Differential Negative Reinforcement of Other Behavior to Increase Compliance with Wearing an Anti-Strip Suit

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Abstract

Using a changing-criterion design, we replicated and extended a study (Cook, Rapp, & Schulze, 2015) on differential negative reinforcement of other behavior (DNRO). More specifically, educational assistants implemented DNRO to teach a 12-year-old boy with autism spectrum disorder to comply with wearing an anti-strip suit to prevent inappropriate fecal behavior in a school setting. The duration for which the participant wore the suit systematically increased from 2 s at the start of treatment to the entire duration of the school day at the termination of the study. Moreover, these effects were generalized to a new school with novel staff and persisted for more than a year. These findings replicate prior research on DNRO and further support the use of the intervention to increase compliance with wearing protective items, or medical devices, in practical settings.

Keywords: autism, compliance, differential reinforcement of other behavior, rectal digging, school

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Individuals with autism spectrum disorder (ASD) often demonstrate a variety of disruptive behaviors, which pose an increased risk to their physical health, and social and emotional well-being (Hong, Dixon, Stevens, Burns, & Linstead, 2018; Horner, Carr, Strain, Todd, & Reed, 2002). A wide body of research exists on the treatment of many of these disruptive behaviors using differential reinforcement of other behavior (DRO) procedures (e.g., Jessel & Ingvarsson, 2016; Weston, Hodges, & Davis, 2017). A DRO intervention is a treatment procedure in which reinforcement is delivered contingent on the absence of a target behavior. During DRO, the reinforcer can either be arbitrary or match the function of the disruptive behavior. If a child's physical aggression is maintained by escaping/avoiding instructional tasks, a function-based DRO procedure (i.e., with a reinforcer matched to the function) would involve providing breaks from work following a period of time without aggression. In contrast with the use of an arbitrary reinforcer, function-based DRO has the advantage of not requiring a preference assessment as the reinforcer has already been shown to be potent enough to maintain a disruptive behavior.

When targeting behavior maintained by negative reinforcement, the function-based variation of DRO is termed differential negative reinforcement of other behavior (DNRO; Kodak, Miltenberger, & Romaniuk, 2003). For example, Kodak et al. (2003) demonstrated increased compliance with instructional tasks and decreased disruptive behavior for two individuals with ASD by using DNRO and noncontingent escape. Buckley and Newchok (2006) also used DNRO to decrease disruptive behavior evoked by music in a young child with pervasive developmental disorder. More recently, Cook, Rapp, and Schulze (2015) successfully

replicated the aforementioned studies by using DNRO to increase the duration a child with ASD tolerated wearing a medical alert bracelet. Their study extended the literature by demonstrating that DNRO procedures can lead to continuous wearing of a formerly aversive stimulus.

The purpose of the current study was to replicate and extend Cook et al. (2015) using DNRO procedures in a school setting with an anti-strip suit. Specifically, the behavior analyst at the school worked with a child who had to wear an anti-strip suit to prevent inappropriate fecal behavior (e.g., fecal smearing, rectal digging). Given that the child engaged in severe disruptive behavior whenever the staff attempted to have him wear the suit, the school team used DNRO as an intervention to increase compliance.

Method

Participant, Materials, and Setting

Jacob was a 12-year-old boy diagnosed with ASD, developmental delay, and developmental coordination disorder. During the study, Jacob attended school full-time in a self-contained classroom with one-to-one support from two educational assistants (EAs). Jacob demonstrated a strong communicative repertoire, consisting of mands for items, actions, activities and information, and various intraverbal responses throughout the day. He engaged in many daily living and self-help skills independently (e.g., cooking, hygiene tasks, and cleaning), although toileting required prompting due to inappropriate fecal behavior.

Jacob's mother and school staff expressed concerns with his history of inappropriate fecal behavior. Prior to his participation in the study, he was assessed by a pediatrician who ruled out known medical causes for inappropriate fecal behavior. To prevent inappropriate fecal behavior during school hours, an anti-strip suit was acquired by the school board. The anti-strip suit was a sleeveless, short bodysuit intended to be worn under other garments. It was made of titanium to

withstand tearing and other destructive behaviors. The back of the suit had a long zipper that was secured with a buckle, which prevented Jacob from independently removing it.

