Toward Efficient Toilet Training of Young Children in Early Childcare Programs

By

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Abstract

Young children between the ages of 18-30 months begin to have the skills necessary to begin the process of toilet training (U.S Department of Health and Human Services, 2006). However, delayed toilet training of typically developing children has become a trend (Simon & Thompson, 2006). Delayed training can have negative health, financial, and social implications. To date, we have systematically replicated an intensive toilet training procedure described by LeBlanc et. al (2005) with seven children (ages 22-58 mo) with and without intellectual and developmental disabilities for whom a treatment package described by Greer et al. (2016) was not immediately effective. A nonconcurrent multiple baseline was used to evaluate the intensive training procedure, which consisted of a graduated sit schedule, reinforcement of successful urinations and self-initiations, increased fluids, communication training, a urine sensor and alarm, and positive practice for accidents. Results showed that the LeBlanc training procedure was effective for rapid performance acquisition that generalized and maintained in the preschool classroom for 5 of 7 subjects. Results are discussed in terms of treatment efficacy and efficiency, generality of procedures across populations (children with and without IDD), and social validity of treatment procedures in early childhood education and intervention environments.

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Toward Efficient Toilet Training of Young Children in Early Childcare Programs

Toileting is a critical life skill that is necessary for independent living and quality of life (Kroger & Sorensen-Burnworth, 2009). Independent toileting can help facilitate active community involvement (e.g., ability to engage in everyday activities) and develop a sense of responsibility and confidence for individuals of all ages and skills (Cicero & Phadt, 2002). Incontinence is a frequent problem in numerous settings (e.g., institutional care services, geriatric care facilities, clinics, schools, etc.) and for various populations (e.g., older adults, individuals with intellectual and developmental disabilities (IDD), and young children). Self-help skills, such as toilet training, may be a significant hurdle especially for individuals with developmental disabilities, and continues to be one of the most researched self-help skills in this population (Cocchiola, Martino, Dwyer, & Demezzo, 2012). For example, Williams, Oliver, Allard, and Sears (2003) systematically reviewed medical and familial conditions for individuals with autism spectrum disorder (ASD) and found that the toileting age for children with ASD was delayed (i.e., *M*= 3.3 years for individuals with ASD and *M*=2.5 years for individuals with IDD).

Toilet training delays have also been observed with typically developing children. In 1961, 90% of children were toilet trained by the age of 2.5 years as compared to only 22% in 1997 (Simon & Thompson, 2006). Delayed toilet training can have numerous negative or undesirable effects. Increased rates of urinary tract dysfunction (Bakker & Wyndaele, 2000), increased risk of contracting Hepatitis A (Vernon, Schable, & Francis, 1982), increased risk of acute infectious diarrhea (Pickering, Bartlett, & Woodward, 1986), and increased risk of diaper dermatitis (Luxem & Christophersen, 1994) are all associated with prolonger diaper use and delayed toilet training practices. Child-care programs are at risk for hepatitis and infectious diarrhea due to the increasing incidence of children who are not toilet trained (Luxem &

Christophersen, 1994). Additionally, prolonged use of diapers is costly (an estimated 2,700 diapers are used within the first year of a child's life) and may have negative environmental impacts (Luxem & Christophersen, 1994). Finally, children may be excluded from private child-care programs that have a toilet-trained prerequisite, which may require care options that are either limited or more expensive for parents (Simon & Thompson, 2006).

Even with the growing body of literature to suggest delays in toilet training, childcare programs are still requiring children to be toilet trained as a prerequisite before enrollment (Cicero & Phadt, 2002; Luxem & Christophersen, 1994). Preschools include a wide range of programs from public to private educations and are largely half-day or a typical school day (i.e., about six hours). Center-based child care refers to full-day programs that offer services during traditional work hours such as 7:00 am to 6:00 pm (Kamerman & Gatenio-Gabel, 2007). According to ChildCare Aware of America (2018), there are a total of 19,853,211 children between birth and four years of age in the United States that require child care service; 198,873 of those children live in Kansas. There are 597 center-based child care programs in the state of Kansas and only 129,657 slots available. In an informal survey of 10 center-based child care programs in Lawrence, Kansas, 60% of the centers required children to be toilet trained prior to starting the program.

According to the Agency for Healthcare Research and Quality (AHRQ) of the U.S. Department of Health and Human Services (2006), young children between the ages of 18 to 30 months start to have the skills necessary to begin the process of toilet training. According to Casey and Carter (2016), the most important factor for a successful toileting program is identifying when the child is ready to begin. Although toilet training appears to be a universally acquired skill for typically developing children, there is limited information about the requisite

skills needed or the readiness signs for toilet training to be successful (Schum et al., 2002). Although Kaerts, Van Hal, Vermandel, and Wyndaele (2012) conducted a literature review with 23 articles and found a total of 21 readiness skills (e.g., child can imitate behavior, child is capable of sitting up, child can say no, child can voluntarily control bowel and bladder reflex actions, child understands toileting related words, child insists on completing tasks without help, etc.), the results suggested that there was no consensus on which of the readiness skills or how many readiness skills were associated with the success in toileting.

There are two general approaches to toilet training children in the United States: a child-oriented approach and an intensive-training approach. The first approach to toilet training children was described by Brazelton (1962), which suggests that children start learning to use the toilet when they are approximately 18 months of age and are physically and emotionally ready to begin toilet training (Christophersen, 2003). The approach emphasizes dependency on the child's willingness to participate. For example, the child first sits on the toilet fully clothed and is explained differences between adult toilets and child toilets. Then, the child sits on the toilet without a diaper. Gradually, the child progresses to sitting on the toilet without clothes. However, this child-oriented approach may unnecessarily delay toilet training in cases where a child refuses to initiate interest in being trained such that learning opportunities are limited. Further, attempting the child-oriented approach with a disinterested child presumably would increase training duration time. In a review of childhood urinary continence, Wu (2010) noted that children toilet trained with the Brazelton approach require between 6 and 18 months to complete training. It is interesting to note that despite the widespread use of the Brazelton approach, there are little to no empirical data published. The second approach to toilet training children was initiated by Azrin and Foxx (1971), in which an intensive and multifaceted toilet

training package was used to increase the continence of adults with IDD. Several empirical studies have used similar intensive toilet training procedures to increase continence across several populations such as ASD, moderate to severe mental retardation (MR), Pervasive Developmental Disorder (PDD), and Angelman syndrome (e.g., Azrin & Foxx, 1971; Cicero & Phadt, 2002; Hanney, Jostad, LeBlanc, Carr, & Castile, 2013; Kroeger & Sorensen-Burnworth, 2009; & LeBlanc, Carr, Crossett, Bennett & Detweiler, 2005). Intensive-training packages have been found to be effective at teaching toileting performance in a shorter duration as compared to non-intensive-training packages (Cicero & Pfadt, 2002).

Azrin and Foxx (1971) has been acknowledged as the seminal article for toilet training. Azrin and Foxx developed a toilet training procedure that rapidly trained nine adults with IDD to remain continent using reinforcement-based procedures. The training procedure consisted of numerous training components, including increased fluid intake, differential reinforcement for alternative behaviors (i.e., staying dry and appropriately eliminating), programmed consequences for accidents (i.e., showers, cleaning of accidents, washing soiled clothes, and timeout), scheduled toileting trips, and a urine alarm. Specifically, increased fluids consisted of giving the subjects "as large a volume of fluids to drink each half hour as he or she would consume" to increase urinations, thereby increasing the number of opportunities to reinforce correct toileting behaviors (Azrin & Foxx, 1971, p.92). Programmed consequences for accidents involved restitutional overcorrection. Restitutional overcorrection is a procedure in which, contingent on misbehavior (e.g., accidents), a learner is required to "return the environment to its original state and to engage in additional behavior to bring the environment to a condition vastly better than it was in prior to the misbehavior." (Cooper, Heron, & Heward, 2006, p. 15). Scheduled toileting trips involved arranging for individuals to sit on the toilet more frequently according to a

predetermined time- or response-based schedule. (Kroeger & Sorensen-Burnworth, 2009). Finally, Azrin and Foxx used both a "pants alarm" (worn by the individuals and signaled accidents by way of auditory cue) and a "toilet-chair" (apparatus in toilet bowl that sounded a signal upon detection of urine or feces). Results of the Azrin and Foxx (1971) study showed that the toilet training procedure increased appropriate eliminations and eliminated accidents for all 9 subjects. The authors reported that the effects were rapid, only requiring a few days of implementation (i.e., $M = 6$ days). These toileting procedures have become standard-practice procedures for many clinicians working with individuals with IDD (Cicero & Pfadt, 2002). In 1973, Foxx and Azrin assessed the effects of using a toilet training method almost identical to those described in their 1971 study with 34 typically developing children ranging in age from 1 yr and 8 mo to 3 yrs old that had a history of unsuccessful toilet training (as reported by their parents). Specifically, the authors used the following components: distraction-free environment, increased fluid intake, reinforcement for dressing skills, reinforcement of approximations of movement towards the toilet, instructions for behaviors related to the toilet, gradual decrease of reminders, detection of accidents, practice of correct behaviors after accidents, differential reinforcement for various appropriate toileting behavior, imitation of others, fading of reinforcement, and attention to cleanliness. Results suggested that all 34 children were toilet trained (i.e., near zero levels of accidents) in an average of 3.9 hours. Additionally, during the four-month follow-up, all children's accidents still remained at near-zero levels. Although the results were rapid, the procedure was intensive in nature. Numerous authors have suggested that parents may question whether this level of intensity is necessary, especially for children with no-known diagnoses.

