ESTABLISHING APPROPRIATE TOILETING BEHAVIOR IN AN ADULT FEMALE WITH DEVELOPMENTAL DISABILITIES AND SEVERE SELF-INJURIOUS BEHAVIOR

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The participant was a 52 year-old woman, diagnosed with a profound intellectual disability, who engaged in high rates of severe self-injurious behaviors (SIB) predominantly in the forms of head banging and head hitting. A series of analyses and interventions was implemented to establish appropriate toileting behavior in the natural environment. Treatment consisted of conjugate reinforcement for optimal toilet positioning with the absence of SIB, episodic positive reinforcement of eliminating in the toilet, and programed generalization across environments and staff. Results showed the maintenance of optimal toilet positioning, decrease in SIB (under 1 instance per min), and appropriate eliminating in 96.3% of all available sessions. Direct support staff were trained to implement the program with 100% fidelity.

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CHAPTER 1

INTRODUCTION

Enuresis and encopresis are disorders in which individuals eliminate urine and feces, respectively, in inappropriate locations at least twice a week for a minimum time frame of three months (American Psychiatric Association, 2013). Additional diagnostic criteria stipulate that the individual must be over the age of four and medical and physiological impairments have been ruled out as primary causes (American Psychiatric Association). Studies indicate that individuals with intellectual disabilities (ID) and developmental disabilities (DD) are likely to have co-morbid diagnoses of enuresis and encopresis (Simonoff, Pickles, Charman, Chandler, Loucas & Baird, 2008). Negative impacts of toileting deficits may be acutely problematic for individuals with DD or ID due to lack of social, communicative and independent living skills. Toileting deficits often contribute to unhygienic conditions, irritation and infection of genitalia, compounded toileting issues, stigmatization, and disruption or restriction of schedules and activities (Didden, Sikkema, Bosman, Duker, & Curfs, 2008; Kroeger & Sorensen-Burnworth, 2009). For these reasons effective toilet training is considered a critical life skill with widespread implications for quality of life.

The most widely cited method for training toileting skills is Azrin and Fox's 1971 rapid toilet training method (RTT) (Kroeger & Sorensen-Burnworth, 2009; Francis, Mannion & Leader, 2017). During training sessions, Azrin and Foxx provided learners with large quantities of fluid in order to increase the likelihood of urination and increased the frequency of trips to the toilet. They implemented a positive punishment procedure contingent on toileting accidents (e.g. cleaning soiled areas or clothing) along with positive reinforcement following successful eliminations into the toilet. These procedures have been shown to be useful with many

individuals (Kroeger & Sorensen-Burnworth, 2009; Francis, Mannion & Leader, 2017); however, RTT procedures can be difficult or even impossible to implement with individuals with severe/profound intellectual abilities, older learners, learners with mobility impairments, or learners who present with severe challenging behaviors.

Lohmann, Eyman and Lask (1967) collected census data on 86 patients of a state hospital to assess demographic factors related to acquiring and maintaining continence. Higher IQ scores and younger age were strong indicators of success, with participants who were younger than 6 years of age and whose IQ scores exceeded 20 being most likely to achieve and maintain continence. Similarly, Wendt, Simila, Niskanen and Jarvelin (1990) found that individuals with diagnoses between moderate and profound ID were more likely to struggle to acquire bowel control and to be incontinent as adults. Additionally, adults with lower adaptive functioning often experience greater toileting difficulties and suffer disproportionally from physically related ailments such as pelvic aches and urinary tract infections (Belva, Matson, Barker, Shoemaker & Mahan, 2011).

Smith and Smith (1977) examined the relationship between chronological and social age and successful toilet training. Thirteen participants with ID were divided into three groups: younger with high social age, younger with low social age and older with low social age. Their results showed differentiation in results between the younger low social age group and the older low social age group. Individuals in the younger group saw an 80% decrease in accidents 2-4 weeks earlier than was observed in the older group. Moreover, all the members of the younger group had achieved 100% reduction of accidents by the seventeenth week; whereas only one of the five individuals in the older group eliminated all accidents.

Results of studies investigating relations between age, functioning level, and responsiveness to toileting interventions suggest that lower age and higher overall functioning level are associated with success (Lohmann, Eyman and Lask, 1967); however, these outcomes should not be taken to indicate that toilet training efforts with adults with more severe intellectual impairments cannot produce improvements. For example, the participants in Azrin and Foxx's 1971 study were between the ages 20 and 62, showing that RTT can be effective with some older learners. Despite this, more recent publications to continence tend to focus on childhood toileting (Kroeger & Sorensen-Burnworth, 2009). This may be a result of increased funds and attention directed towards early intervention. Additionally, there is evidence that older children and adults may have greater difficulty acquiring full continence (Lohmann et al., 1967; Smith & Smith, 1977). Efforts should be made to identify procedures that can be used to improve outcomes with older learners with disabilities.

Another factor that can be a barrier to successful toilet training is impaired mobility. Individuals with ID and immobility often show deficits in self-care skills such as dressing, hygiene routines, and toileting (Eyman, Olmstead, Grossman & Call, 1993). Impaired mobility may limit individuals' ability to travel to the toilet independently, remove clothing, transfer to the toilet, and so on. Furthermore, some training procedures, such as positive practice following accidents (Azrin & Foxx, 1971) may be difficult or impossible to implement with persons with impaired mobility. Positive practice requires learners to obtain clean clothes, shower, change into the fresh clothes, and clean up the site of accidents. Adaptive equipment exists that may ameliorate the burden of completing these tasks; however, not every individual has access to such supports.

An important consideration when creating a toileting program is the availability of resources and the limitations of more institutionalized settings. Smith and Smith (1977) suggested that caregiver factors could account for differences in maintenance of toileting skills in their younger and older participants. Caregivers may be less optimistic about an older individual's potential for success and might therefore be less rigorous with training and maintenance procedures. Staff turnover is often very high in institutional settings. High turnover and under-staffing may lead to under-trained staff with too many demands on their time (Smith & Smith, 1977; Sadler & Merkert, 1977). In recent years there has been a migration from institutionalized settings to smaller residential settings. From 1988 to 2011, the percent of individuals with ID living in small residential facilities has grown from 29% to 75% (Woodman, Mailick, Anderson, & Esbensen, 2014). Mansell, Beadle-Brown, Whelton Beckett & Hutchinson (2008) found that while staff engagement was generally higher in residential facilities than in institutions, staff still only average around 6 minutes of every hour engaging with individuals. For individuals with severe or profound ID the time is closer to 1 minute per hour. The insufficiency of staff time and engagement may be barriers to implementation and maintenance of labor-intensive toileting programs.

To address the effectiveness and social validity of different toileting programs, Sadler and Merkert (1977) compared the RTT method to a scheduling method in which participants were taken to the toilet four times throughout the day. A group receiving no toilet training was used as a control. Fourteen participants were randomly assigned to each group. All participants were between the ages of 7 and 12 and diagnosed with severe or profound ID. Both groups showed a reduction in accidents following intervention; however, only the RTT group was able to almost eliminate all accidents. Interestingly, when surveyed, staff reactions to RTT were

varied. While staff reported overall satisfaction with the results, they expressed displeasure with training time requirements. Despite the efficacy in promoting continence, staff expended an average of 35 hours (range: 25 hr. to 165 hr.) for each RTT participant, compared to an average of 5.3 hours for each scheduling participant. This suggests that modified or alternative toileting regimens may be necessary in institutionalized settings.

Another factor that may affect efforts to achieve continence is the presence of disturbing behavior patterns, or problem behavior. For example, Hagopian, Fisher, Piazza and Wierzbicki (1993) implemented a series of treatments for a 9-year-old male who engaged in severe self-injurious behavior (SIB) during toileting. When positive reinforcement alone was unsuccessful, addition of overcorrection procedures increased continence but, unfortunately, also increased rates of SIB. Eventually, it was necessary to incorporate procedures that were targeted specifically at decreasing SIB (differential reinforcement of other behaviors, or DRO) with a water-prompting procedure to initiate urinations and train appropriate urinary continence. This package effectively taught appropriate toileting while maintaining low levels of SIB.

Brown and Peace (2011) modified RTT procedures for a Ben, 13-year old male who engaged in aggressive behaviors (i.e. biting, hitting, kicking) when given demands and engaged masturbation during toileting. An ABCA design was used to train and fade RTT procedures; however less intrusive demands were used for positive practice (e.g., sit on the toilet, hold clothes, flush toilet, etc.) and extended throughout the toileting process. This modification decreased aggression and provided competing activities for masturbation so that Ben could acquire continence without exhibiting challenging behavior. For individuals who have achieved continence, problem behavior may negate maintenance of regular and appropriate toileting. Luiselli (1977) used token reinforcement and self-recording to reduce toileting related phobic

behaviors such as hyperventilating, inappropriate vocalizations, bathroom avoidance and wetting.

Problem behavior may impact the quality of care an individual receives which may, in turn, present challenges to toilet training efforts. Carr, Taylor and Robinson (1991) studied behavior changes in adults working with children who engaged in severe problem behavior and no problem behavior. Carr et al. found that the adults spent more time working with the children who did not engage in problem behavior and often limited interactions with the disruptive children to low demand interactions. Their findings suggest a reciprocal negative reinforcement cycle wherein the adults avoided aversive tantrums and children with problem behavior avoided or escaped a multitude of learning opportunities. Given that most toilet-training procedures involve high levels of close personal engagement with learners, it is reasonable to suggest that a) severe problem behaviors, such as SIB, may be more likely to be observed during intrusive toilet training than at other times, and b) the presence of SIB may discourage caregivers from implementing toilet training procedures.

Consistent with this notion, Kahng, Iwata, and Lewin (2002) suggested that problem behavior "… may limit the individual's participation in therapeutic activities, such as academic, self-care, or vocational instruction, which may result in continued placement in restrictive living situations" (p. 212). The restriction of therapeutic opportunities may result from caregivers' avoidance of situations that evoke problem behavior; however, it may also result from other conditions necessitated by the prevalence or intensity of the individual's SIB. For example, manual or mechanical restraint is often used with individuals who display, both as an emergency intervention in instances of imminent risk of injury or damage to the environment and as a general preventive measure (Fisher, Piazza, Bowman, Hanley & Adelinis, 1997). Although such

interventions are often necessary to insure the safety of the individual, others, or the general environment, they often prevent the occurrence of both problem behavior and responses essential for the development of critical life skills (Kahng et al., 2002). For example, arm splints and other restraints may decrease the likelihood of injury; however, the loss of mobility associated with these restraints also may limit independent activities like dressing, eating and toileting. Additionally, an individual may be confined to controlled locations and barred from more appropriate learning areas. Restrooms and kitchens, for example, might be dangerous environments for some individuals due to the presence of hard, un-cushioned surfaces. Toileting programs for individuals with SIB may require additional precautions and nontraditional procedures to be both effective and safe.

Efforts to identify practices that can result in toileting success and promote the quality of life for adults with disabilities and incontinence would be helpful. Furthermore, procedures should be developed that will be likely to be adopted maintained in the natural environment to ensure continuing effectiveness. The purpose of this study was to identify and establish the necessary environmental conditions for a 52-year-old woman with profound ID and severe SIB to safely acquire and maintain continence in an institutional setting.

CHAPTER 2

GENERAL METHOD: PARTICIPANT

Simone was a 52-year-old female diagnosed with autism spectrum disorder (ASD) and Profound Intellectual Disability. Simone had limited ambulatory ability and required a wheelchair to navigate long distances. She was able to communicate preferences by reaching for preferred items or individuals. She lived at a residential training facility for adults with intellectual and developmental disabilities in North Texas. The facility referred Simone to a specialty clinic for assessment and treatment of severe SIB during toileting. Simone's SIB included hitting her head against objects and others and punching herself on the face and legs.