The EAs conducted the trials in a self-contained classroom (approximately 4.7 m by 7.0 m) within an elementary school. The classroom contained two work stations, including two desks, chairs, a whiteboard, a large window, some academic materials, and a safety room (approximately 2.4 m by 2.1 m). The EAs conducted trials in other areas of the school (e.g., washroom, hallways, outdoors for recess) as the duration for which Jacob wore the anti-strip suit increased. Ensuing generalization probes took place in a different self-contained classroom after Jacob had transitioned to high school.

Data Collection and Interobserver Agreement

To monitor compliance with wearing the anti-strip suit, the school team (i.e., school EAs, itinerant EA, and Special Education Resource Teacher) used the same methods employed by Cook et al. (2015). The EAs scored a trial as compliant when Jacob did not display suit-related disruptive and inappropriate fecal behavior for the entire duration of the trial. Contrarily, a trial was scored as noncompliant when Jacob displayed suit-related disruptive behavior or inappropriate fecal behavior at any time during the trial. Suit-related disruptive behavior involved a behavior chain that always began with requests to remove the suit (e.g., “Take this [expletive] off me, I’m going to rip it off!”, “[Expletive] off, no!”) or destructive behavior directed towards the suit (i.e., grasping and pulling at the suit, zipper, or buckle), which were typically followed by aggression and flopping. Given that flopping and aggression had to be part of the chain to be scored, data collection focused on requests to remove the suit and destructive behavior. Inappropriate fecal behavior involved defecating in areas other than the toilet, attempting to or successfully using fingers to obtain feces from the rectum, wiping feces on any

surface, ingesting feces, or any combination thereof. The EAs also collected data on the latency from the instruction to don the suit until noncompliance (for noncompliant trials only) as well as on the presence or absence of any suit-related disruptive behavior and inappropriate fecal behavior during each trial (as in partial interval recording).

A second observer measured interobserver agreement (IOA) for 21% of the total number of trials. For compliance (or noncompliance) with wearing the strip suit, the data collectors scored a trial as an agreement when the second observer recorded the same behavior (i.e., compliant or noncompliant) within ± 2 s of the latency measured by the EAs. The 2-s criterion only applied to noncompliant trials. The trial was scored as a disagreement if one observer scored a trial as compliant and the other the same trial as noncompliant, or both observers scored a trial as noncompliant but the latency to noncompliance differed by more than 2 s . For suit-related disruptive and inappropriate feacbal behaviors, the data collectors recorded an agreement if both observers recorded the behavior as present (or absent) during a trial. If one observer scored the behavior as present and the other as absent, a disagreement was recorded for the trial. To calculate IOA, the data collectors divided the number of agreements by the sum of agreements and disagreements, and multiplied the result by 100%. The IOA scores were 80% for the compliance measure, and 94% for suit-related disruptive and inappropriate fecal behaviors.

Treatment Integrity

Staff training. Although the EAs held a Community College Educational Assistant Certificate and had training on crisis intervention, EA staff did not have any specialized training in Applied Behavior Analysis (ABA). Behavior analysts had provided yearly training on general ABA strategies on a small number of professional development days. Any specific training in ABA was based on the programs utilized with each student. In this case, the EAs implementing

the intervention with Jacob were trained to implement the procedures using behavioral skills training (BST) and an integrity checklist.

Similar to the training conducted by Cook et al. (2015), the first and second authors provided training to the EAs using BST, which included a 9-item integrity checklist (available from the corresponding author upon request). One of the trainers observed each EA administering the DNRO procedure and scored their competency using the 9-item integrity checklist. To calculate integrity, the total number of checklist items performed correctly was divided by the total number of checklist items, and the result was converted to a percentage. After receiving training and prior to running trials in the absence of the trainers, the five EAs assigned to Jacob demonstrated competency (80% or greater) with the procedures. The EAs demonstrated competency with the procedures after a mean of 2.4 training sessions (range 1-5 sessions). Competency with the DNRO procedure continued to be evaluated using the integrity checklist at random intervals during the study. Integrity data were collected for 16% of the total number of trials and averaged 90% (range, 67% to 100%).