Several studies have reported success of toileting for young children in classroom settings (e.g., Luiselli, 1994; Luiselli, 1997). For example, Luiselli (1997) evaluated a training program for one eight-year-old boy diagnosed with Pervasive Developmental Disorder in an inclusive educational setting in a public elementary school. The toileting procedures consisted of three phases: a) increased scheduled sits, b) reinforcement for appropriate eliminations, and c) intermittent schedule of reinforcement. Results suggested that during the implementation of the second phase (i.e., reinforcement phase), 100% appropriate eliminations was observed. Additionally, 100% appropriate eliminations maintained during the 6 mo follow-up. Cicero and Phadt (2002) used the procedures of Azrin and Foxx (1971) with three participants diagnosed with ASD in the child's school. These procedures involved the use of positive reinforcement, prompting, graduated guidance, and scheduled trips. The authors were among the first to use a stimulus preference assessment to identify potential reinforcers to use as programmed consequences for appropriate eliminations and included a communication component to increase independent self-initiations rather than relying on the sit schedule for toilet access. The results of this study were similar to those of Azrin and Foxx, in terms of performance, but the effects were not as rapid. Specifically, increases in self-initiations and decreases in accidents were achieved after an average of 7-11 days of training as compared to an average of six days of training reported by Azrin and Foxx. The Cicero and Phadt study may potentially be more broadly accepted by caregivers, however, there were several experimental limitations. First, the experimenters used an AB (i.e., pre-post) design, which could have potential threats to internal validity. Second, generalization data were not objectively collected, and the generality of the study was limited (i.e., all subjects were 7 years old and diagnosed with ASD).

Greer, Neidert, and Dozier (2016) evaluated the combined and individual effects of three commonly used toilet training components with 20 children ranging in age from 1 yr 7 mo to 3 yrs 3 mo in a center-based child care program. The combined toileting package consisted of wearing underwear, dry checks occurring on a fixed time (FT) 30-min schedule, and differential reinforcement for alternative behaviors (i.e., being dry, appropriately eliminating, and self-initiating). Results of the study showed that the combined components increased percentages of appropriate eliminations. Additionally, similarly to other findings in the literature, having the children wear underwear appeared to be the most influential treatment component (e.g., Simon & Thompson, 2006). Their results extended the literature on toileting programs for center-based child care programs. However, although the treatment package produced clinically significant results, the effects were not as rapid as other procedures described in the literature (i.e., the duration of training ranged from 20-50 days before performance was stable). Additionally, self-initiations were not observed for the majority of children.

In 2005, LeBlanc, Carr, Crossett, Bennett, and Detweiler evaluated a modified version of the intensive, rapid toilet training procedures originally described by Azrin and Foxx (1971) with three young children diagnosed with ASD. LeBlanc et al. had caregivers implement training procedures in the home (in addition to the therapists in the clinic), they used a positive practice procedure instead of restitutional overcorrection, they conducted communication training to teach independent requests to use the toilet, they used a levels system of rapidly increasing schedules of sits on the toilet, and they first demonstrated that a low-intensity toilet training procedure (i.e., scheduled sits at 2-hr intervals, wearing underwear, and positive reinforcement for voids) was unsuccessful at increasing toileting performance. Additionally, they addressed the methodological limitations of the Cicero and Phadt (2002) study by using a multiple baseline

across participants experimental research design to demonstrate experimental control, assessing reliability of the measurement system by assessing interobserver agreement, conducting follow-up assessments, and assessing social validity (i.e., conducting a social validity assessment) of their procedures. The intensive toilet training treatment consisted of 12 levels and began with a 10-min sit on the toilet, followed by 5 min off the toilet. The child's sit-schedule moved up a level every hour on the first day, a level every half day on the second and third day, and a level every two days on day four and all subsequent days. Results showed that these procedures improved toileting performance and performance was maintained after one month. Effects were observed after an average of 19 days. Self-initiations increased for 2 of the 3 participants.

Given potential concerns of surrounding the social acceptability of restitutional overcorrection procedures, an alternative form of overcorrection has become common: positive practice. Positive practice involves the learner practicing appropriate behavior (e.g., sitting on the toilet) for a predetermined amount of time contingent on the target misbehavior (e.g., accidents) (Cooper, Heron, & Heward, 2006). However, Hanney, Jostad, LeBlanc, Carr, and Castile (2012) noted that even the use of positive practice may be of concern to practitioners, presumably because it is a form of punishment. Doan and Toussaint (2016) replicated the procedures used by LeBlanc et al. (2005) with three young children with ASD at an autism center. However, they accounted for potential parental concerns about the positive practice and urine-sensor alarm components by allowing parents to choose whether these components were used with their child during training. Additionally, the experimenters assessed whether any problem behaviors occurred with the RTT procedure. Finally, the experimenters assessed the social validity of the individualized RTT procedure. All caregivers selected not to use a urine sensor for one of three reasons: 1) the cost of the urine sensor was restricting, 2) parents were

concerned that the alarm would frighten the child, and 3) the alarm would be unbeneficial because the child was already aware of the accident. Additionally, one child's caregiver (Peter's mother) discontinued the use of positive practice after the first implementation because Peter was too distressed by the practice. Results showed that RTT was effective at increasing successful self-initiations and decreasing accidents across the home and clinical setting for all three participants. Although the effects were clinically significant, they were not as rapid (i.e., *M*=23 days).

The purpose of the current study was to systematically replicate LeBlanc et al. (2005) by evaluating the effects of the RTT treatment procedure with both typically developing children and children diagnosed with IDD for whom the intensive toilet training package described by Greer et al. (2016) was ineffective. An overarching aim was to obtain empirical information about whether the RTT procedure might be useful as standard practice in our clinical programs in terms of both efficiency and efficacy.

Method

Participants and Setting

Participants were recruited from two classrooms operated in a child-development center in a Midwest university. Classroom teachers, undergraduate research assistants, or graduate-student supervisors implemented the procedures in the study. Classroom teachers were either undergraduate students enrolled in a five-credit early childhood education practicum course (i.e., 20 hours a week) or paid staff that were hired as classroom teachers. Undergraduate research assistants were students enrolled in either a five-credit research practicum course (i.e., 20 hours a week) or a one to three credit research course (one credit-hour equates to four face-time hours).

Classroom supervisors were graduate teaching assistants in the Applied Behavioral Science department.

Eight children between the ages of 22 and 56 months, both with and without a diagnosis of IDD, participated (see Table 1 for participant demographics). Participants were selected for participation in the study if: a) parents expressed an interest in training their child to use the toilet, and b) if the classroom teacher and supervisors recommended that the child may be ready to begin toilet training. Procedures were reviewed and approved by the university internal review board, and consent was attained from each child's legal guardian prior to the start of the study.

Baseline sessions took place in each child's typical classroom, either the toddler classroom or the early intensive behavioral intervention classroom. The toddler classroom serves 10 children (both typically developing and those with or at risk for intellectual and developmental [IDD] disabilities) between the ages of 1 to 2.5 years. The teacher-to-child ratio in the classroom is 1:5. The classroom operates Monday through Friday between the hours of 7:45 am and 5:30 pm. Teachers work one of three different daily shifts, (Morning [AM], Middle [Mid], and Afternoon [PM]). Nap time occurs from 12:00 pm to 2:30 pm. The children are not required to nap; however, they are instructed to sit quietly on their nap-time cots until 1:45pm. Toilet training procedures (including data collection) did not take place during this time. The early intensive behavioral intervention classroom serves 8-10 children diagnosed with IDD and severe learning deficits who are between the ages of 2.5 to 8 years. The teacher-to-child ratio in the classroom is 1:1. The classroom operates Monday through Friday between the hours of 9 am and 3 pm. Teachers work one of two shifts (AM or PM). Nap time does not occur unless specifically requested by the child's parent. Both classrooms are equipped with play areas,

feeding areas, an outdoor playground, and toileting areas with multiple child-sized toilets, child-sized sinks with step stools, paper towel dispensers, soap, and storage bins containing preferred tangible and edible items (for ease of teacher accessibility).