Family reports indicated a long history of SIB, particularly surrounding toileting. Simone's father stated that she engaged in SIB for the majority her life. At the age of 7, Simone was admitted to the residential training facility where this study was conducted. In 2007, she was temporarily transferred to sister facility 226 miles away. Though Simone engaged in high rates of SIB at the new facility, she was able to use the toilet with adaptive supports, including a helmet, padded commode chair and fully padded restroom. Reports indicated that Simone was able to sit on the toilet with support once a day. In 2015 Simone transferred back to her current facility. However, this facility was unable to continue Simone's toileting program due to restrictions regarding helmet usage and a prohibition of permanently affixed padding in restrooms. For these reasons, Simone was required to use briefs until her SIB decreased enough to permit more independent bathroom usage.

CHAPTER 3

STUDY I: FUNCTIONAL ASSESSMENT

Observations and Anecdotal Assessment

Three preliminary observations were conducted prior to formal analysis. Observations occurred at predetermined check and change periods following Simone's lunchtime. These observations revealed that the mean duration of Simone's changes was 1 minute and 6 seconds (range = 58 seconds to 1 minute 4 seconds), and the mean frequency of head bangs was 14.33 times per changing (range = 11 to 18). Head hitting and leg hitting were not observed during these observations.

In conjunction with direct observation, two anecdotal assessments, the Motivation Assessment Scale (MAS) (Durand & Crimmins, 1988) and the Questions about Behavioral Function (QABF) (Matson & Vollmer, 1995), were administered with multiple direct support caregivers. These assessments were designed to obtain information from caregivers about the types of antecedent and consequent conditions that are associated with problem behaviors, and the results are used to develop informed hypotheses about the operant function(s) of the behavior.

The questionnaires were delivered using procedures described by Smith, Smith, Dracobly, and Peterson-Pace (2012). Smith and colleagues administered the assessments with several respondents and found that high agreement among respondents regarding a given participant's challenging behaviors was predictive of correspondence between assessment results and the functional analysis results. That is, if assessment results showed that 4 or 5 of 5 responders agreed on the likely maintaining consequence for the behavior being assessed, there was a strong likelihood that their conclusions would match the findings of a functional analysis.

In the current study, 5 direct support staff who had worked with Simone a minimum of 6 months were selected to complete MAS and QABF assessments for Simone's head banging and self-hitting. Trained graduate students administered the questionnaires, reading questions aloud and scoring staff's responses.

Extended No Interaction Analysis

An extended no interaction analysis was implemented to ascertain whether Simone's SIB persisted in the absence of social consequences (Vollmer, Marcus, Ringdahl & Roane, 1995). Sessions were conducted in a padded, 2.5 x 2.5 m room with a one-way observation window for data collectors. Four total sessions, lasting 30 min each, were conducted in the span of a week. During the no interaction sessions, Simone was seated on a cushion in the middle of the empty room. One therapist was stationed within arm's reach, directly behind Simone. The therapist did not interact with Simone during sessions, except to silently block instances of head-hitting that were too dangerous to be ignored. Head banging and leg-hitting were ignored.

Measurement

Data were collected using laptop computers with B-Data Pro software. Three topographies of SIB were scored used event recording: head banging, head-hitting and leg hitting. *Head banging* was scored when Simone's neck extended or rotated so that any part of her head made rapid contact with a surface outside of her person. Instances of contact in which her neck remained stationary were excluded from this definition (e.g., adjusting in her seat). *Head-hitting* was scored when Simone's fist contacted any part of her face or head. *Leg-hitting*

was scored when Simone's fist contacted her thighs, knees or shins. Head banging, head-hitting and leg-hitting were scored throughout all phases of assessment and treatment.

To assess interobserver agreement (IOA), each session was divided into 10-s intervals and the average percent agreement for each interval was calculated. Results for all intervals were totaled and divided the number of intervals. This result was multiplied by 100. IOA was calculated for 50% of extended alone sessions, and averaged 100% for head banging, 100% for head-hitting, and 99.16% for leg-hitting (range, 98.33% to 100%).

Results and Discussion

Simone's assessment results for head-hitting are displayed in Table 1. On the QABF, three out of five respondents reported "Sensory/Non-Social" as the highest category (mean = 6.6, range = 0 to 13). For the MAS, four out of five respondents reported "Automatic" as the highest category (mean = 12.2, range = 4 to 22). These outcomes suggest that Simone's self-hitting was maintained by some sort of automatically produced, nonsocial reinforcement.

Results for head banging are shown in Table 2. Outcomes for the QABF show that four out of five respondents ranked "Sensory/Non-Social" as the highest category (mean = 7.4, range = 0 to 13). Four out of five MAS respondents rated "Automatic" as the highest category (mean = 12.2, range = 5 to 24). These outcomes suggest that Simone's self-hitting was maintained by some sort of automatically produced, nonsocial reinforcement, with a potential secondary function of negative reinforcement in the form of escape from demands or activities.

Figure 1 shows the results of the Extended No Interaction Analysis. The top panel of Figure 1 shows a cumulative record of Simone's head banging and self-hitting in session one. Leg-hitting and head-hitting were not identified as separate topographies until session two.

Simone engaged in a total of 113 instances of head banging and 113 instances of self-hitting. During session 2, 16 min and 30 s into the session, Simone stopped engaging in head banging. Head banging decreased from a rate of 6.85 responses per minute to 0 responses per minute, with no responses observed after 16 min and 30 s into the session. Self-hitting persisted throughout the session but decreased from a rate of 4.85 responses per minute to 2.44 responses per minute. The second panel of Figure 1 shows the results from the second session, during which Simone did not engage in head banging. Head-hitting occurred at a rate of 0.17 responses per minute and ceased at approximately 10 min into session. Simone engaged in leg-hitting throughout the session at a rate of 1.2 responses per min. The third panel of Figure 1 shows a cumulative record of Simone's SIB in session three. Simone did not engage in head banging during the session. Head-hitting occurred at a rate of 0.13 responses per minute and leg-hitting occurred at a rate of 1.2 responses per minute. All SIB ceased approximately 5 minutes into the session. Simone then sat calmly for the remaining 25 minutes. The bottom panel of Figure 1 shows that Simone engaged in 0 instances of head banging or self-hitting throughout session 4.

Results from the extended no interaction analysis strongly suggested that Simone's head banging and self-hitting were social in nature, maintained by some form(s) of social reinforcement that was not available during extended no-interaction sessions. First, evidence of within-session extinction was observed for head banging and hitting in the first session, with both responses occurring at relatively high rates during the initial minutes of the session but ceasing to occur during the final third of the session. Head banging not observed throughout the remainder of the analysis. Low rates of head hitting were observed during the initial moments of the second and third sessions but decreased to zero levels in both each and was not observed during the last session. Leg hitting emerged during the second session and maintained throughout

that session; however, this topography, too, showed evidence of within-session extinction during the third session and was not observed during the fourth session.

Relative patterns of responding across the three measured topographies are suggestive of their membership in a common response class and, tentatively, of a hierarchical relationship among the responses. For example, the top panel of Figure 1 shows that head banging and total self-hitting tended to co-vary in a systematic way, with increases in one topography correlated with decreases in the other. This is perhaps most notable when head banging ceased to occur from approximately the 11th through the 14th minute of the first session. Total self-hitting increased immediately but decreased when head banging briefly resumed at approximately the 15th minute. When head banging again ceased, total self-hitting resumed at higher rates and then showed a decreasing trend to near-zero levels after approximately the 21st minute of the session. These patterns suggest that these topographies were members of the same response class, with both showing within-session patterns of extinction (Epstein, 1985). Leg hitting showed some evidence of hierarchical membership in the same response class. It seemed to emerge after head banging and head hitting had largely extinguished, showed some evidence of negative covariance with face hitting during the second session, decreased across sessions, and did not occur at all after session 3. These patterns suggest that it may have been a later-appearing member of the same response class as head banging and head hitting. Interestingly, although head banging and head hitting also appeared to be members of the same response class, evidence of a hierarchy *between those responses* is not so clear, suggesting that they were nearly equally likely to occur during the extinction process, with leg hitting appearing only after those topographies had largely ceased to occur.

Finally, although the results from Simone's extended no interaction analysis strongly indicated that her problem behaviors were maintained by social reinforcement, the type of reinforcement contingency (positive or negative) was not clear. Because of the severe nature of her SIB her treatment team determined to proceed with treatment analysis in the absence of a definitive determination of the precise nature of the reinforcement contingency responsible for her SIB. Because Simone's referral was to establish proper toileting positioning and to establish and maintain elimination on the toilet, and because Simone had a history of SIB and disruptive behavior during toileting and toilet training routines, Simone's treatment was developed based on the assumption that her SIB was maintained primarily by avoidance or escape from those situations.

CHAPTER 4

STUDY II: TREATMENT

Measurement

Head banging, head-hitting and leg-hitting responses were measured using the definitions and procedures described in Study I. Three additional measures were scored in Study II. *Toilet positioning* was scored using a duration measure. Recording started when Simone's legs were extended forward, her knees were at 90-degree angles, and her feet were placed flat on her wheel chair footrest or adaptive step stool appropriate toilet positioning ended when Simone's feet broke contact with the raised surface.

After observing a potential correlation between staff interruptions to sessions and SIB, data collectors began recording the duration of interruptions during Condition 7: On Toilet. Interruptions were scored when an individual not involved in Simone's treatment session (i.e., a person not acting as therapist or data collector) physically entered the training location. The interruption ended when that person physically left the training location.

Observers began recording *Eliminations,* which were defined as any instance Simone voided urine or feces into the toilet bowl, during Condition 8: Pants Down. Prior to Condition 8, Simone had no opportunity to engage in eliminations. *Eliminations* were scored when observers heard or saw evidence of urination or defecation while Simone was seated on the toilet. If eliminations were not detected at the time of their occurrence, urine or feces observed in the toilet bowl at the end of the session were used as evidence of elimination.

Partial agreement within intervals IOA was calculated for 27.72% of treatment sessions, and averaged 92.56% for head banging (range, 62.5% to 100%), 99.41% for head-hitting (range,

90% to 100%), 98.63% for leg-hitting (range, 93.75% to 100%), 92.66% for interruptions (range, 66.67% to 100%), and 99.2% for eliminations (range, 90.48% to 100%).

General Procedures

Prior to treatment, investigators attempted a single stimulus preference assessment (Pace, Ivancic, Edwards, Iwata & Page, 1985) and a free-operant preference assessment (Roane, Vollmer, Ringdahl & Marcus, 1998); however, both were discontinued as Simone did not select any item and engaged in frequent SIB. Finger games, in which caregivers touched their fingertips to Simone's or ran their fingers over her arms and shoulders, was indicated as a preferred activity in an annual behavioral health plan provided for Simone by the facility. This was corroborated by direct observations; thus, finger games were used as a reinforcer throughout treatment. Similarly, records and caregiver reports indicated that Simone enjoyed hearing caregivers sing children's songs; therefore, the therapist sang to her during reinforcement intervals.

During treatment sessions, the therapist stood directly in front of Simone, facing her from a distance no more than two feet away. Sessions lasted 20 min, or until the termination criteria specific to each condition were met, provided Simone was not engaged in self-injurious behavior at that time. If Simone was engaging in SIB at the end of 20 min, the session was extended until Simone was calm enough for the therapist to provide 10 consecutive s of reinforcement. Sessions began with the verbal instruction "Put your feet down" or the phrase "Nice sitting!" if Simone was in the correct position at the start of the session. The therapist used partial physical prompts (e.g., lightly tapping Simone's ankles) and repeated the instruction every five seconds until Simone was in the appropriate toileting position. When Simone sat in the correct position and did

not engage in head-hitting or head banging, the therapist sang and played finger games with Simone.

If Simone engaged in head banging or head-hitting, the therapist immediately stopped singing and playing finger games, and withdrew attention except to block head-hits. When Simone stopped hitting or banging her head, the therapist resumed singing and playing finger games. This arrangement was intended to function as conjugate reinforcement when Simone was seated quietly on the toilet (Lindsley, 1962). These procedures were used throughout the course of Simone's treatment.