Experimental Design and Procedures

The school team used a changing-criterion design to examine the effects of a DNRO procedure on the duration that Jacob wore the anti-strip suit. They based the initial DNRO criterion on the latency to noncompliance in baseline, and subsequently increased the duration the suit stayed on the body incrementally. When Jacob met a criterion for five consecutive trials, an EA implemented the next DNRO subphase as laid out in Cook et al. (2015), but due to integrity errors by the staff, the criteria was not always respected. Once Jacob met the criteria of placing both of his feet in the suit, the EA probed the following four subphases until he donned the suit zipped and fastened.

Jacob participated in trials in the school setting each day from arrival (8:20 a.m.) to dismissal (3:10 p.m.) for 14 months. A trial always began with the EA presenting an instruction to don the suit and ended when the time interval elapsed (see description of conditions for trial durations) or when the child displayed suit-related disruptive behavior or inappropriate fecal behavior, whichever came first. Prior to the start of each school day, the EA read the written procedures, which included the predetermined criterion and the corresponding data sheet. Jacob received praise from the EAs for participation in tasks throughout the course of the day as DNRO trials were conducted across all regular school activities. When the suit was removed during bathroom use, the EAs blocked all attempts at inappropriate fecal behavior. These attempts led to the trial being scored as noncompliant (as per our definition of inappropriate fecal behavior) and to another trial commencing immediately.

In the early stages of DNRO, when Jacob was not required to don the suit entirely, EAs typically conducted 1 to 13 trials per day. As trial length increased and Jacob was required to don the suit for trial lengths ranging from 2.0 hr to 6.5 hr, the number of trials per school day decreased gradually from three to one. If the remaining school day duration was less than the allotted duration in a subphase (e.g., 1 hr remaining in the day and the target subphase was 2 hr), the EAs informed Jacob that the suit would only come off at the end of the day. These trials were not included in the data. Generalization probes were conducted every month for 4 months on the first school day of the month until the end of the school year, again 12 months later from the last monthly probe, and the transition to high school after the summer break (18 months in total from the last treatment session).

Baseline. Immediately after Jacob entered the classroom, the EA presented the suit and stated, “It’s time to wear your suit now.” The baseline condition mirrored the escape condition

used in Cook et al. (2015). The EA removed the suit for 30 s contingent on suit-related disruptive behavior or inappropriate fecal behavior. After the escape duration elapsed, the EA re-presented the instruction and another trial commenced until 10 trials were conducted. Jacob exhibited suit-related disruptive behavior immediately after the suit was presented on all trials.

Differential negative reinforcement of other behavior. The DNRO procedure involved providing escape contingent on zero levels of disruptive behavior throughout the DNRO interval (Vollmer & Iwata, 1992) to increase wearing the anti-strip suit during the school day, which was similar to the procedures adopted by Cook et al. (2015). The EA presented the suit at the beginning of each trial while providing the instruction. Subsequently, the EA followed the specified criterion (e.g., touch suit, foot in suit, full suit on) and set a timer for the predetermined interval (see below for specific criteria). The response effort required to don the suit entirely was considerably higher than the response effort to wear the bracelet used in Cook et al. (2015). Thus, the school team added several intermediate steps with the suit (e.g., touching the suit, putting only one leg in) before the duration criterion was increased.

For each trial, the EAs started the timer when they delivered the instruction and stopped it following Jacob's engagement in disruptive behavior or the successful completion of the DNRO interval. A new trial commenced immediately after the prescribed escape interval lapsed. If Jacob refrained from engaging in disruptive behavior, the EA provided brief praise, simultaneously removed the suit for the indicated escape duration, and scored the trial as correct (i.e., compliant). If Jacob demonstrated disruptive behavior, the EA blocked Jacob's attempts to remove the suit and described criteria required for suit removal (e.g., "let's try to wait again without ripping the suit"), reset the timer, and scored that trial as incorrect (i.e., noncompliant). For compliant trials, the escape period was (a) 30 s during baseline through the 5-min subphase,

(b) 1 min during the 7-min to 30-min subphases, (c) 5 min during the 45-min and 60-min subphases, (d) 15 min during the 2-hr to 5-hr subphases, and (e) removal at the end of the school day (6.5-hr subphase).