The first four days of treatment took place in a private bathroom area, separate from the classrooms, located in the Program Coordinator's office in the center. A layout of the private bathroom is provided in Appendix A. The private bathroom contained one child-sized toilet, a child-sized sink with a step stool, a paper towel dispenser, soap, and a bin filled with identified preferred tangible and edible items for accessibility. The private bathroom connected with a small, adjoining room with two child-sized desks and chairs. This room served as a location for children to work on target educational goals or engage in play during the inter-sit interval (i.e., the time the child spends off the toilet). Following the first four days of treatment, children returned to their typical classrooms for the remainder of the treatment evaluation.

Pre-Experimental Assessments

Readiness assessment. At the beginning of each semester, parents and classroom teachers completed a toilet readiness skills questionnaire (see Table 2) for each child (Casey & Carter, 2016). The questionnaires were completed after two weeks of the start of the semester to ensure that teachers were familiar with the children in the classroom. Figures 1 -2 depict the teacher and parent readiness results and the itemized toilet readiness questionnaire results.

Preference assessment. Initial indirect assessments were conducted with teachers/therapist and supervisors in the classroom to identify possible tangible and edible items to function as programmed consequences for the study. A multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) was conducted twice for each participant for each assessment (i.e., tangible and edible items) to identify moderately (MP) and highly-preferred (HP) items. The average rank of each item was calculated. The item identified as HP was ranked first in preference while the item identified as MP was ranked second in preference for each participant. The array of items included eight items that were spaced equally apart. The array was presented to the child. The child was prompted to "pick your favorite" or some variation of this statement. The child had access to the tangible items for 10 s or had the opportunity to consume the edible item. After an initial selection and engagement of tangible item or consumption of edible item, the therapist reorganized the items, and repeated the process until there is no more selections to make. All attempts of reaching for both items, were blocked and the trial was represented. If an item was not selected, the therapist would represent the trial until a selection was made. If two items were ranked equally, the therapist conducted a single MSWO trial with the two items that were equally ranked to determine an HP and MP item.

Response Measurement and Reliability

Primary and reliability data were collected by undergraduate and graduate research assistants, as well as teachers and supervisors in the classroom. Data were collected daily on the frequency of the child's appropriate eliminations, accidents, and self-initiations. An *appropriate elimination* was defined as any instance in which the child voided in the toilet. An *accident* was defined as any instance of voiding anywhere other than in the toilet. A *self-initiation* was defined as any instance in which the child requested independently to use the toilet by either

saying “potty” or using the American Sign Language sign for toilet (i.e., placing the thumb in between the pointer and middle finger and rotating the wrist), or by walking into the bathroom and orienting toward the toilet.

A second independent observer simultaneously collected data on appropriate eliminations and accidents during an average of 30% (range, 16% to 50%) of toileting opportunities (i.e., trips to the bathroom). Similarly, a second independent observer recorded self-initiations during an average of 44% of daily sessions (i.e., the total time the participant was in the classroom). Interobserver agreement (IOA) coefficients were calculated by adding the total number of agreements and then dividing that number by the number of agreements and disagreements, and the results were multiplied by 100 to obtain a percentage. An agreement constituted both data collectors scoring the same information for a toileting opportunity (i.e., any target behavior that occurred when the child was brought back to the toileting area). Across baseline and treatment, the average IOA across participants for appropriate eliminations was 95.78% (range, 80.7% to 100%), for accidents was 94.5% (range, 80% to 100%), and for self-initiations was 97% (range, 81% to 100%).

The second data collector also collected procedural integrity data on reinforcer delivery, provision of moderately preferred tangible items to the child while they were sitting on the toilet, and correct implementation of positive practice. *Reinforcer delivery* during baseline was defined as any instance in which the teacher or therapist provided 10-s access to a tangible item and two highly preferred edible items contingent upon: a) dry underwear, b) self-initiations, and/or c) appropriate eliminations. During treatment, reinforcer delivery was defined as any instance in which the teacher/therapist provided 30-s access to a tangible and two highly preferred edible items for appropriate eliminations. *Access to moderately preferred tangible items* was recorded

during treatment and was defined as the therapist providing the child moderately preferred items during toileting sits following teacher prompts to sit or self-initiated sits to help minimize aversiveness of sitting on the toilet. Items were not to be given to the child following accidents. *Correct implementation of positive practice* was recorded during treatment and was defined as the therapist telling the child "No wet pants" using a neutral voice tone after every accident and walking the child to the toileting area to be changed, siting the child on the toilet for no longer than one minute, and quickly returning them to the area in which the accident occurred for four repetitions. This procedure occurred four times unless the child eliminated in the toilet during the implementation in which the programmed consequences for appropriate eliminations was implemented. The level of procedural integrity was calculated by summing the number of correct implementations per trip, dividing by the total number of trips, and multiplying by 100 to obtain a percentage. Procedural integrity averaged 88.5% (range: 70% to 100%) for reinforcer delivery, 95% (range: 86% to 100%) for access to moderately preferred tangible items, and 98% (range: 96% to 100%) for positive practice.

Experimental Procedure

Children were first exposed to a baseline condition that consisted of a toilet-training procedure similar to that described by Greer et al. (2016). If improvements in all three targeted toileting behaviors described above (i.e., appropriate eliminations, accidents, and self-initiations) were not observed during baseline, the intensive behavioral toilet training procedure described by LeBlanc et al. (2005) was evaluated during the treatment phase. A chart comparing the baseline and treatment procedures are depicted in Table 7. A nonconcurrent multiple baseline across participants design (Watson & Workman, 1981) was used to evaluate the effects of the treatment procedure. That is, implementation of treatment was staggered across children

following the points at which responding during baseline stabilized and did not reflect acceptable toileting performance.

Daily sessions were terminated if a child cried for one consecutive min during a toileting trip. A child's participation in the study ended if a) parents requested termination, b) the child moved to a different center, or c) the child displayed two consecutive days in which they met session-termination criteria (i.e., 1 min of crying during toileting trips).

Baseline. The primary components of the training procedure were a) children wearing underwear (instead of diapers), b) frequently scheduled trips (i.e., FT 30-min sits) to the toilet, and c) differential reinforcement. The children wore cotton underwear in place of diapers. The underwear was provided by the child's parents. Teachers changed children with minimal attention as soon as accidents were detected (as required by State of Kansas childcare licensing regulations). Children were prompted to sit on the toilet every 30 min. Each sit lasted three min or until the children appropriately eliminated. Appropriate elimination resulted in immediate escape from the toilet. Self-initiations resulted in a 3-min sit on the toilet. Differential reinforcement consisted of the teacher providing the child with their highly preferred tangible item for 30 s and two highly preferred edible items contingent upon dry underwear when inspected during a scheduled sit, self-initiations, and appropriate eliminations.

Treatment (RTT). The treatment procedure, referred to as rapid toilet training (RTT), included a) a graduated sit schedule, b) differential reinforcement for appropriate elimination and self-initiation, c) increased fluids, d) communication training, e) a urine sensor and alarm, and f) positive practice.

Sit schedule. The sit schedule consisted of 12 levels (see Table 3). The graduated sit schedule began with a 10-min sit followed by 5 min off the toilet (Level 1) and ended with a 5-

min sit followed by 4 hours off the toilet (Level 12). The schedule advanced by one level each hour (Day 1), one level each half-day (Days 2 and 3), and one level every two days (Day 4 and until the schedule was removed). Children started 1 level higher than the level on which the previous day ended for Days 1 – 3). For example, if a participant ended Day 1 on Level 6, the subsequent day started at Level 7. For Days 4 and beyond, the sit schedule progressed one level every two days. For example, if a participant ended Day 4 on Level 10, the participant remained in Level 10 until Day 6 (as long as the fading criteria was met). Moderately preferred items were provided during toileting sits to help minimize potential aversive properties of scheduled sits. That is, immediately after the participant has sat on the toilet, the teacher or research assistant delivered the MP item to the child. If the child stated that they did not want the tangible item, teachers and research assistants placed the tangible in a bin located near the toilet.

Differential reinforcement. Programmed consequences for appropriate toileting behavior were similar to those in baseline. Specifically, appropriate elimination resulted in 30-s access to HP items and immediate escape from sitting on the toilet. If a child appropriately eliminated before the sit-schedule time had elapsed, the remaining time was added to the inter-sit interval time. For example, if a child in Level 1 (10-min sit on the toilet, 5 minutes off the toilet) eliminated within two minutes of the start of the sit, then eight minutes was added to the inter-sit time for a total of 13 minutes off the toilet). Self-initiations resulted in praise and immediate access to the toilet provided by the therapist; however, self-initiations did not reset the sit schedule. Unlike baseline procedures, dry underwear during trips to the toilet did not result in programmed differential consequences.

Increased fluids. During the first day of treatment, the therapist offered the child fluids on a specified schedule. These fluids were not caffeinated (except for Travis because his parents

requested that he drink tea brought from home). The child was offered a drink every 5 min during the first hour, every 10 min during the second hour, and every 15 min the third hour, and every 30 min for the rest of Day 1. The amount of fluid consumed was recorded to the nearest half ounce during the fluid offering progression schedule. Water remained continuously available every day throughout the study, and fluid intake was recorded by the primary and reliability data collector. On average, 31 ounces (range, 5 to 76.5) was consumed across all participants during the first four days of treatment.