A series of data-based protocol changes was made during Simone's treatment. Simone progressed through conditions after two-to-three consecutive sessions during which she remained in the correct toileting position for at least 80% of the session and engaged in no more than 1 instance of SIB per minute. Each protocol change is described in detail below.

Protocol Changes and Procedures

Condition 1. Wheelchair in Clinic

The general procedures described above were carried out once a day, three times a week, following Simone's afternoon meal (these conditions remained in place throughout the course of treatment). Simone's first positioning training sessions took place in the 2.5 x 2.5 m room where the no interaction analysis was conducted. Simone's wheelchair was moved to the center of the room which restricted her ability to head bang on walls but did not prohibit her from head banging on her wheelchair.

Condition 2. Wheelchair in Home

In this condition, all general procedures were carried out in the home. Sessions were

conducted in Simone's bedroom, approximately 30 min following Simone's afternoon meal, when direct care staff and other residents had relocated to a workshop, leaving Simone's home relatively vacant. This allowed sessions to be run with limited interruptions.

Probe 1

A probe session was conducted under the supervision of the director of the research project (a Ph.D./BCBA-D level behavior analyst). Simone's portable commode chair was moved into her bedroom and positioned against her bedframe. This positioning stabilized the commode chair and provided 1.25 m of space between Simone and the bedroom wall. A padded adaptive step stool was placed at Simone's feet at the start of session. During this probe, three assistants were present to stabilize the commode chair and block Simone's attempt to head-bang on the chair. These assistants were positioned behind the chair and on Simone's left and right side. General procedures were followed.

Condition 3: Commode Chair Training in Bedroom

Based on the results of Probe 1, padding was added to the arm rests and back of the chair. An assistant was positioned behind Simone and was responsible for blocking her left side and stabilizing the chair. A second assistant was positioned to her right and was responsible for blocking head-hitting and head banging on her right side.

Probe 2

A second probe session was conducted by the project director. Procedures during the first 5 min were identical to that of condition three; however, after 5 min a 5-s time delay between the

offset of head banging or head-hitting and the onset of singing and finger play was implemented to make the reinforcement contingency more salient. The session was terminated after 10 min.

Condition 4: 5-Second Time Delay

A 5-second time delay between the offset of head banging or head-hitting and the onset of singing and finger play was implemented to make the reinforcement contingency more salient.

Condition 5: Increased Padding

Following a session with unavoidable interruptions from maintenance staff in the home, padding on Simone's armrests were doubled to prevent serious injury.

Probe 3: Systematic Interruptions

Procedures for this probe were identical to those of Condition 5; however, approximately 10 min into the probe session a graduate supervisor entered the room and stood within Simone's line of sight. Seventeen min into the probe session the graduate supervisor walked in a random pattern throughout the bedroom, keeping in Simone's line of sight.

Condition 6: One Assistant

To approximate naturalistic conditions in the restroom, the presence of assistants was faded out. During Condition 6, one assistant, rather than two, remained behind Simone's chair to provide necessary stabilization and block SIB.

Condition 7: On Toilet

Sessions were conducted in the bathroom that was adjacent to Simone's bedroom.

Simone's commode chair was positioned over the toilet. Because the toilet was located 30cm from a wall, a mat was placed between the wall and her commode chair. No assistant was present to block SIB; therefore, the therapist was responsible for blocking head-hits.

Condition 8: Pants-Down Elimination Training

Simone's pants were lowered and her brief was removed before she sat on the commode chair. If excrement was present in her brief, the therapist washed Simone before assisting her to sit on the commode chair. If Simone eliminated on the toilet, she was praised and given a small spoonful of guacamole. Guacamole had been identified as a preferred food item in an unstructured interview with Simone's guardian. Simone remained on the toilet for five minutes after the first void to allow for additional eliminations. If Simone did not eliminate, the session ended after 20 minutes.

Condition 9: Removal of Wall Mat

When rates of self-injurious behavior stabilized near one or fewer instances per minute, the wall mat was removed.

Condition 10: Staff and Occupants in Home

Sessions were scheduled immediately following her afternoon meal, when staff were scheduled to take Simone to the restroom. Staff and residents were present in the home, providing an opportunity to promote generalization of treatment gains in an increasingly naturalistic context.

Condition 11: Staff Observing

Each session, a member of the direct care staff was asked to observe procedures from the back corner of the bathroom. Initially, each caregiver was required to observe three sessions before they conducted sessions as therapist. Due to high caregiver turnover, this requirement was decreased to one observation.

Condition 12: Removal of High Preference Item

At the request of the caregivers, guacamole was not presented to Simone after successful eliminations in order to assess whether it was a necessary treatment component. Subsequently, Guacamole was removed from the treatment package for the remainder of Simone's treatment.

Condition 13: Staff as Therapists

After all direct contact caregivers from the afternoon shift on Simone's home had observed at least one session, they were trained on her toileting protocol. The therapist read Simone's protocol to caregivers aloud in a quiet area. The therapist asked caregivers to pose questions pertaining to the protocol before session. When the caregiver's questions had been answered, the caregiver conducted Simone's session at her regularly scheduled time. The therapist provided prompts when caregivers made errors and scored implementation fidelity.

Interruption Analysis

During treatment Conditions 7-11, interruption measures were recorded and analyzed to assess potential effects of interruptions on SIB. A series of probability analyses was conducted to assess the effects of interruptions on Simone's rate of SIB. The following probabilities were

calculated and compared based on the procedures outlined by Fritz, Iwata, Hammond and Bloom (2013): types of each target behavior were calculated and compared: the conditional probability of the target (i.e., SIB) given an interruption [p(T|I)], the unconditional probability of the target [p(T)], and the unconditional probability of an interruption [p(I)]. Table 3 contains each probability type and the corresponding formula.

Results

Toilet Positioning

The results for toilet positioning in treatment are depicted in Figure 2. While seated in her wheelchair during condition one, Simone engaged in the appropriate toileting position 86.1% of session time (range, 83.33% to 89.48%). In condition two, the mean percent of session time with appropriate toilet positioning was slightly lower, although an increasing trend is discernible. After moving sessions to the commode chair and incorporating the adaptive step stool, Simone's engagement in appropriate toilet positioning increased to a mean of 99.29% of session time throughout the remainder of treatment (range, 94.64% - 100%).

SIB

The results for SIB during treatment are depicted in Figures 3 and 4. Both figures display session-by-session measures of SIB throughout the course of Simone's treatment. Data presented in Figure 6 were derived from all sessions conducted during treatment; in Figure 7, data from sessions in which one of a set of potentially confounding variables occurred have been removed. Confounding variables were identified prior to sessions and were defined as extraneous variables that may influence either the dependent or independent variables of study. Confounding

variables included: prolonged and invasive interruptions, illness, infection, and any hiatus of more than six days between sessions. Confounds were identified and criteria for determining their occurrence were developed prior to sessions to which they were applied. A total of 20 confound sessions occurred in Study II. Head banging occurred at a mean of 3.3 rpm (range, 0 – 13.94 rpm), head-hitting occurred at a mean of 0.18 rpm (range, 0 - 1.23 rpm), and leg-hitting occurred at a mean of 0.24 rpm (range, 0 – 1.45 rpm).

During Condition 1: Wheelchair in Clinic, in both Figures 3 and 4, 0 instances of head banging occurred. Head-hitting occurred in only one session at 0.3 rpm and leg-hitting occurred at a mean of 0.17 rpm (range, 0- 3 rpm).

During Condition 2: Wheelchair in Home, 0 instances of head banging occurred. Head-hitting occurred in only one session at 0.9 rpm. Leg-hitting occurred at 0.18 rpm (range, 0 to 0.4).

During Probe 1, head banging occurred at 19 rpm, and there were no occurrences of head-hitting or leg-hitting.

During Condition 3: Commode Chair Training, head banging occurred at 4.65 rpm (range, 1.12 to 8.51), head-hitting occurred at a mean of 0.99 rpm (range, 0.53 - 1.43), and there were no occurrences of leg-hitting. As witnessed in Simone's no interaction analysis, a decreasing trend in SIB occurred both within and across sessions. This pattern can be seen in Figures 5, 6, and 7, which depict the within-session cumulative measures of SIB for this condition.

During Probe 2, head banging occurred at a rate of 1.12 rpm, head-hitting occurred at a rate of 0.75 rpm, and there were no occurrences of leg-hitting.

Figure 3 contains results from all sessions conducted During Condition 4: 5 Second Time Delay, including sessions in which suspected confounds were present. Head banging occurred at a mean of 6.57 rpm (range, 0.55 - 21.41), head-hitting occurred at a mean of .76 rpm (range, 0.05 - 2.3), and leg-hitting occurred at a mean of 0.33 rpm (range, 0 to .94). Figure 4 shows results with sessions in which a potential confounding condition was identified removed from the display. Head banging occurred at a mean of 5.65 rpm (range, 0.55 - 21.41), head-hitting occurred at a mean of .78 rpm (range, 0.05 to 2.3), and leg-hitting occurred at a mean of 0.34 rpm (range, 0 - 0.94).

During all sessions of Condition 5: Increased Padding (Figure 3), head banging occurred at a mean of 1.07 rpm (range, 0 - 2.45), head-hitting occurred at a mean of 0.03 rpm (range, 0 - 0.1), and leg-hitting occurred at a mean of 0.04 rpm (range, 0 - 0.2). When sessions containing potential confounds were removed from the analysis, head banging occurred at a mean of 0.94 rpm (range, 0 - 2.45), head-hitting occurred at a mean of 0.02 rpm (range, 0 - 0.05), and leg-hitting occurred at a mean of 0.05 rpm (range, 0 - 0.2).

During Probe 3, head banging occurred at a rate of 1.04 rpm, head-hitting occurred at a rate of 0.15 rpm, and leg-hitting occurred at a rate of 0.2 rpm. A cumulative record of within-session data is shown in Figure 8. This display shows that Simone's SIB appeared to increase when the observer (project director) entered and moved about the room.

During all sessions of Condition 6: One Assistant (Figure 3), head banging occurred at a mean of 2.47 rpm (range, 0.15 - 9.04), head-hitting occurred at a mean of 0.02 rpm (range, 0 - 0.1), and leg-hitting occurred at a mean of 0.04 rpm (range, 0 - 0.25). When sessions containing potential confounds were removed from the analysis (Figure 4), head banging occurred at a mean

of 2.04 rpm (range, 0.15 - 4.76), head-hitting occurred at a mean of 0.02 rpm (range, 0 - 0.1), and leg-hitting occurred at a mean of 0.04 rpm (range, 0 - 0.25).

During all sessions of Condition 7: On Toilet (Figure 3), head banging occurred at a mean of 2.34 rpm (range, 0.55 - 4.31), head-hitting occurred at a mean of 0.08 rpm (range, 0 - 0.3), and leg-hitting occurred at a mean of 0.37 rpm (range, 0 - 0.6). When sessions containing potential confounds were removed from the analysis (Figure 4), head banging occurred at a mean of 2.49 rpm (range, 0.55 - 4.31), head-hitting did not occur, and leg-hitting occurred at a mean of 0.25 rpm (range, 0 - 0.4).

During all sessions of Condition 8: Pants Down Elimination Training (Figure 3), head banging occurred at a mean of 0.94 rpm (range, 0 - 2.65), head-hitting occurred at a mean of 0.01 rpm (range, 0 - 0.06), and leg-hitting occurred at a mean of 0.06 rpm (range, 0 - 0.28). When sessions containing potential confounds were removed from the analysis (Figure 4), head banging occurred at a mean of 1.17 rpm (range, 0.54 - 2.65), head-hitting occurred at a mean of 0.01 rpm (range, 0 to 0.06), and leg-hitting occurred at a mean of 0.07 rpm (range, 0 - 0.28).