Results

Figure 1 illustrates the duration Jacob was compliant through the baseline and DNRO phases. During baseline (upper panel), Jacob never complied with the instruction to don the suit. Then, the EAs introduced the DNRO procedure that started with a 2-s touch and was gradually increased to touching the suit for 5 s, which required 28 trials of training. Then, Jacob was expected to don the suit, starting with putting one foot in and increasing the expectation until he donned the suit entirely, which required an additional 35 trials. Following a total of 165 trials of training, the participant started to don the suit under his clothes at the 25-min subphase (middle panel). This change allowed for fewer situations of dressing and undressing during the school day. However, the EAs made occasional errors in adherence to the mastery criterion (i.e., 2-min and 10-min subphases). The criterion to wear the suit for the entire school day was reached after 42 school days (i.e., 255 trials of training). Subsequently, the EAs conducted monthly, yearly, and generalization probes to ensure Jacob continued to wear the suit while at school. After Jacob transitioned to a high school setting, the duration of compliance required with the suit decreased due to shorter school days (5.67 hr).

Figure 2 depicts the cumulative trials with suit-related disruptive behavior and inappropriate fecal behavior. During baseline, inappropriate fecal behavior was not observed, while suit-related disruptive behavior occurred across each of the 10 trials. From the implementation of the initial DNRO criterion until Jacob was required to don the entire suit (trials 11 to 73), inappropriate fecal behavior remained at 0 whereas suit-related disruptive

behavior occurred across 11 trials. As the duration that Jacob wore the suit increased from 20 s to the full school day, cumulative trials with inappropriate fecal behavior increased to 10 and suit-related disruptive behavior to 67. The EAs observed no occurrrences of either behavior during the generalization probes.

Discussion

The results of the current study contribute to the literature on DNRO by replicating and extending Cook et al. (2015) from a clinical to an educational setting. The DNRO was effective in increasing tolerance with wearing an anti-strip suit for extended periods of time. The EAs implemented the DNRO procedure at criterion procedural integrity level. These results show that educational support staff, with limited knowledge of ABA, can effectively increase compliance in a highly variable classroom environment. Jacob complied with wearing the anti-strip suit in the school setting, further supporting that differential reinforcement procedures do not warrant a student being removed from their educational placement to be effective (Vollmer & Iwata, 1992).

Nevertheless, our replication study has limitations that should be noted. Due to the nature of the school environment, consistent access to trained staff was variable. This limitation produced delays in staff training to deliver the DNRO intervention, occasional errors in adherence to mastery criteria, and may have resulted in some delays to the achievement of the terminal goal. These issues may explain some of the lower levels of compliance observed during the 3-hr and 4-hr subphases. Alternatively, the 3-hr and 4-hr subphases immediately followed an extended period of absence (i.e., vacations), which may also explain this pattern. Second, the authors did not probe the terminal DNRO interval during the treatment phase of the intervention. Therefore, the terminal interval may have been achieved sooner than reported. Third, as this

study was based on Cook et al. (2015), the authors replicated their experimental design and did not conduct a reversal to previous conditions which would have strengthened experimental control. Although the design is referred to as a changing criterion to remain consistent with Cook et al., one may argue that it is more closely related to an AB design as a bidirectional change was not demonstrated (Kazdin, 2011) and the opportunity to meet or exceed the criterion was not available for each subphase (Roane, Ringdahl, Kelley, & Glover, 2011).

Furthermore, the school team did not address inappropriate fecal behaviors in other environments because the parents declined to implement the intervention in the home. Anecdotally, parents reported that inappropriate fecal behavior persisted in their presence. The school team also did not conduct a functional analysis to confirm the maintaining variables of inappropriate fecal behavior. Finally, one potential drawback of using anti-strip suits are their high cost and uncomfortable nature (e.g., weight). The suit selected for this intervention weighed 280 grams and the total purchase price was less than 70 dollars, which made it a more affordable option. Future research should continue exploring the effectiveness of training educational support staff (i.e., EAs) in the delivery of complex behavioral programming. Replicating and extending this study to other environments and to other items (e.g, protective, medical devices) should also warrant the attention of researchers in the future.