Communication training. Prior to each scheduled sit on the toilet, the therapist prompted the child to emit a vocal-verbal request (saying "potty") or a nonvocal-verbal request (signing "toilet"). If neither response occurred, the therapist used a three-step least-to-most intrusive prompting procedure (verbal prompt, model prompt, physical prompt) to evoke the communication response (i.e., signing toilet).

Urine sensor and alarm. A Wet-Stop[3®] *urine sensor* was clipped to the front of the child's underwear such that the alarm was able to detect small drops of urine (a urine sensor was not used for Mason or Valerie). Appendix D displays an image of the WetStop[3®]. No part of the sensor contacted the child's skin. The sensor activated a battery packed alarm that was clipped to the child's back collar. Activation of the alarm resulted in an auditory and tactile feedback (i.e., vibration) and immediate implementation of positive practice (see below). We assessed the accuracy of the urine sensors throughout the course of the study to ensure correct detection of the presence or absence of urine in the child's underwear. That is, errors of omission were recorded when a child had an accident and the alarm did not sound and errors of commission was recorded when the child had dry pants and the alarm sounded. Data collectors recorded whether the alarm

was activated or not activated and whether the child was dry or wet during each toileting trip. The average accuracy of the urine sensor was 90% (range, 67% to 99%).

Positive practice. When a child had an accident (signaled by urine-sensor alarm or visually apparent due to wet pants), the therapist implemented positive practice. Specifically, the therapist stated "No wet pants" in a neutral voice, escorted the child to the toilet, removed the child's pants, sat the child on the toilet for approximately 1 min, replaced the clothing, and the escorted the child back to the site of the accident. All of the steps were repeated for a total of four repetitions or until the child appropriately eliminated in the toilet, in which case the programmed consequences for appropriate eliminations were implemented. The accident did not reset the sit-schedule.

Treatment Fading (No sit- schedule and No Wet-Stop). The sit schedule was faded if the child displayed 80% appropriate eliminations (i.e., appropriate eliminations ÷ [appropriate eliminations + accidents] x 100) for two consecutive days. Once the child reached Level 12 with the thinning criterion, the schedule was removed. Specifically, there were no longer any programmed sits, and the child had to self-initiate to gain access to the toilet. Once the child displayed either a) 100% appropriate eliminations for two consecutive days or b) 80% appropriate eliminations and at least 40% self-initiations, the urine sensor alarm was removed.

Follow-up. The child entered the follow-up phase when at least 80% appropriate eliminations was displayed following removal of both the sit schedule and urine sensor alarm. Data were collected once per week for a full day across four consecutive weeks (five weeks for Chloe). The day of the week that data were collected was selected randomly using a random number generator. During follow-up, appropriate eliminations resulted in praise.

Social Validity Questionnaire

After each child completed the follow-up phase of the study, parents were given a treatment evaluation questionnaire. Specifically, a modified version of the *Treatment Evaluation Inventory -Short Form* (TEI-SF: Kelley, Heffer, Gresham, & Elliott, 1989) was used to have the parents rate the procedures of the study. The questionnaire was composed of nine statements to which caregivers responded to each question by indicating either*: strongly disagree, disagree, neutral, agree, or strongly agree* (see Table 4 for the statements and average responses across parents).

Results

Figure 1 displays the data for the cumulative number of toilet readiness skills displayed as reported by the child's parents and the child's classroom teacher. Scaled to the x-axis are the participants with their age during the completion of the assessment. Scaled to the y-axis are the total number of toilet readiness skills. The height of the black bar denotes teacher responses. The height of the white bar denotes parent responses. Generally, teachers and parents reported the same number of readiness skills except for Mason, whose parents did not identify any skills, and Aaron, whose parent identified three more skills than his teacher.

Figure 2 displays the individual data from the toilet readiness skills reported by the child's parent and the child's classroom teacher. Scaled to the x-axis are the participants with their age during the completion of the assessment. Scaled to the y-axis are the toilet readiness skills. The black triangles denote teacher responses. The white squares denote parent responses. Generally, teachers and parents not only agreed on how many readiness skills the child had, but as well as the same skills.

The top panel of Figure 3 displays the data for Mason (who was one of two pilot participants). Scaled to the x-axis are days. Scaled to the left y-axis is the frequency of

accidents denoted by the height of the grey bars, self-initiations denoted by the open white circles, and total eliminations denoted by the red squares. Scaled to the right y-axis is the percentage of appropriate eliminations denoted by the closed black circles. Graphing conventions remain the same for all subsequent figures. Prior to RTT (without a Wet-Stop) Mason wore underwear, followed a FT 30-min sit schedule, received DRA for appropriate eliminations with high quality peer attention (i.e., several friends would clap or give Mason high-fives when appropriate eliminations occurred), was offered one ounce of fluid every 30 min, and wore a WetStop[3®]. During baseline, Mason was appropriately eliminating around 66%, having two to four accidents a day, self-initiating zero times a day, and eliminating about four times a day. During treatment, Mason was appropriately eliminating around 80-100%, having zero to two accidents, self-initiating zero times a day, and eliminating about five times a day. During follow-up, Mason was appropriately eliminating 100%, having zero accidents, self-initiating once a day, and eliminating about twice a day. Overall, RTT was effective at increasing toileting performance in two days.

The bottom panel of Figure 3 displays the data for Valerie (the other pilot participant). Prior to RTT (without a WetStop[3®]) Valerie wore underwear and was not prompted to sit on the toilet. However, self-initiations resulted in access to the toilet for a 10-min sit, and high preference items were provided contingent on appropriate eliminations (DRA). During this baseline, Valerie was appropriately eliminating around 33%, having about 5 accidents a day, self-initiating about once a day, and eliminating about eight times a day. During treatment, Valerie was appropriately eliminating around 80-100%. Initially, she was having six to 13 accidents, however, the number of accidents decreased across the course of treatment until she was having no more than one accident at the end of the treatment condition. Additionally, she

was self-initiating four to seven times a day and eliminating about eight times a day. During follow-up, Valerie was appropriately eliminating 100%, having zero accidents a day, self-initiating about three times a day, and eliminating about twice a day. Overall, RTT was effective at increasing toileting performance in seven days.

The top panel of Figure 4 displays the data for Odeza. During the baseline, Odeza was appropriately eliminating approximately 20%, having four to six accidents a day, self-initiating between zero to once a day, and eliminating approximately six times a day. During treatment, Odeza was appropriately eliminating around 80-100%, having zero to two accidents a day, self-initiating about five times a day, and eliminating about eight times a day. During follow-up, Odeza was appropriately eliminating 100%, having zero accidents a day, self-initiating two to four times a day, and eliminating about twice a day.

The middle panel of Figure 4 displays the data for Sergio. During baseline, Sergio was appropriately eliminating around 80-100%, having zero to two accidents a day, self-initiating zero to three times a day, and eliminating about 10 times a day. During the initial treatment condition, Sergio was appropriately eliminating around 50-100%, having zero to three accidents a day, self-initiating zero to four times a day, and eliminating about three times a day. After twelve days of RTT, Sergio was observed to stop responding. However, after further analysis, Sergio was observed to only eliminate upon arriving to school during his daily health checks and after waking up from nap. Therefore, Sergio was not prompted to sit upon arriving to school and his diaper was removed during nap time. During RTT with no sits upon arrival and after nap, Sergio was appropriately eliminating at 100%, having zero accidents a day, self-initiating about twice a day, and eliminating about twice a day. During the follow-up condition, all patterns of responding remained the same.

The bottom panel of Figure 4 displays the data for Chloe. During baseline, Chloe was appropriately eliminating around 80-100%, having two accidents a day, self-initiating zero accidents, and eliminating about six times a day. During treatment, Chloe was appropriately eliminating around 66-100%, having zero accidents, self-initiating zero to six times a day, and eliminating about five times a day. During follow-up, Chloe was appropriately eliminating 75-100%, having zero to one accident a day, self-initiating one to four times a day, and eliminating about once a day.

Figure 5 depicts the data for Aaron, who was exposed to baseline only. Initially, Aaron displayed low levels of appropriate eliminations, but was only occasionally having an accident. However, beginning on day nine (and upon return from a semester break), we observed a sustained level of 100% appropriate eliminations (total eliminations averaged 7 per day) and a near-zero level of accidents for the next 60 days. However, we rarely observed self-initiations.

Figure 6 displays the data for Travis. During baseline, Travis was appropriately eliminating around 0% or not at all during the day, was having zero to two accidents a day, self-initiating zero to one time a day, and eliminating about zero to two times a day. During treatment, Travis was appropriately eliminating around 0%, having zero to one accident a day, self-initiating once a day, and eliminating twice a day. After day three of treatment, Travis stopped eliminating completely, and parents requested that he be pulled from the study for medical concerns.