During Condition 9: Removal of Wall Mat, head banging occurred at a mean of 1.16 rpm (range, 2.38 - 0.32), no instances of head-hitting occurred, and leg-hitting occurred at a mean of 0.19 rpm (range, 0 - 0.37).

During Condition 10: Staff and Occupants in Home, head banging occurred at a mean of 0.79 rpm (range, 0.08 - 2.31), head-hitting occurred at a mean of 0.05 rpm (range, 0 - 0.17), and leg-hitting did not occur.

During all sessions of Condition 11: Staff Observing (Figure 3), head banging occurred at a mean of 1.79 rpm (range, 0.05 - 8.61), head-hitting occurred at a mean of 0.14 rpm (range, 0 - 1.23), and leg-hitting occurred at a mean of 0.2 rpm (range, 0 - 1.45). When sessions containing

potential confounds were removed from the analysis (Figure 4), head banging occurred at a mean of 0.93 rpm (range, 0.05 - 2.19), head-hitting occurred at a mean of 0.08 rpm (range, 0 - 0.47), and leg-hitting occurred at a mean of 0.12 rpm (range, 0 - 0.5).

During all sessions of Condition 12: Removal of High Preference Item (Figure 3), head banging occurred at a mean of 0.65 rpm (range, 0 - 1.96), head-hitting occurred at a mean of 0.01 rpm (range, 0 - 0.08), and leg-hitting occurred at a mean of 0.6 rpm (range, 0 - 0.4). When sessions containing potential confounds were removed from the analysis (Figure 4), head banging occurred at a mean of 0.4 rpm (range, 0 - 1.09), head-hitting did not occur, and leg-hitting occurred at a mean of 0.6 rpm (range, 0 - 0.4).

During Condition 13: Staff as Therapist, head banging occurred at a mean of 0.19 rpm (range, 0 - 0.25), and no instances of head-hitting or leg-hitting occurred.

Latency to First Elimination

Figure 9 displays data on the latency to the first elimination within session. Simone engaged in eliminations in all but two of the 54 sessions, or 96.3% of sessions. The average latency to first elimination was 4 minutes and 59 seconds. First eliminations occurred within 10 minutes of session for 90.38% of sessions in which eliminations occurred. However, for sessions 91 and 98 eliminations were detected by the permanent products (urine or feces in the toilet) rather than by direct observation; therefore, it was not possible to calculate the latency to elimination for these sessions.

Interruption Analysis

Results of the interruption analysis are presented by conditions in Figure 10, 11, 12, 13,

14, 15 and 61. Interruptions occurred in 19 of the 59 sessions. In Condition 7: On Toilet, only one session in five contained an interruption. The conditional probability of SIB given an interruption [p(T|I)] in this session was 1.00. Unconditional probability of SIB within that session [p(T)] being 0.43.

Interruptions occurred in one of the five sessions during Condition 8: Pants Down Elimination Training. The conditional probability of SIB given an interruption [p(T|I)] in this condition was lower (0.23). The unconditional probability of SIB during that session [p(T)] was 0.38.

Interruptions occurred in two of the five sessions in Condition 9: Removal of Wall Mat. The mean conditional probability of SIB given an interruption [p(T|I)] for sessions in which interruptions occurred was 0.59 (range, 0.50 to 0.68). The mean probability of SIB [p(T)] for sessions in which interruptions occurred was 0.44 (range, 0.43 to 0.45).

In Condition 10: Staff and Occupants in Home, interruptions occurred in one of the six sessions. The conditional probability of SIB given an interruption [p(T|I)] in this session was 0.5. The unconditional probability of SIB during that session [p(T)] was 0.34.

Interruptions occurred in seven of the 23 sessions in Condition 11: Staff observing. The mean conditional probability of SIB given an interruption [p(T|I)] for sessions in which interruptions occurred was 0.44 (range, 0.00 to 1.00). The mean probability of SIB [p(T)] for sessions in which interruptions occurred was 0.25 (range, 0.01 to 0.42). Condition 11 is the first condition in which a decreasing trend in the probability of SIB following an interruption was not observed. It should be noted that Simone was diagnosed with a urinary tract infection (UTI) in session 84.

Interruptions occurred in four of the eleven sessions in Condition 12: No Guacamole. The mean conditional probability of SIB given an interruption [p(T|I)] for sessions in which interruptions occurred was 0.17 (range, 0.00 to 0.50). The mean probability of SIB [p(T)] for sessions in which interruptions occurred was 0.09 (range, 0.04 to 0.14).

Interruptions occurred in three of the six sessions in Condition 13: Staff as Therapist. The mean conditional probability of SIB given an interruption [p(T|I)] for sessions in which interruptions occurred was 0.17 (range, 0.00 to 0.50). The average probability of SIB [p(T)] for sessions in which interruptions occurred was 0.06 (range, 0.00 to 0.16).

The results of the interruption analysis indicated that, initially, interruptions tended to be associated with increased probabilities of SIB (i.e., interruptions occasioned SIB), as indicated by greater conditional probabilities of SIB given interruptions than unconditional probabilities of SIB. In addition, both probabilities showed general decreases over the course of Simone's treatment. That is, the likelihood of SIB given an interruption decreased over the course of treatment, as did the overall probability of SIB.

CHAPTER 5

GENERAL DISCUSSION

The current study was designed to identify and create the conditions necessary for initiation and maintenance of appropriate toileting for a woman with profound DD and severe SIB. Conjugate reinforcement for appropriate toilet positioning and escape extinction were initially implemented to establish prerequisite skills for safe toileting. When sessions were moved to the commode chair, an adaptive step stool was included, and Simone's duration of appropriate toilet positioning increased to nearly 100% of session time. The step stool was not markedly higher or more accessible than the wheelchair footrest, but Simone had an extensive history of sitting cross-legged in her wheelchair. The novelty of conjugate reinforcement in the presence of the step stool may account for the improvement in toilet positioning.

When Simone was presented the opportunity to eliminate on the toilet, guacamole was used as a potentially reinforcing consequence to increase appropriate eliminations, as recommended in the RTT literature (Azrin & Foxx, 1971). Simone eliminated during 94.87% of sessions when guacamole was presented as a consequence, suggesting that it did, indeed function as reinforcement for elimination. However, during Condition 11: Staff Present, caregivers voiced concerns regarding the acceptability of the use of edible reinforcement for eliminations. To address caregiver concerns a component analysis was conducted to determine the necessity of continuing to deliver edible reinforcement. No adverse effects were observed when guacamole was not delivered after eliminations and Simone eliminated during 100% of sessions without guacamole; therefore, the change was made permanent. Unfortunately, the design of the study does not permit a definitive conclusion about the initial necessity of using a contrived reinforcement contingency to establish elimination, as guacamole was presented following the

first occurrence of elimination during Condition 8: Pants Down Elimination Training and elimination persisted after it was discontinued.

The final goal of this study was to train and prepare caregivers to routinely and correctly run Simone's program. In Condition 11: Caregiver Present and Condition 12: No Guacamole, each session was observed by a caregiver. Initially caregivers were required to observe three sessions prior to training; however, these requirements were decreased to one observation session due to high staff-turnover. In Condition 13: Caregivers as Therapist, caregivers' accuracy was 100% for performing the program fidelity steps. Moreover, caregivers reported feeling confident in their ability to complete Simone's toileting program.

An interesting finding was a brief and temporary increase in SIB after each condition change, which were typically followed by decreases in SIB within 2-8 sessions. This pattern was particularly prominent in early treatment conditions and provided rationale for moving gradually and progressively from a safe but contrived context to the natural environment (bathroom, on toilet). Simone's reaction to seemingly minor environmental changes and disruptions may also account for her caregivers' false positive identification of sensory and non-social stimulation as maintaining consequences of SIB. Simone's natural environment may have been too chaotic for caregivers to recognize and effectively manage relevant contingencies. This finding also provides some tentative support for the notion that Simone's SIB was maintained by escape from aversive procedures. Each time new "challenges" were presented (i.e., with each new condition and/or when disruptions occurred during sessions) Simone's SIB increased briefly before returning to previous levels. This outcome suggests that each new challenge functioned as an aversive event, evoking escape behavior. As the behavior met with extinction (i.e., toilet training continued despite SIB) evidence of extinction (decreases in SIB within and across sessions) was

observed. It must be noted that any account of the particular variables responsible for maintaining Simone's SIB are tentative, due to the absence of direct contingency manipulations.

Throughout treatment several potentially confounding variables were observed. Some, though not all of these variables appeared to result in increases in SIB. For example, during session 21, Simone's treatment was interrupted by the presence of a wheelchair mechanic who proceeded to repair her wheelchair intrusively throughout session. This interruption led to an increase in SIB that persisted into the next session and ultimately required increasing protective padding to ensure Simone's safety. Other common confounds that appeared to affect Simone's behavior included illnesses and unavoidable hiatuses between sessions.

Johnston and Pennypacker (1993, p. 307) deem data are "interpretively worthless" or suitable for discard when "…they were either collected in the presence of undesirable variables or that some aspect of their collection was unacceptable." In the current study, two graphic displays were generated from the data – one containing data from all sessions and one in which sessions containing likely confounds were eliminated from the display. This permitted analyses of the uncontaminated effects of the independent variables on Simone's behavior as well as a preliminary analysis of whether, and the extent to which, potential confounds actually affected Simone's SIB. Thus, inspection of Figure 3, which depicts data from all sessions, reveals variability that appears to be correlated with potential confounds (e.g., long breaks between toileting sessions and interruptions), providing useful information about the types of conditions and events that may impede treatment efforts and, thus, allowing experimenters to eliminate or otherwise address those influences. Figure 4, on the other hand, depicts data only from sessions in which potential confounds were not observed, providing an uncontaminated representation of the effects of the independent variables on Simone's patterns of responding.

In the current study, conditional probability analysis was used to evaluate the potential effects of one type of extraneous variable that seemed particularly likely to occasion SIB: interruptions during sessions. Conditional probability analysis has been used by behavior analysts to evaluate relations between precursors and problem behaviors, to assess caregiver training effectiveness, and to assist in the identification of impactful environmental arrangements (Hagopian, Paclawskyj & Kuhn, 2005; Felce, Bowley, Baxter, Jones, Lowe & Emerson, 2000; Pence, Roscoe, Bourret & Ahearn, 2009). In the current study the conditional probability of SIB given an interruption was compared to the unconditional probabilities of SIB and interruptions to assess the impact of unanticipated intrusions during sessions and to illuminate sources of variability between sessions. These analyses showed that interruptions and changes in environmental conditions did, indeed, increase the likelihood of SIB and provided information that informed the subsequent course of treatment. For example, based on conditional probabilities of SIB given (unplanned) interruptions during Conditions 7-9, conditions 10 (Staff and Occupants in Home), and 11 (Staff Observing) were purposefully arranged to increase interruptions. Exposing Simone to frequent interruptions that did not affect ongoing contingency arrangements appeared to decrease their disruptive influence over time, as demonstrated by decreases in conditional probabilities across conditions. The mechanisms underlying this generalized decrease in responsiveness to interruptions are not clear, and future research might further investigate the effects of treatment challenges such as interruptions, how and why those challenges impact treatment effects, and how they can best be managed or minimized.

One limitation for Study II is a lack of IOA due to the unexpected malfunction of data collection equipment partway through treatment. During Condition 3: Commode in Bedroom, the computer used for scoring interobserver agreement data failed. Based on concerns about the

deleterious effects of a break in treatment sessions for computer repairs it was determined to continue to conduct sessions with only one observer, and so it was not possible to collect IOA between sessions 9 and 51. That said, high IOA scores from other parts of the study provide some evidence of the general validity of the dependent measures.

