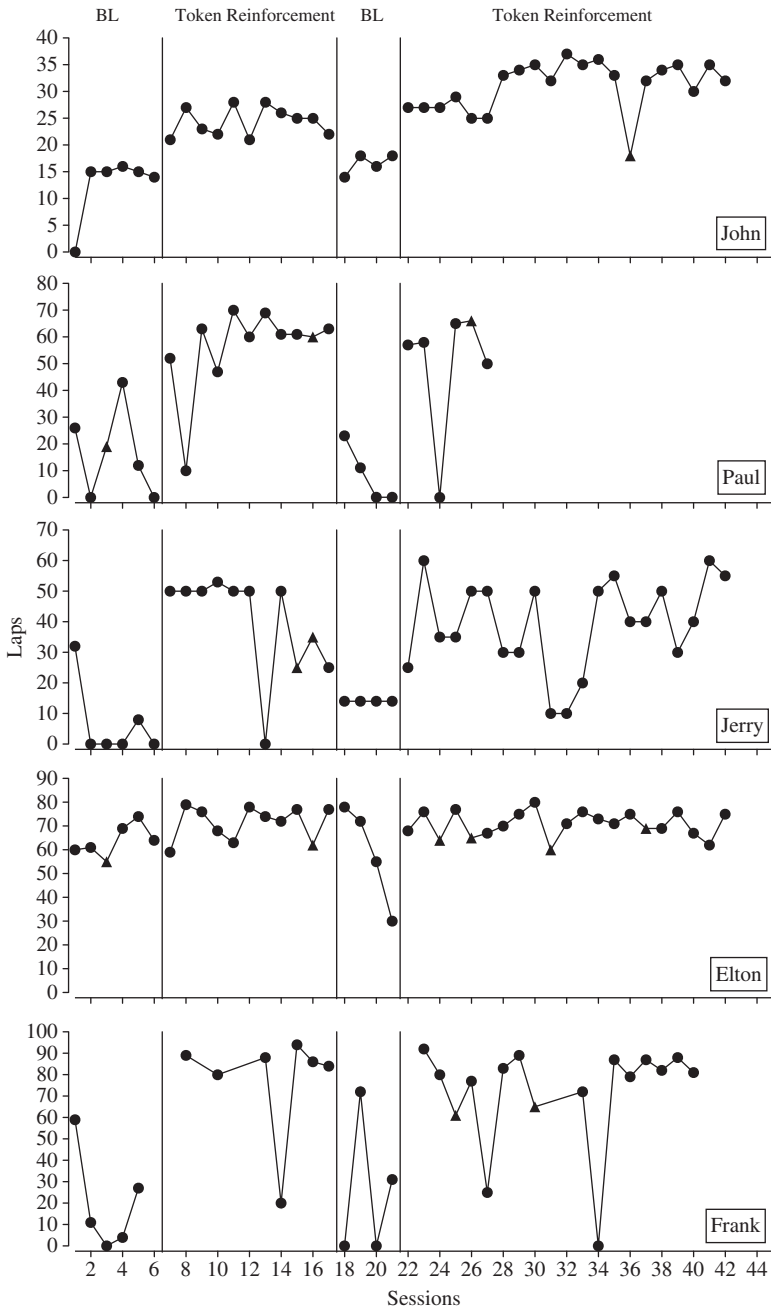


Figure 1. Laps walked per session for each participant. Triangles indicate days in which the participants arrived late to the walking session.

token exchange rate, and including a detailed account of the back-up reinforcers selected and their price.

Unlike Todd and Reid (2006) and Croce and Horvat (1992), this study demonstrated a functional relation between the token-reinforcement

intervention and distance walked, as demonstrated in the ABAB design. The 1-hr session duration in this study is similar to that of Croce and Horvat, which is longer than in previous studies; Bennett *et al.* (1989) conducted 15-min sessions, and Todd and Reid conducted 30-min sessions.

The total cost for each participant's reinforcers ranged from \$9 to \$53 (\$0.59 to \$1.74 per day). Although this study used a preference assessment to determine individual reinforcers and to determine the token exchange rate, it is unclear whether it was more effective than other studies that used rewards not identified with a preference assessment. Future research should focus on determining which of these approaches is more effective and efficient to increase exercise behaviors. Another limitation is that stating the lap numbers in a neutral tone in baseline may have been a form of attention that influenced baseline performance. Also, the interobserver agreement data collection may have been affected because the second observer may have heard the lap number being stated by the researcher. Despite these limitations, the token-reinforcement program had high social validity and was an effective and easy-to-implement intervention to increase physical activity in individuals with ID.

REFERENCES

- Bennett, F., Eisenman, P., French, R., Henderson, H., & Shultz, B. (1989). The effect of a token economy on the exercise behavior of individuals with Down syndrome. *Adapted Physical Activity Quarterly*, *6*, 230–246.
- Centers for Disease Control and Prevention. (2015a). *Body mass index*. Retrieved from <http://www.cdc.gov/healthyweight/assessing/bmi/index.html>
- Centers for Disease Control and Prevention. (2015b). *Physical activity and health*. Retrieved from <http://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>
- Croce, R., & Horvat, M. (1992). Effects of reinforcement based exercise on fitness and work productivity in adults with mental retardation. *Adapted Physical Activity Quarterly*, *9*, 148–178.
- DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis*, *29*, 519–533. doi: 10.1901/jaba.1996.29-519
- Peterson, J. J., Janz, K. F., & Lowe, J. B. (2008). Physical activity among adults with intellectual disabilities living in community settings. *Preventive Medicine*, *47*, 101–106. doi: 10.1016/j.ypmed.2008.01.007
- Thomas, S., Reading, J., & Shephard, R. J. (1992). Revision of the Physical Activity Readiness Questionnaire (PAR-Q). *Canadian Journal of Sport Sciences*, *17*, 338–345.
- Todd, T., & Reid, G. (2006). Increasing physical activity in individuals with autism. *Focus on Autism and Other Developmental Disabilities*, *21*, 167–176. doi: 10.1177/10883576060210030501

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