Figure 7 displays the data for Opie. During the baseline condition, Opie was appropriately eliminating around 75-85%, having three to four accidents a day, self-initiating zero to two times a day, and eliminating about 10 times a day. During treatment, Opie was appropriately eliminating around 33-50%, having 3-5 accidents a day, self-initiating 0-2 times a

day, and eliminating about three times a day. After further analysis, Opie was observed to have accidents around 8:45 am and 11:45 am, therefore scheduled sits occurred during those times and appropriate eliminations resulted in DRA in an effort to increase appropriate eliminations. Responding remained low and variable. The same pattern of responding was observed when DRA was provided for self-initiations or appropriate eliminations during the next phase. Again, the same pattern of responding was observed when the behavioral chain (i.e., self-initiations followed by appropriate eliminations) received DRA. A near zero level of appropriate eliminations was observed when the scheduled sits (i.e., 8:45 am and 11:45 am) were removed and no sits occurred upon arrival and after nap time. An increase in appropriate eliminations was observed when we reversed back to scheduled sits and DRA for the behavioral chain (i.e., self-initiations followed by appropriate eliminations). A near zero level of appropriate eliminations was observed during the reversal. In an effort to increase toileting performance, RTT was implemented again. During the second RTT, Opie was appropriately eliminating 50-100%, having three to four accidents a day, self-initiating zero to two times a day, and eliminating two to four times a day. During the final phase, RTT and potty parties (i.e., bringing several peers to the toileting area to cheer for Opie) for appropriate eliminations, Opie was appropriately eliminating 0-100%, having zero to three accidents a day, self-initiating zero to two times a day, and eliminating zero to four times a day.

Table 4 displays the data for the social validity questionnaire. Completed social validity questionnaires were received from five out of seven parents. The average for question six "I believe this child will experience discomfort during the treatment" was scored as a three (i.e., neutral). Notably, this is the one question that was reverse coded where a lower score indicated greater social acceptability. However, responses were positive (i.e., parents agreed with

procedures) for all other questions and parents generally found the procedures and results to be acceptable.

Discussion

The results of the study are mixed. That is, the same pattern of responding did not occur for all children. Two patterns of responding were observed: RTT was effective at increasing toileting performance (i.e., increases in appropriate eliminations, decreases in accidents, and increases in self-initiations) and RTT was not effective at increasing toileting performance (see Table 5 for summarized results). The RTT procedure was effective for five participants (Odeza, Mason, Chloe, Sergio, and Valerie), but not effective for two participants (Opie and Travis). Three children for whom RTT was effective, were typically developing, and two children for whom RTT was effective, were children with IDD. Baseline procedures alone were effective for Sergio, Chloe, and Aaron, however, similar to the findings of Greer et al., self-initiations did not occur. Therefore, Sergio and Chloe moved to the RTT condition. Aaron left the center prior to beginning RTT procedures. One child for whom RTT was not effective was typically developing and the second child for whom RTT was not effective was diagnosed with ASD. RTT not only increased continence, but also increased self-initiations. Additionally, the procedures were socially acceptable to parents.

With respect to efficiency, our RTT procedure was not as rapid as the results reported by Azrin and Foxx. Specifically, our training times averaged 18 days with a range of 13-27, whereas Azrin and Foxx's training times averaged six days with a range of 1-7. However, the training times were similar to or much shorter than those described in previous studies using the rapid toilet training procedure (see Table 6).

A component of our RTT procedures may have produced generalized response suppression for one child (Travis). Although the level of appropriate eliminations increased during the first two days with RTT, Travis stopped eliminating altogether for the remainder of the evaluation.

The current study extended and replicated the findings of LeBlanc et al. (2005) by showing that the RTT procedure could be effective not only for children with IDD but also for children without any known diagnoses. Specifically, increased toileting performance was observed with three young children with no diagnoses, one young child with down syndrome, and one young child with a diagnosis of ASD and Down syndrome.

The current study had a couple limitations. First, maturation may be a threat to internal validity. Second, the effects of the individual training components are unknown. A component analysis could identify necessary and sufficient treatment components, which would allow for elimination of unnecessary and potentially labor-intensive components. However, RTT was still effective for Mason and Valerie without a WetStop$^{3®}$. Two participants from Doan and Toussaint (2016) were still observed to have an effect without the use of a urine sensor and alarm and one participant was observed to have an effect without the use of a urine sensor and alarm and without the implementation of positive practice.

There are several directions for future research. First, although the current study had generality (i.e., the participants consisted of eight young children with and without IDD diagnoses), researchers should increase the sample size and vary the diagnoses. Including additional participants will increase the confidence regarding the efficacy of the RTT procedure. Second, strategies to increase the efficiency of the RTT procedure could be evaluated. Researchers could conduct a component analysis of the RTT procedure to identify the necessary and sufficient conditions for increasing toileting performance (without loss of efficiency).

Conducting a component analysis may ultimately increase the efficacy and efficiency of the current procedures. Third, researchers could implement the procedures described across both home and child-care center. Results may have been more efficient if the procedures were conducted across both locations.

Fourth, the current study conducted toilet readiness questionnaires to identify the number of skills the participants had prior to the current study. However, it is still unclear whether the skills identified in the toileting readiness questionnaires are necessary for the success of the current procedures. Specifically, further analyses should be done to identify the validity of the toileting readiness skills questionnaire and which skills (if any) are the most important for successful cases. Identifying which toilet readiness skills are critical to toilet training success would be helpful information to have prior to implementation of treatment and can help the success of the procedures.

Finally, researchers could consider a less intrusive procedure. The baseline procedures (identical to Greer et al.) was effective at increasing appropriate eliminations and decreasing accidents, however, self-initiations did not occur. The dense sit schedule may have removed the establishing operation for self-initiations to occur (i.e., the child may not actually be toilet trained but rather trip trained – going to the bathroom only when prompted to go, whereas, the RTT procedures might have increased self-initiations because of the rapid fading sit schedule and prompts. The effects of a less rapid fading procedure (e.g., longer durations on the same sit schedule) are unknown.

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Table 1

Participant Demographics

Participant	Diagnosis	Age	Gender
Odeza	None	1 yr 10 mo	Female
Mason	Down syndrome	2 yr 4 mo	Male
Chloe	None	2 yr 1 mo	Female
Sergio	None	2 yr 1 mo	Male
Valerie	Autism and Down syndrome	4 yr 8 mo	Female
Travis	Autism	2 yr 10 mo	Male
Opie	None	1 yr 10 mo	Male
Aaron	None	2 yr 3 mo	Male

Table 2

Toilet Readiness Questionnaire

Child Name:_____ Completed by:_____ Date:_____

Child shows an interest in the potty (asks about potty, watches others use potty, wants to touch potty)	
Child demonstrates the ability to imitate the behavior of others	
Child is able to use words related to the potty	
Child is able to pull pants up and down	
Child wants to wear underwear instead of diapers	
Child is able to follow simple directions (“Go get the toy train and bring it to me”)	
Child is able to sit still with minimal adult prompting for 2-3 minutes	
Child is able to wait patiently for a brief time when told they will receive a reward	
Child is able to put away their toys & clean themselves with assistance (wash face w/cloth, etc.)	
Child can report to adult when they need a diaper change	
TOTAL # of check marks	

Table 3

Levels of Scheduled Toileting "Sits"

Level	Schedule
1	10-min sit on the toilet, 5 min off the toilet
2	10 min on, 10 min off
3	5 min on, 15 min off
4	5 min on, 25 min off
5	5 min on, 35 min off
6	5 min on, 45 min off
7	5 min on, 60 min off
8	5 min on, 90 min off
9	5 min on, 2 hours off
10	5 min on, 2.5 hours off
11	5 min on, 3 hours off
12	5 min on, 4 hours off

Table 4

Social Validity Questionnaire Results

Statements of Treatment Evaluation	Average (*M*)
I find this treatment to be an acceptable way of dealing with the problem behavior (i.e., accidents).	4.2
I would be willing to use this procedure if I had to change the child's problem behavior (i.e., accidents).	4.2
I believe that would be acceptable to use this treatment without children's consent.	4.6
I like the procedures used in this treatment.	4.2
I believe this treatment is likely to be effective.	4.8
I believe this child will experience discomfort during the treatment.	3
I believe this treatment is likely to result in permanent improvement.	4.6
I believe it would be acceptable to use this treatment with individuals who cannot choose treatments for themselves.	4.6
Overall, I have a positive reaction to this treatment.	4.2

Table 5

Demographics		Baseline Effective?			Treatment Effective?				Duration of TX (days)
Name	Diagnosis	Self Initiation	Appropriate Elimination	Accidents	Self Initiation	Appropriate Elimination	Accidents	Maintenance	
Mason (28 mo)	Down Syndrome	N/A	N/A	N/A	No	Yes	Yes	Yes	13
Valerie (57 mo)	Down Syndrome/ ASD	N/A	N/A	N/A	Yes	Yes	Yes	Yes	19
Odeza (22 mo)	None	No	No	No	Yes	Yes	Yes	Yes	13
Sergio (25 mo)	None	No	Yes	Yes	Yes	Yes	Yes	Yes	27
Chloe (25 mo)	None	No	Yes	Yes	Yes	Yes	Yes	Yes	19
Aaron (27 mo)	None	No	Yes	Yes	N/A	N/A	N/A	N/A	N/A
Travis (35 mo)	ASD	No	No	No	No	No	No	N/A	N/A
Opie (22 mo)	None	No	No	No	No	No	No	N/A	N/A