Due to the intensity and frequency of Simone's head banging and head-hitting it was sometimes necessary to prioritize safety and reduce risk to Simone over experimental control. For example, no formal baseline probe was conducted to evaluate Simone's behavior in the terminal position (on toilet, pants down). Future studies might conduct terminal probes prior to initiating treatment and/or implement a multiple probe design to more convincingly demonstrate treatment effects and, potentially, expedite the course of treatment. For example, if terminal probes indicated that treatment could proceed more rapidly, it may be possible to "skip" unnecessary conditions.

Additionally, future research might investigate the efficacy of conjugate reinforcement compared to episodic reinforcement in toilet training procedures. Few studies have focused on the usefulness of conjugate reinforcement in applied settings (Reetz, 2012). The current study confirmed the usefulness of conjugate reinforcement procedures for shaping and increasing durations of appropriate positioning; however, the effectiveness of conjugate reinforcement relative to that of episodic reinforcement is largely unknown.

Limited staff time and engagement in large institutions are common barriers to maintaining independent continence (Smith & Smith, 1977; Mansell et al., 2008; Sadler & Merkert, 1977). Following Simone's participation in this study, several steps were taken to promote program maintenance and increase social validity, data-based alterations were made to Simone's toileting program. A scheduling method was incorporated, in which caregivers

transported Simone to the bathroom based on data showing times when she was most likely to eliminate. Reinforcement procedures were changed for caregiver ease and acceptance, termination times were shortened to lessen work strain, and assistance and training from the experimenter were provided until 100% program fidelity was demonstrated by caregivers.

The purpose of the current study was to develop, implement, and evaluate a behavioral intervention package to reduce severe SIB that had prevented previous toileting efforts, promote appropriate toilet positioning, and set the occasion for appropriate elimination on the toilet. Although toilet-training procedures have been shown to be effective to establish appropriate toileting with younger participants and participants with less severe impairments and behavioral challenges, few studies have demonstrated success with more developmentally and behaviorally challenged adults. In the current study, an adult female with profound intellectual disability and severe problem behavior, and who had not demonstrated independent toileting for at least 3 years, learned to position herself appropriately on the toilet, eliminate on the toilet, and maintain low-to-zero levels of SIB during the toileting process. Efforts were made to promote maintenance and caregiver compliance with the program; however, long-term program maintenance was not assessed in the current study. Future research would do well to investigate the conditions under which long-term program implementation and effectiveness are most likely to be observed.

Table 1

Anecdotal Results for Self-Hitting

QABF					
Rater 1	Non-Social (13)	Physical (1)	Attention/Tangible/Escape (0)	n/a	n/a
Rater 2	Tangible (6)	Attention/Non-Social (5)	Escape (2)	Physical (0)	n/a
Rater 3	Escape (3)	Attention/Tangible/Non-Social/ Physical (0)	n/a	n/a	n/a
Rater 4	Non-Social (8)	Attention/Tangible/Escape/Physical (0)	n/a	n/a	n/a
Rater 5	Non-Social (7)	Attention (4)	Escape (2)	Tangible/Physical (0)	n/a
MAS					
Rater 1	Non-Social (22)	Attention (2)	Tangible/Escape (0)	n/a	
Rater 2	Tangible (15)	Non-Social (12)	Escape (9)	Attention (8)	
Rater 3	Non-Social/Escape (4)	Attention/Tangible (0)	n/a	n/a	
Rater 4	Non-Social (10)	Attention/Tangible (2)	Escape (0)	n/a	
Rater 5	Non-Social (13)	Attention (5)	Tangible (3)	Escape (2)	

Table 2

Anecdotal Results for Head Banging

QABF					
Rater 1	Non-Social (13)	Escape (11)	Physical (3)	Attention (2)	Tangible (0)
Rater 2	Non-Social (9)	Escape (6)	Tangible (4)	Physical (2)	Attention (1)
Rater 3	Non-Social (4)	Attention/Tangible/Escape/ Physical (0)	n/a	n/a	n/a
Rater 4	Non-Social (11)	Attention/Tangible/Escape/Physical (0)	n/a	n/a	n/a
Rater 5	Escape (4)	Attention (1)	Tangible/Non-Social/Physical (0)	n/a	n/a
MAS					
Rater 1	Non-Social (24)	Escape (8)	Attention/Tangible (0)	n/a	
Rater 2	Non-Social/Escape (9)	Tangible (6)	Attention (0)	n/a	
Rater 3	Non-Social (7)	Attention/Tangible/Escape (0)	n/a	n/a	
Rater 4	Non-Social (16)	Attention (4)	Escape (3)	Tangible (0)	
Rater 5	Escape (7)	Non-Social (5)	Attention/Tangible (4)	n/a	

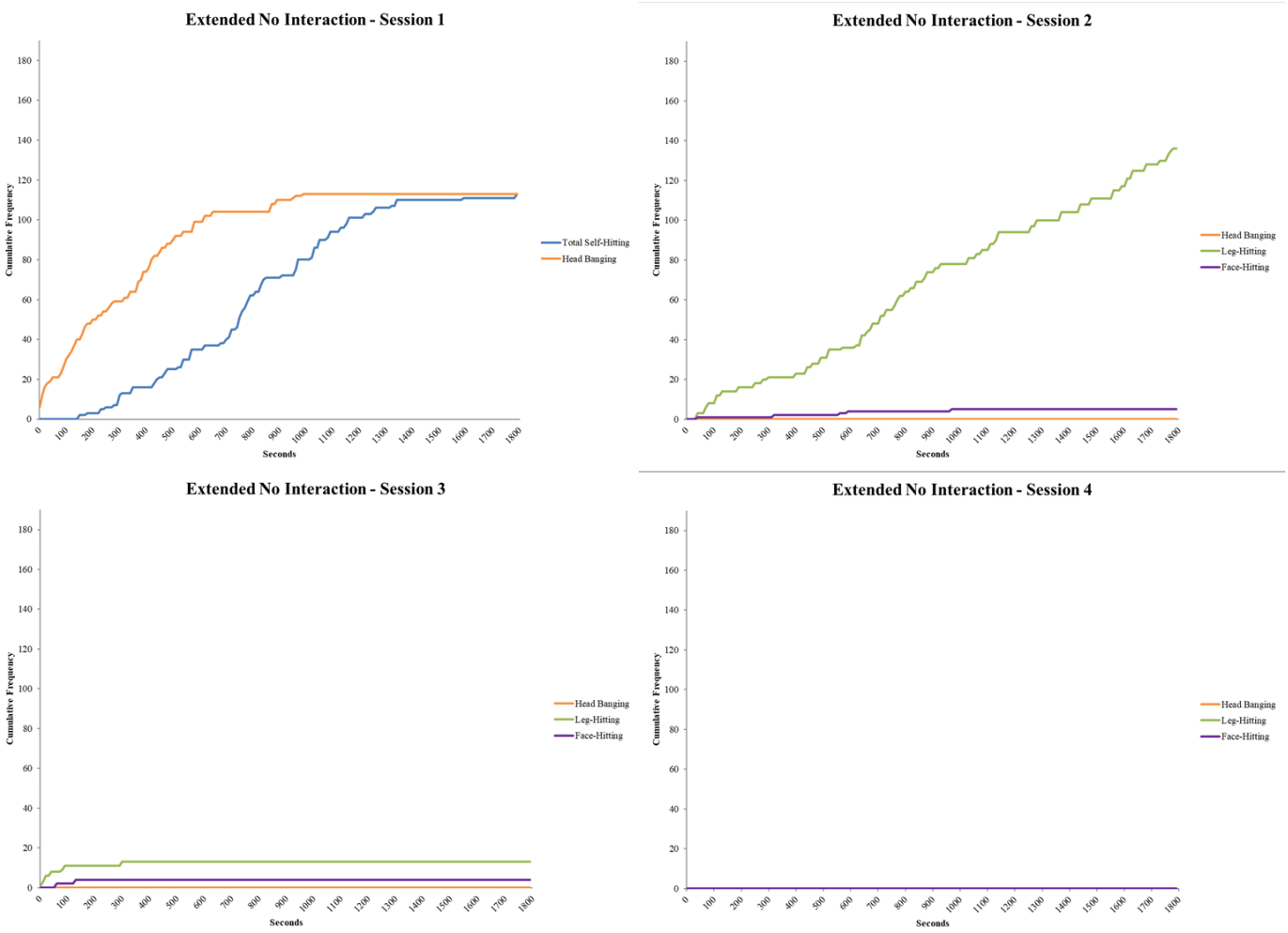

Figure 1. Cumulative record of head banging, head-hitting, and leg-hitting in sessions 1-4 of Extended No Interaction Analysis.

Table 3

Conditional Probability Formulas

Probability Type		Formula
Conditional probability of the target (T) given an interruption (I)	$p(T\|I)$	Trials with I that also contain T/ Trials with I
Unconditional probability of the target	$p(T)$	Trials containing T/ Total Trials
Unconditional probability of an interruption	$p(I)$	Trials containing I/ Total Trials

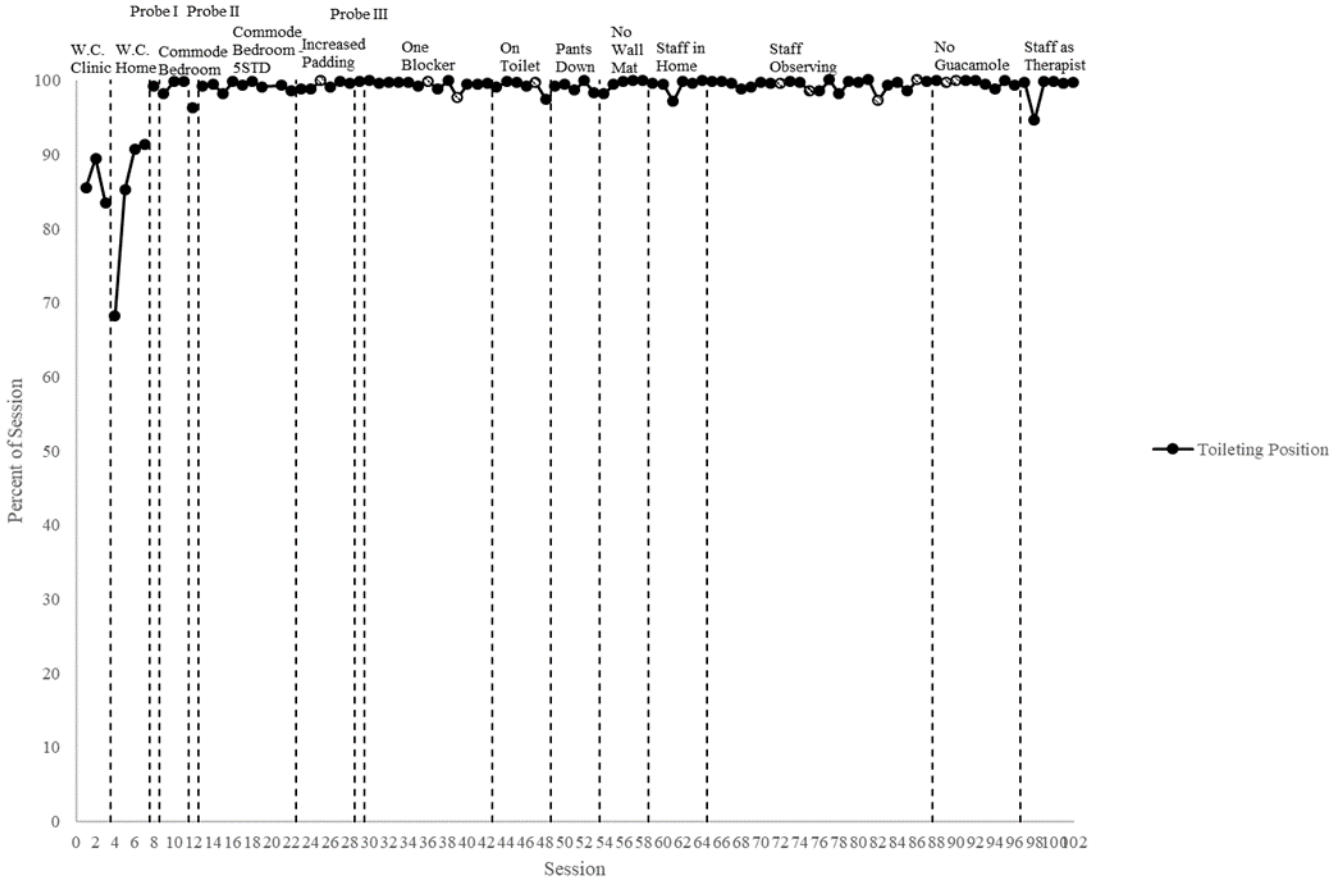

Figure 2. Results for appropriate toilet positioning in Study II. The lined data points indicate sessions that occurred following a hiatus of 6 or more days.