Results Summary

Table 6

Articles	Subjects (N)	Diagnosis	Treatment Duration Average # days (Range)
Foxx & Azrin (1973)	34	None	3.9 hours (0.5 -14 hours)
Hanney et al. (2013)	20	ASD	14 (N/A)
Greer et al. (2016)	20	None	16 (10 – 24)
Romero et al. (*in progress*)	5	None & ASD	18 (13 – 27)
Cicero & Phadt (2002)	3	ASD	19 (18 – 20)
LeBlanc et al. (2005)	3	ASD	20 (12 – 27)
Doan & Toussaint (2016)	3	ASD	23 (13 – 29)
Luiselli (1997)	1	PDD	45 (N/A)
Cocchiola et al. (2012)	5	ASD	56 (32 – 88)
Luiselli (1994)	2	IDD	72.5 (50 – 95)

Note: These data are reported by the authors (i.e., no systematic metric was used to determine the treatment duration average).

Table 7

Component	Baseline	Treatment
Dry pants	10-s access to tangible & 2 edibles	N/A
Self-initiations	10-s access to tangible & 2 edibles	Praise
Appropriate eliminations	10-s access to tangible & 2 edibles	30-s access to tangle & 2 edible
Accidents	Change w/ minimal attention	Positive practice
Urine sensor alarm	N/A	WetStop3®
Sit-schedule	FT 30-min	Levels 1-12
Increased fluids	N/A	Yes
Communication training	N/A	Yes

Component comparison for baseline and treatment conditions.

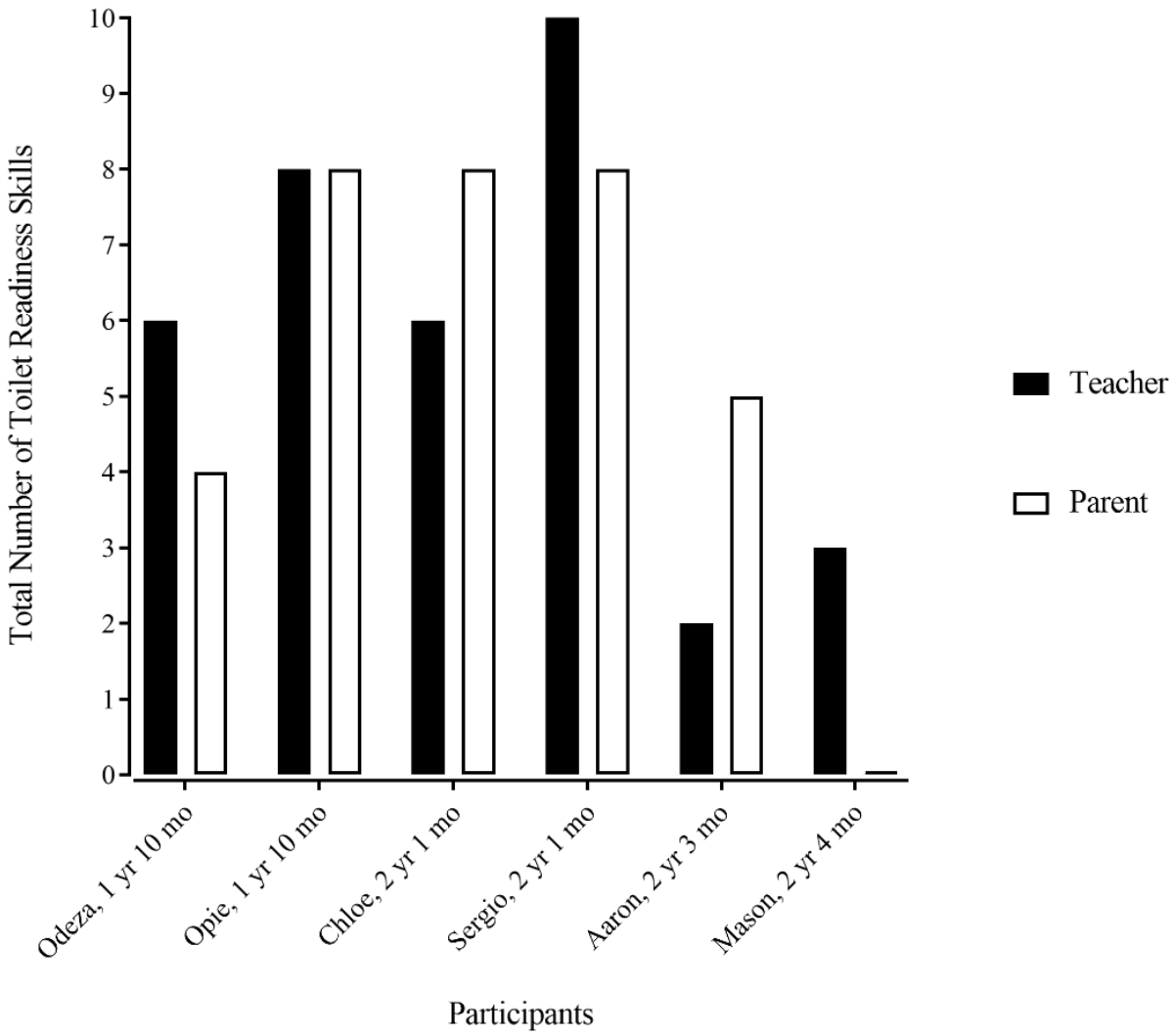

Figure 1. Cumulative (total) number of toilet readiness skills displayed as reported by the child's parent/guardian and the child's classroom teacher via the Toilet Readiness Questionnaire.

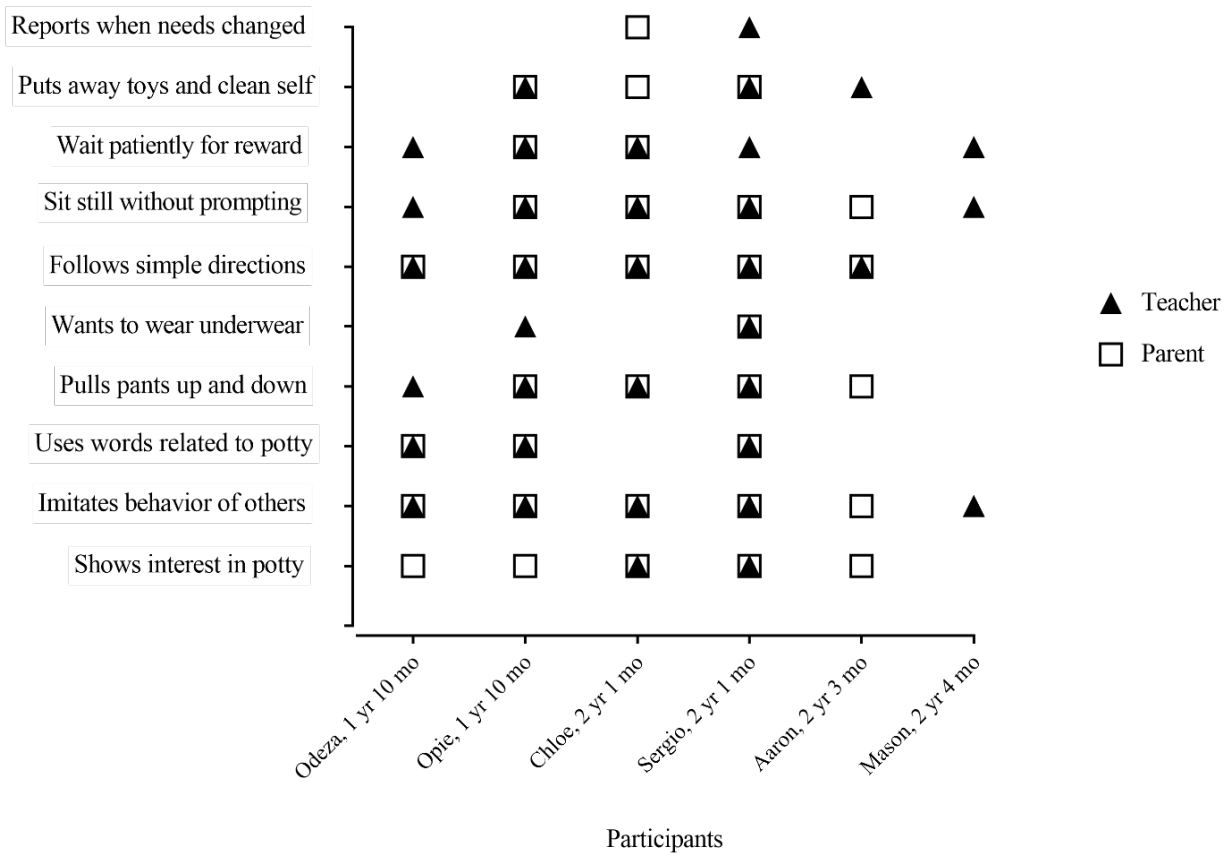

Figure 2. Itemized analysis of the Toilet Readiness Questionnaire results for each participant.