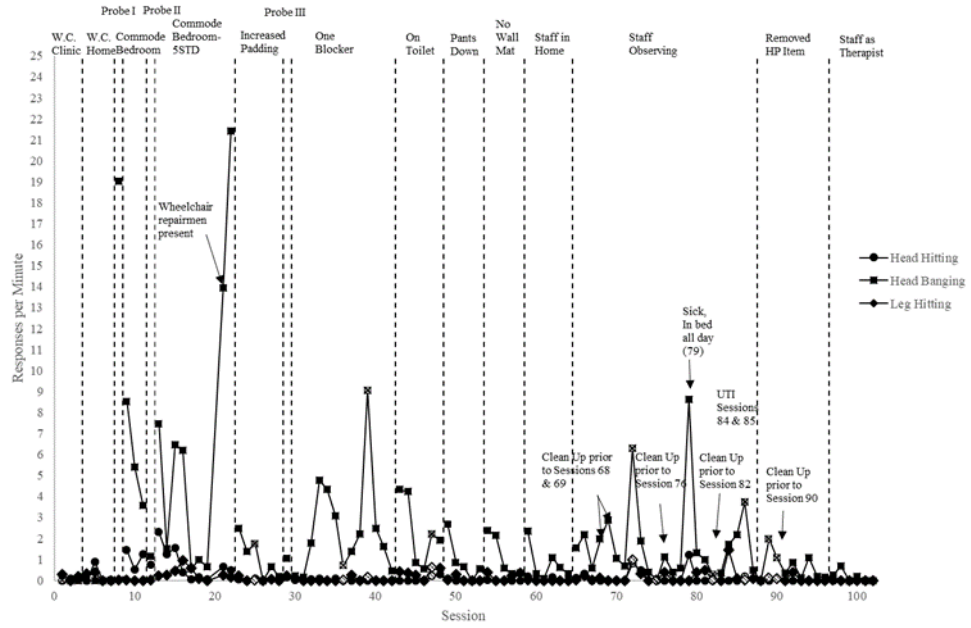

Figure 3. All results for head-hitting, head banging, and leg-hitting in Study II.

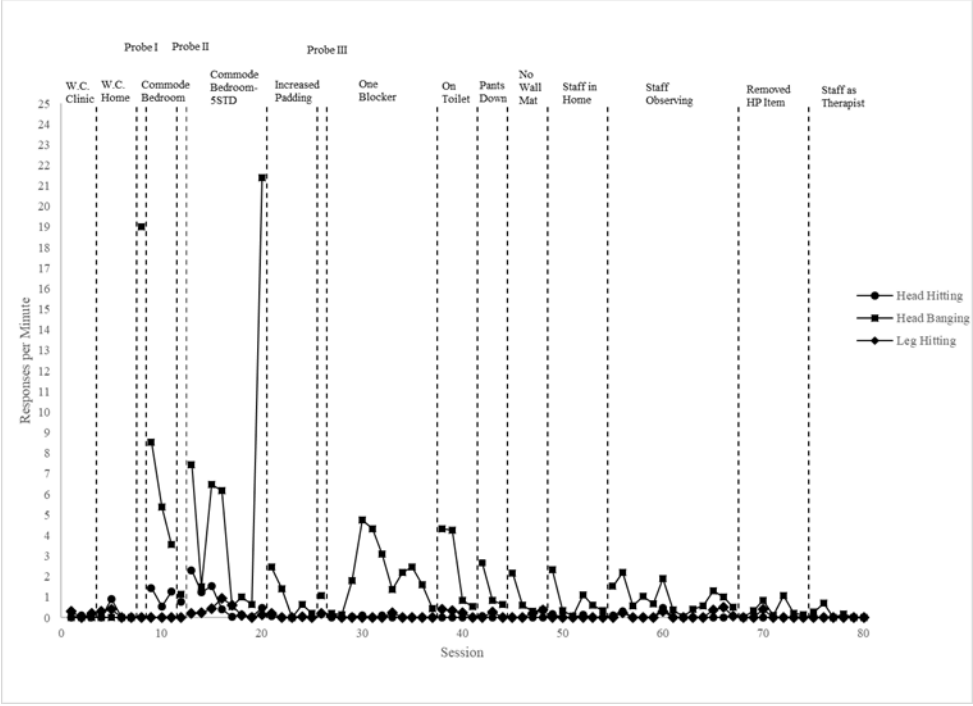

Figure 4. Results for head-hitting, head banging, and leg-hitting in Study II. All sessions with confounds have been removed.

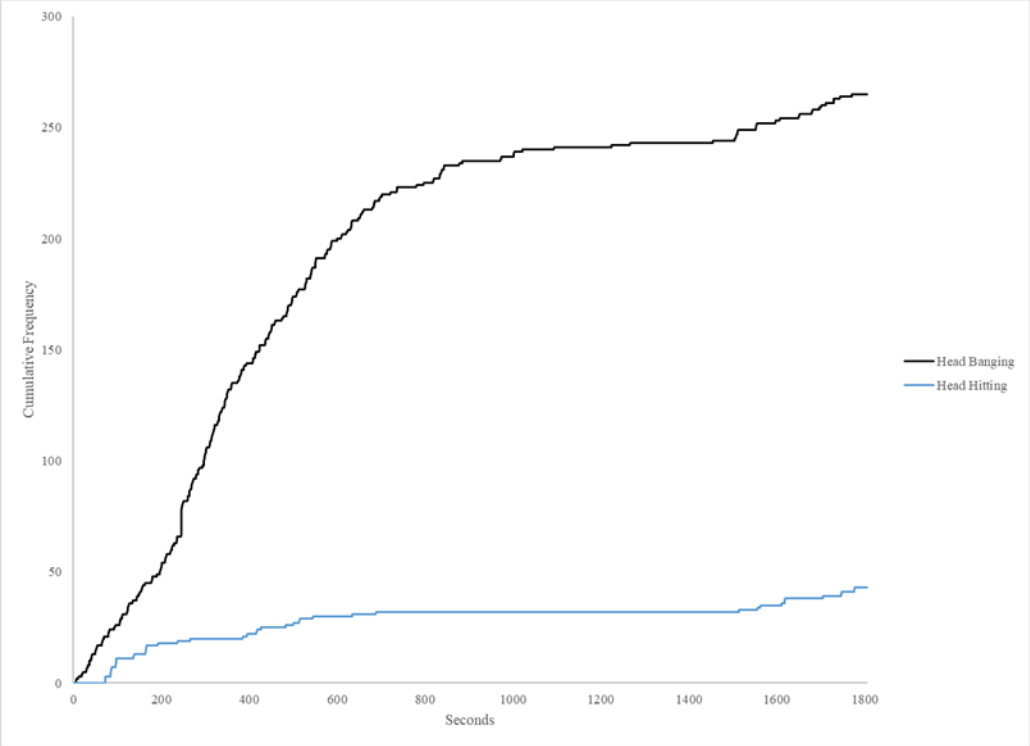

Figure 5. Cumulative record of head banging and head-hitting in Study II, session 9.

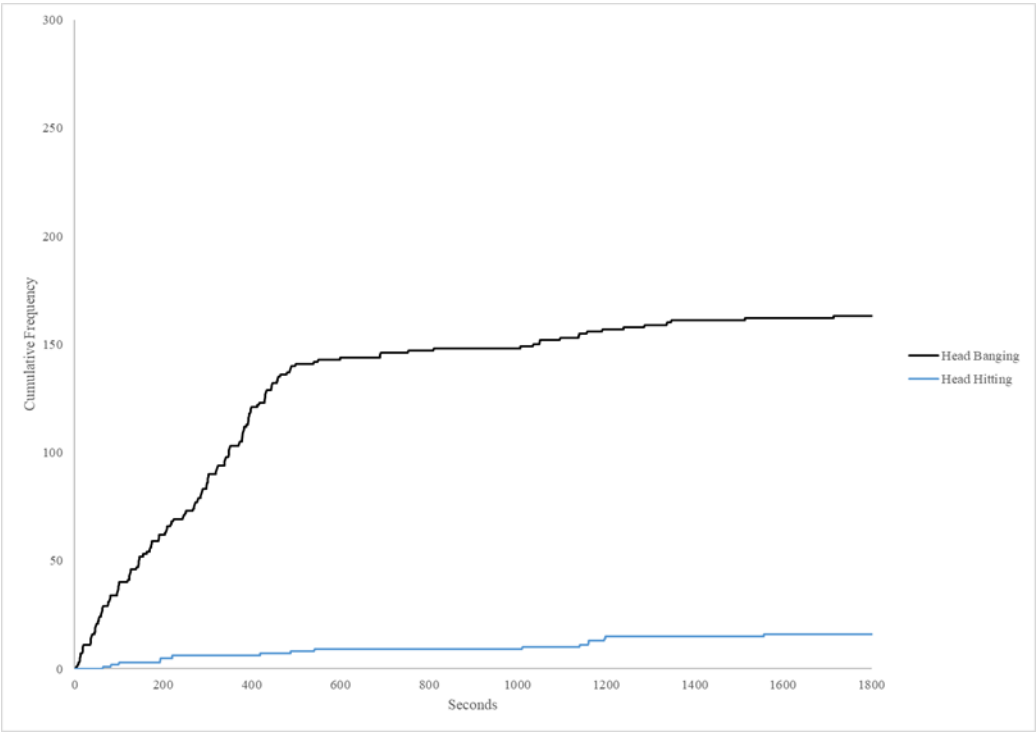

Figure 6. Cumulative record of head banging and head-hitting in Study II, session 10.

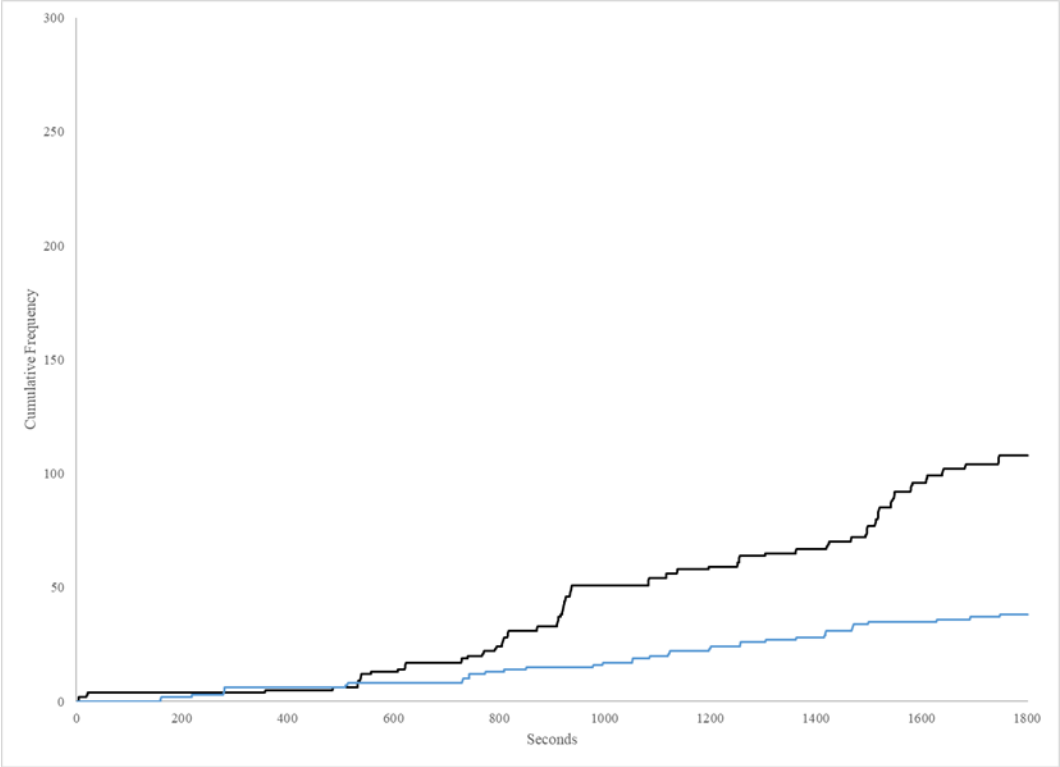

Figure 7. Cumulative record of head banging and head-hitting in Study II, session 11.

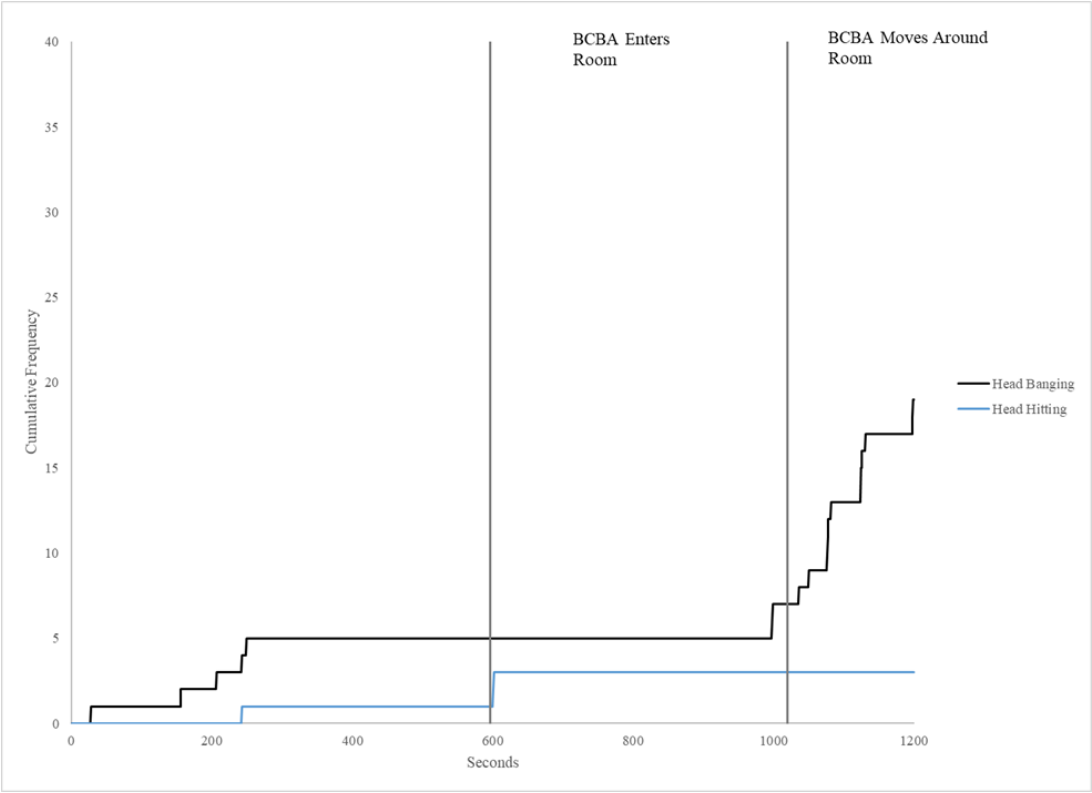

Figure 8. Cumulative record of head banging and head-hitting in Probe III.

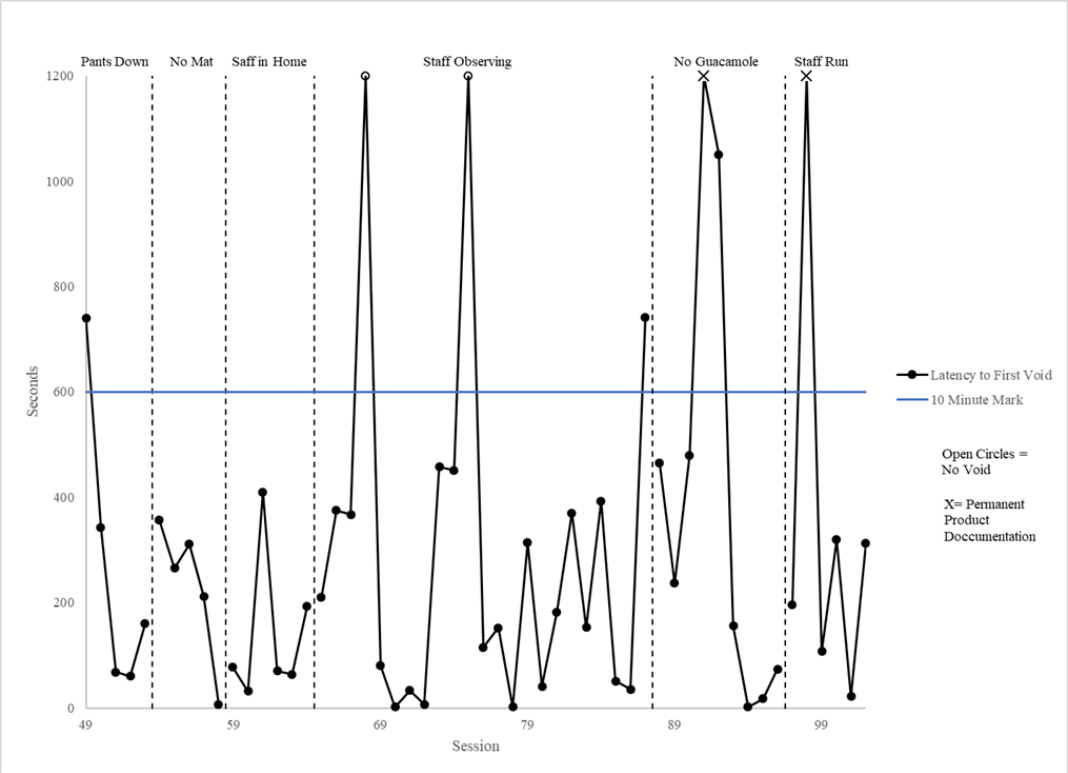

Figure 9. Results of latency to first elimination in Study II.

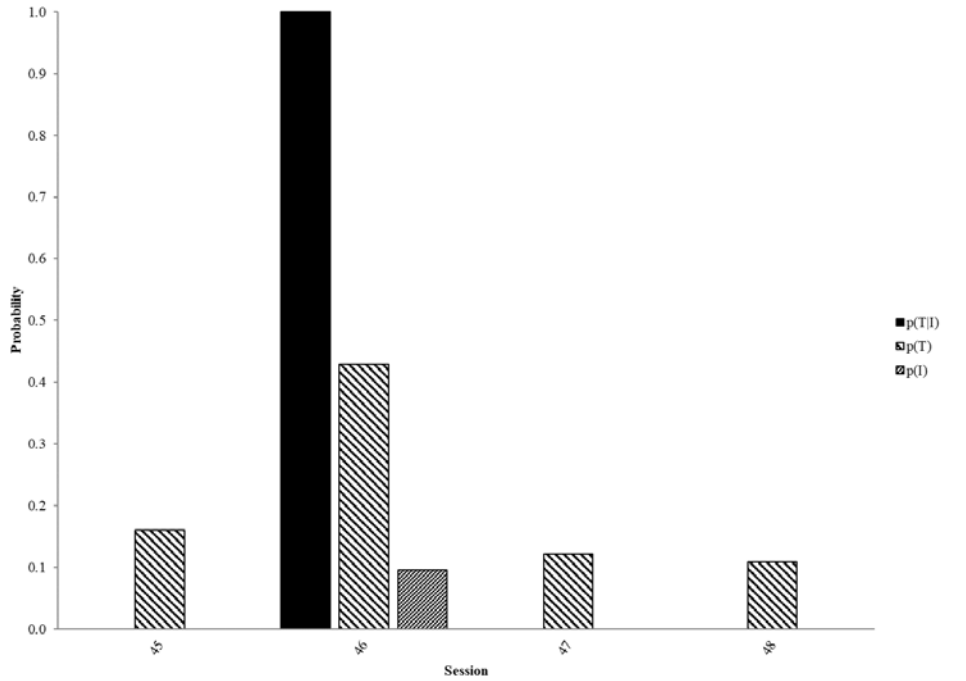

Figure 10. Conditional probabilities for SIB in Condition Seven: On Toilet.

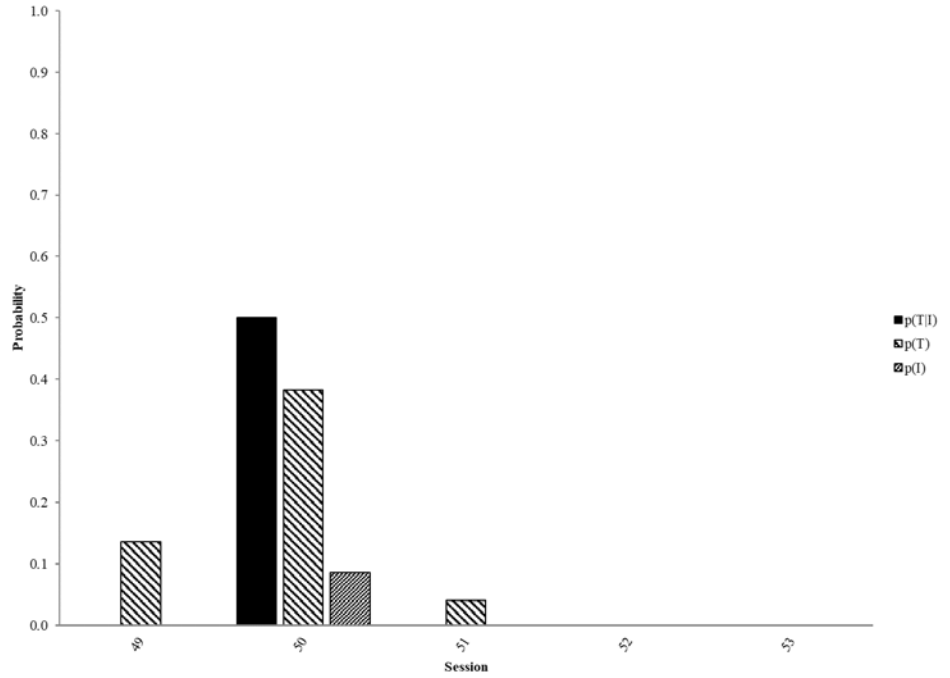

Figure 11. Conditional probabilities for SIB in Condition Seven: On Toilet.