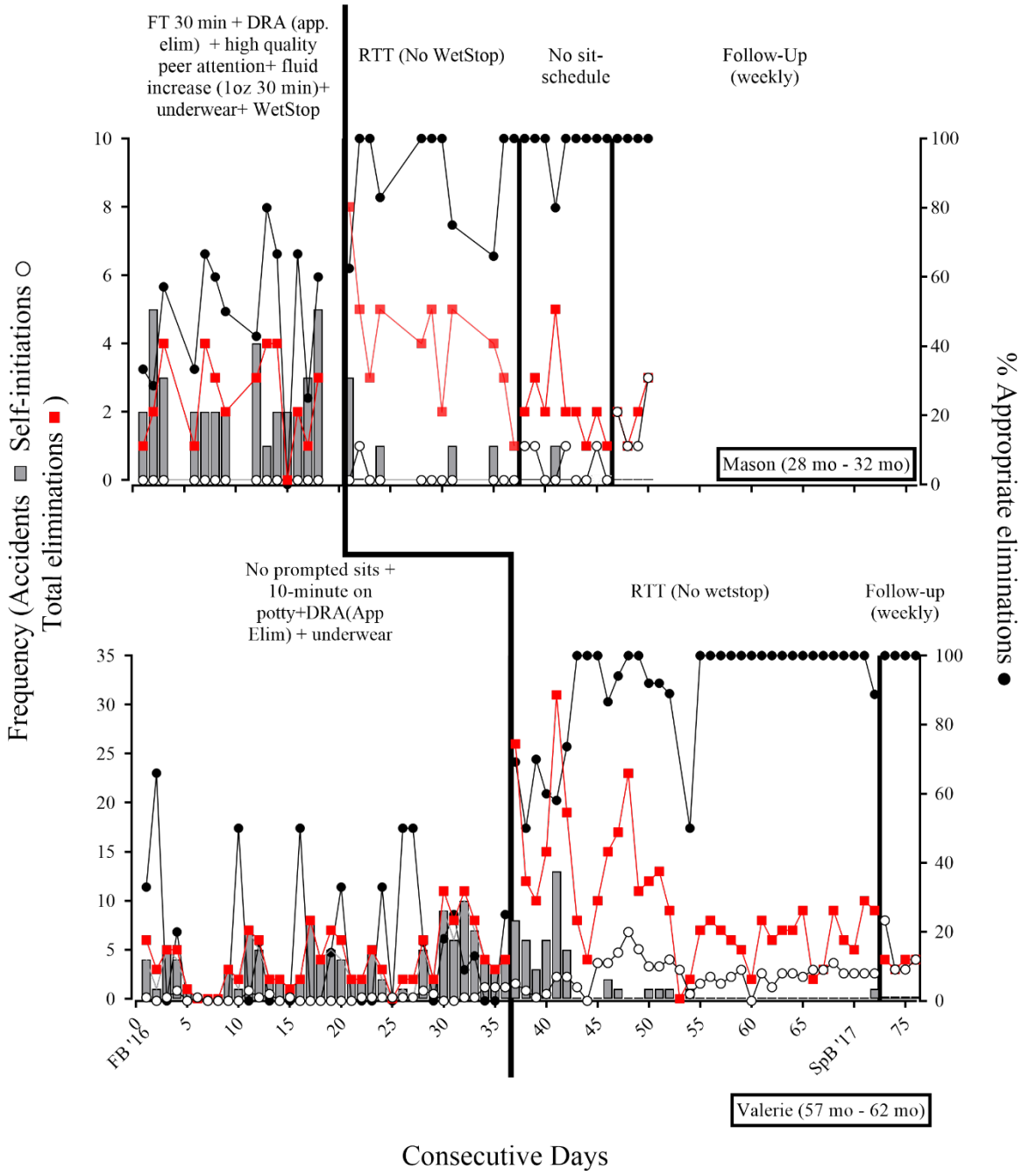

Figure 3. Results of the treatment evaluation for the 2 pilot participants (Mason and Valerie). Children's pre- and post-evaluation ages (in months) are noted parenthetically. (Note: FB 16 denotes Fall Break in which the programs were closed).

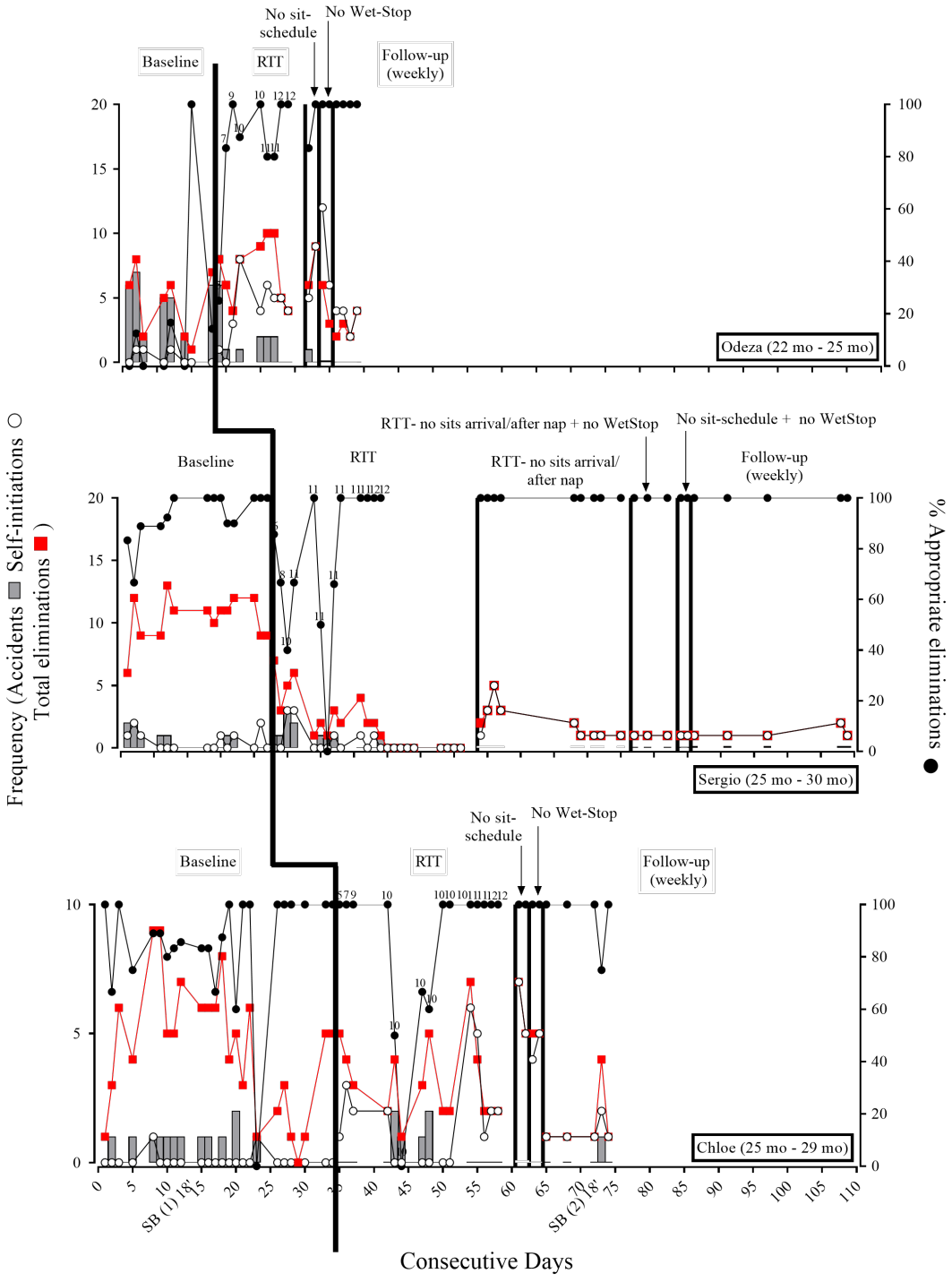

Figure 4. Results of the treatment evaluation for Odeza, Sergio, and Chloe. Children's pre- and post-evaluation ages (in months) are noted parenthetically (Note: The numbers above the black data points are the sit-schedule level in which the participant ended on for that day. Additionally,

SB 1 and 2 denote the first summer break and second summer break in which the programs were closed).