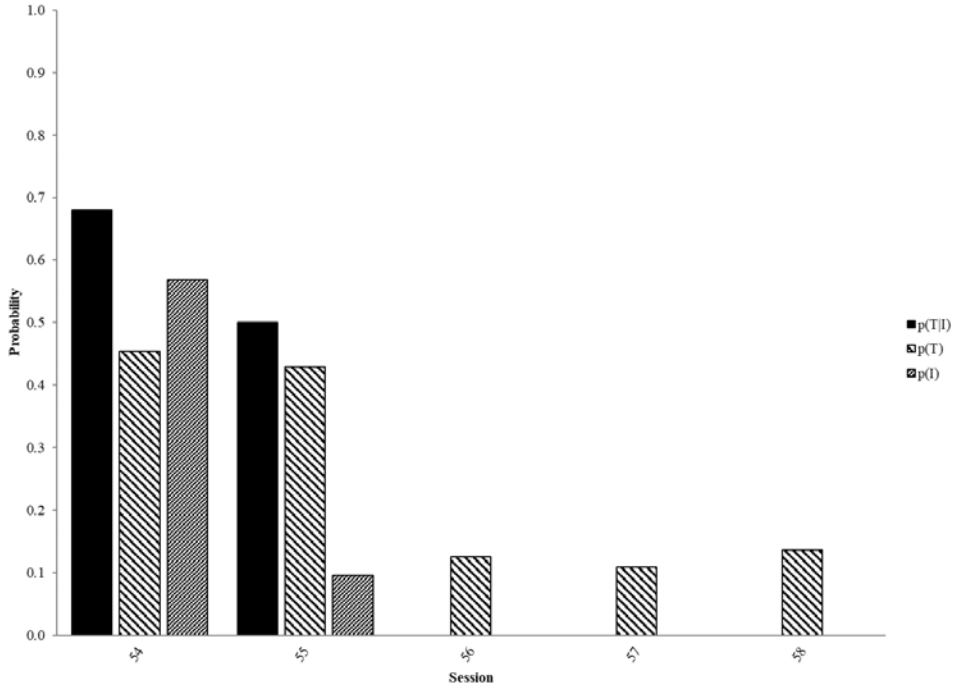

Figure 12. Conditional probabilities for SIB in Condition Nine: Removal of Wall Mat.

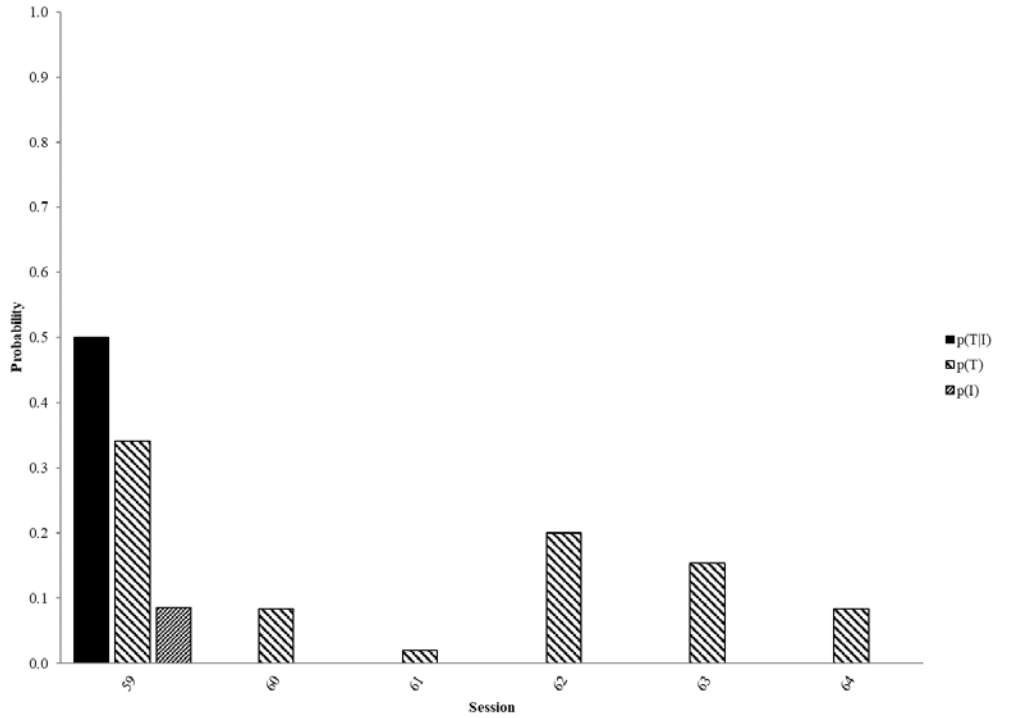

Figure 13. Conditional probabilities for SIB in Condition Ten: Staff and Occupants in Home.

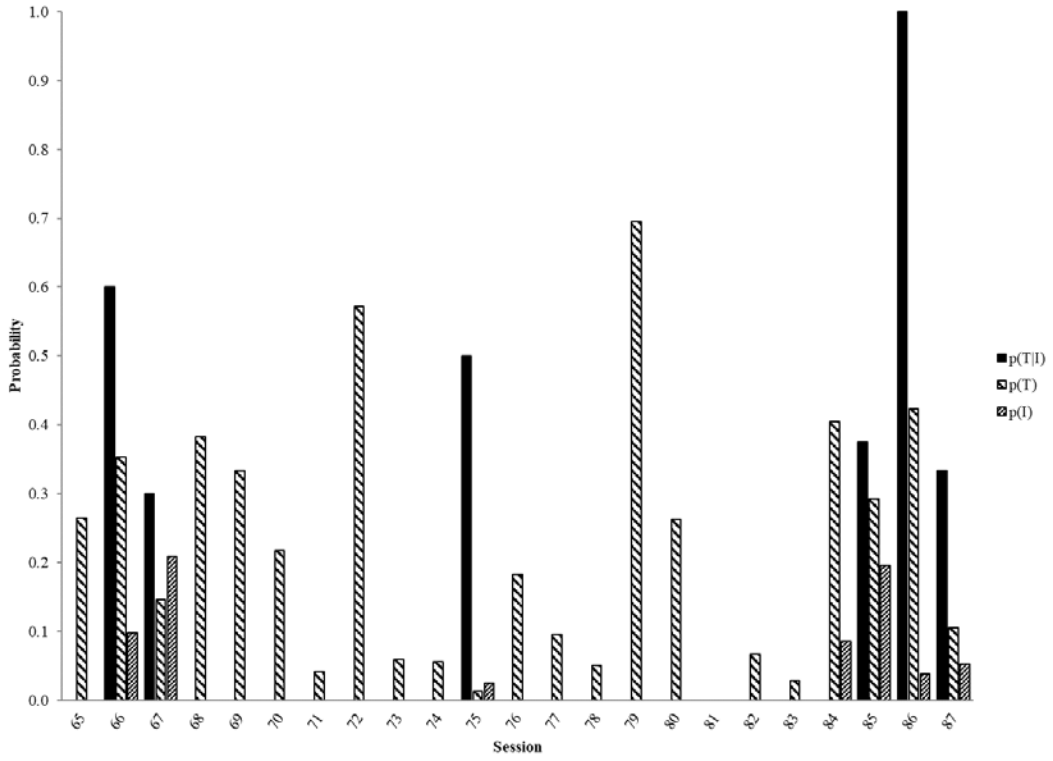

Figure 14. Conditional probabilities for SIB in Condition Eleven: Staff Observing.

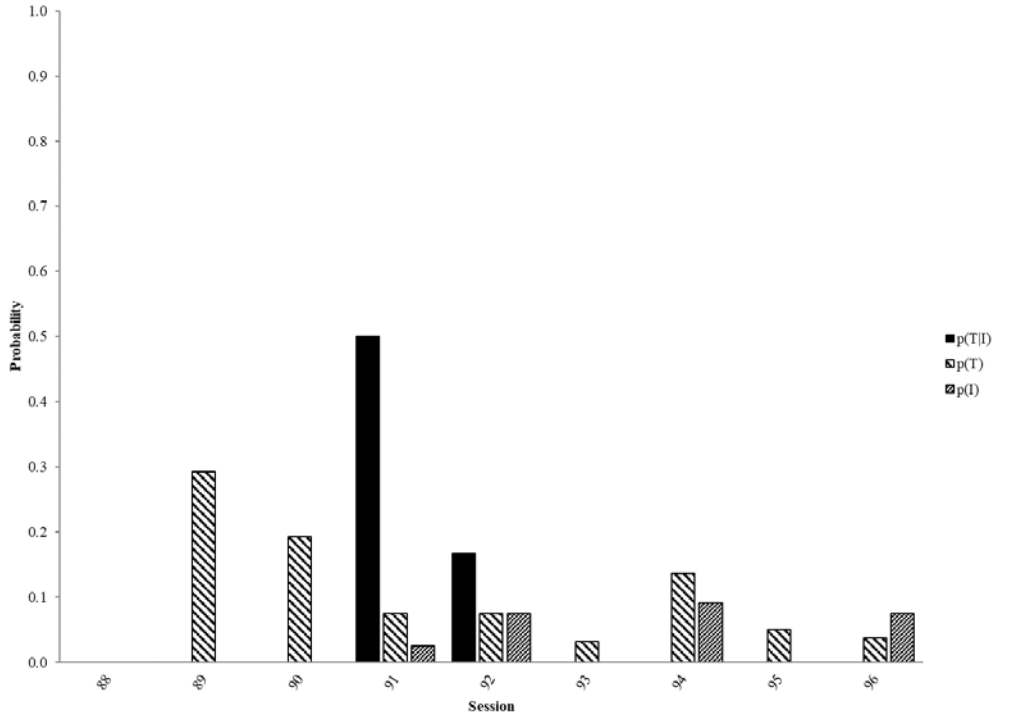

Figure 15. Conditional probabilities for SIB in Condition Twelve: No Guacamole.

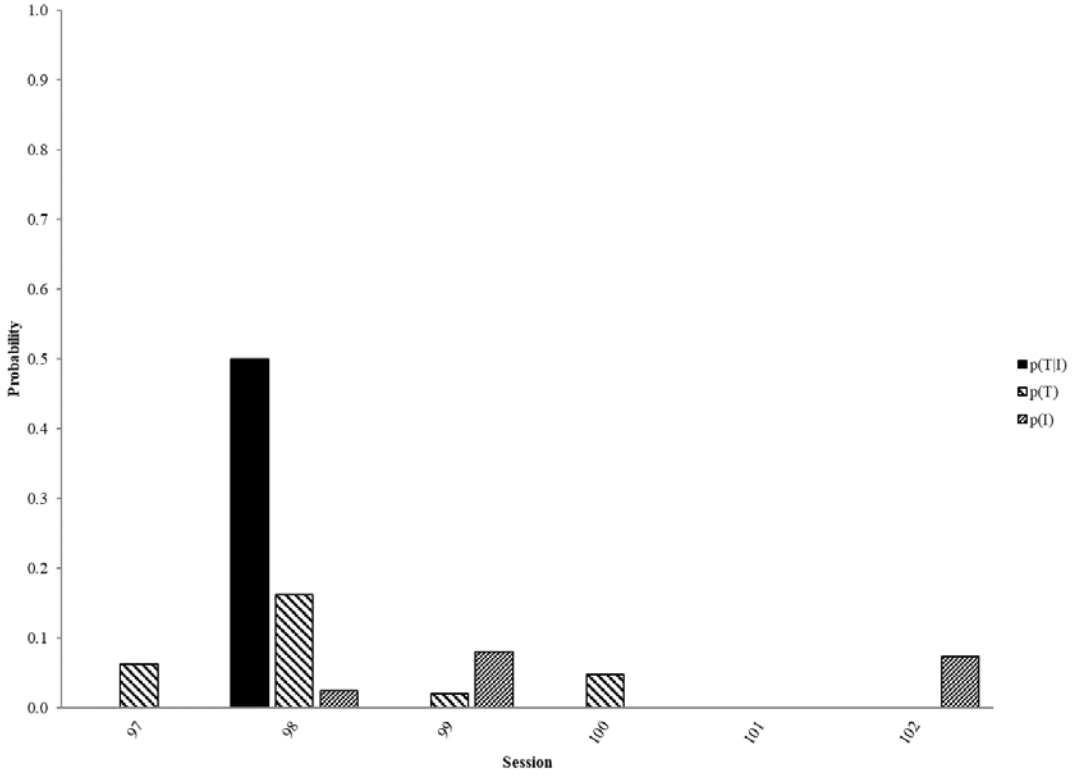

Figure 16. Conditional probabilities for SIB in Condition Thirteen: Staff as Therapist.

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