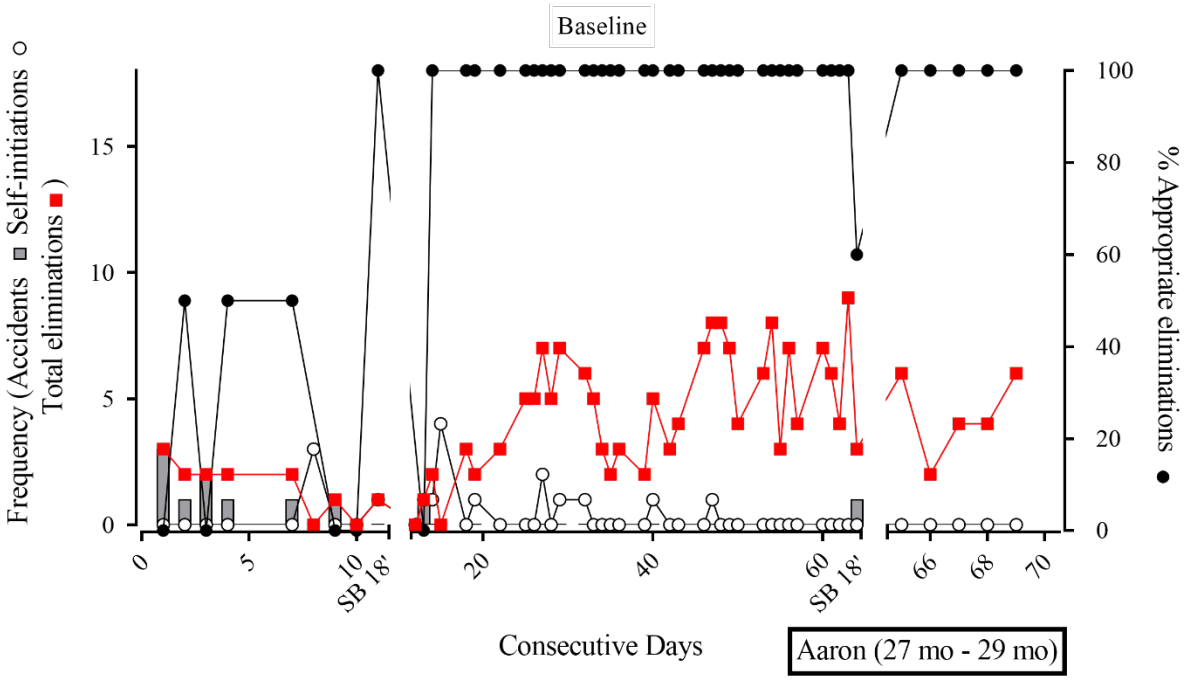

Figure 5. Baseline results for Aaron. Aaron's pre- and post-evaluation age (in months) is noted parenthetically. (Note: SB 18 denotes a summer break in which the programs were closed).

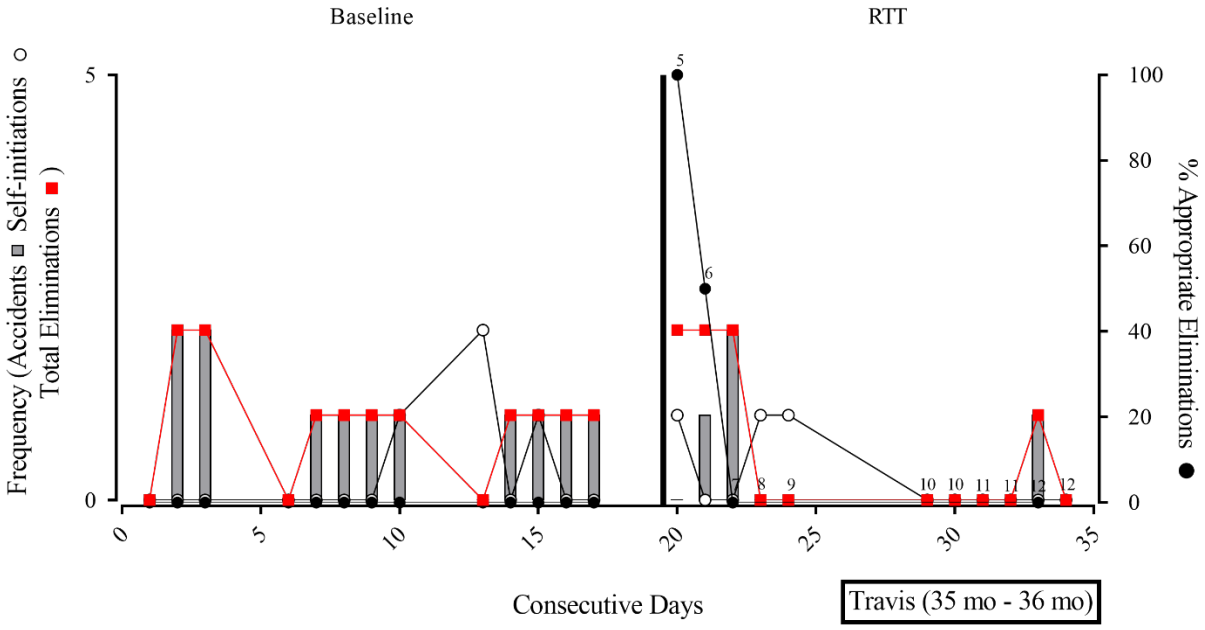

Figure 6. Results of the treatment evaluation for Travis. Travis' pre- and post-evaluation age (in months) is noted parenthetically.

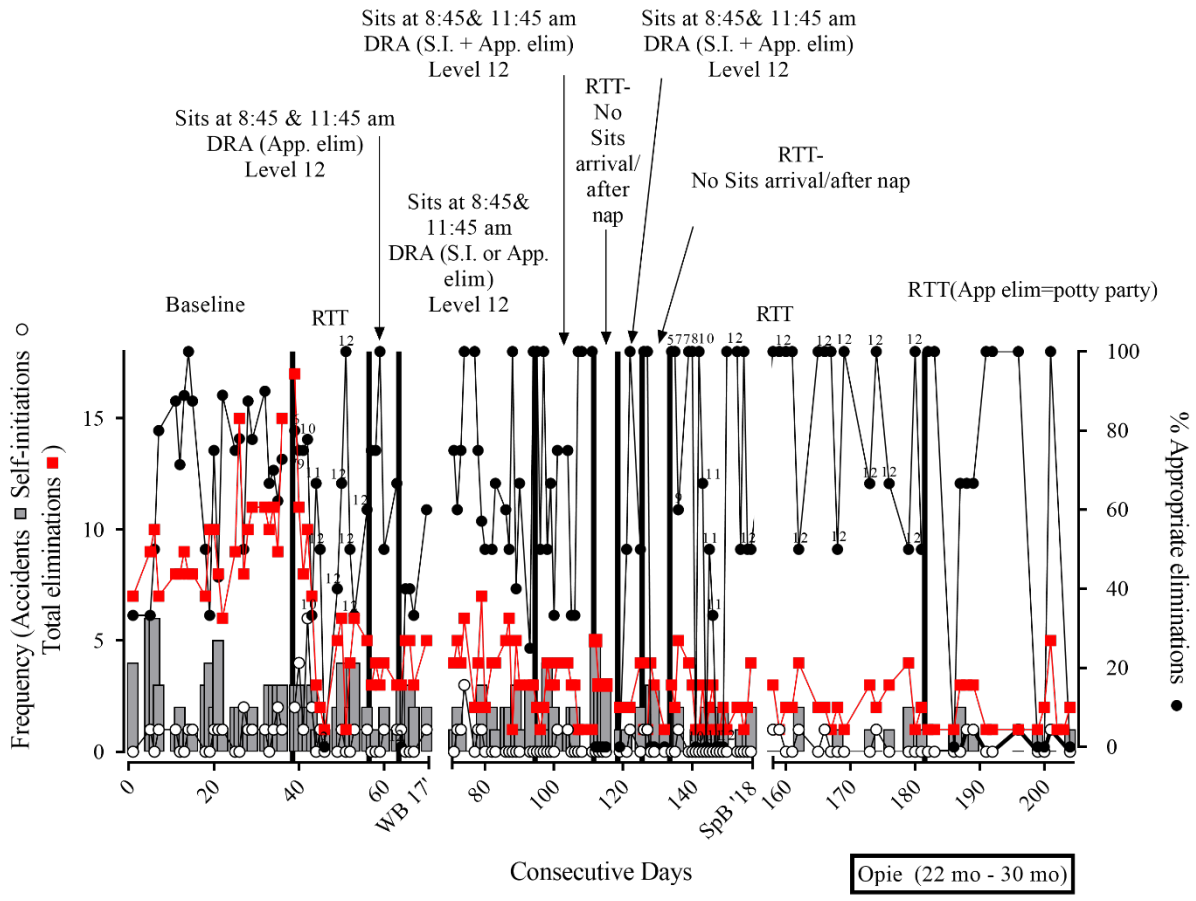

Figure 7. Results of the treatment evaluation for Opie. Opie's pre- and post-evaluation age (in months) is noted parenthetically.

Appendix A

Private Bathroom Area

Appendix D

WetStop$^{3®}$