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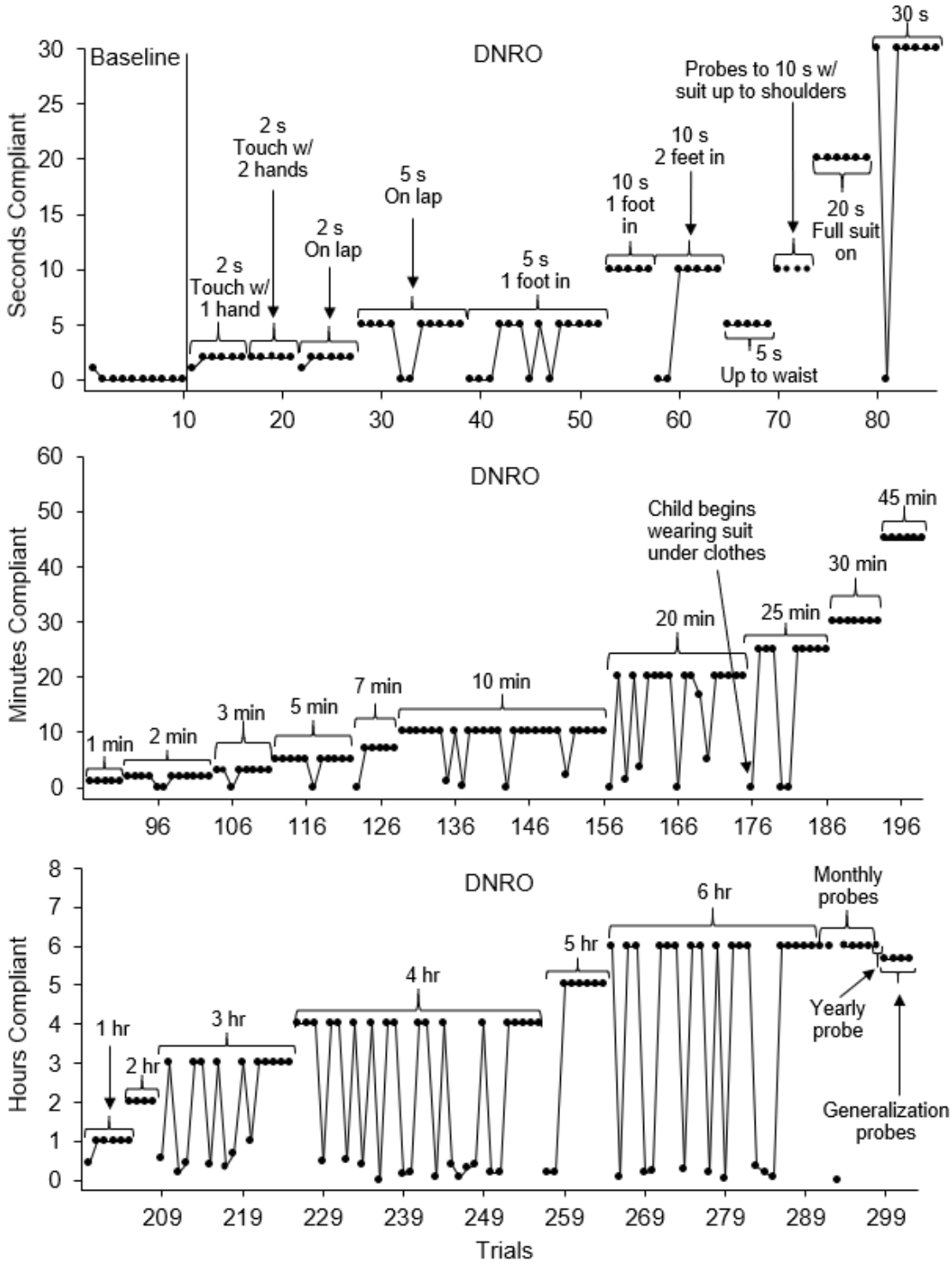

Figure 1. Compliance across trials during the baseline and differential negative reinforcement of other behavior (DNRO) phases. Schedules and response requirements are noted above the data points.

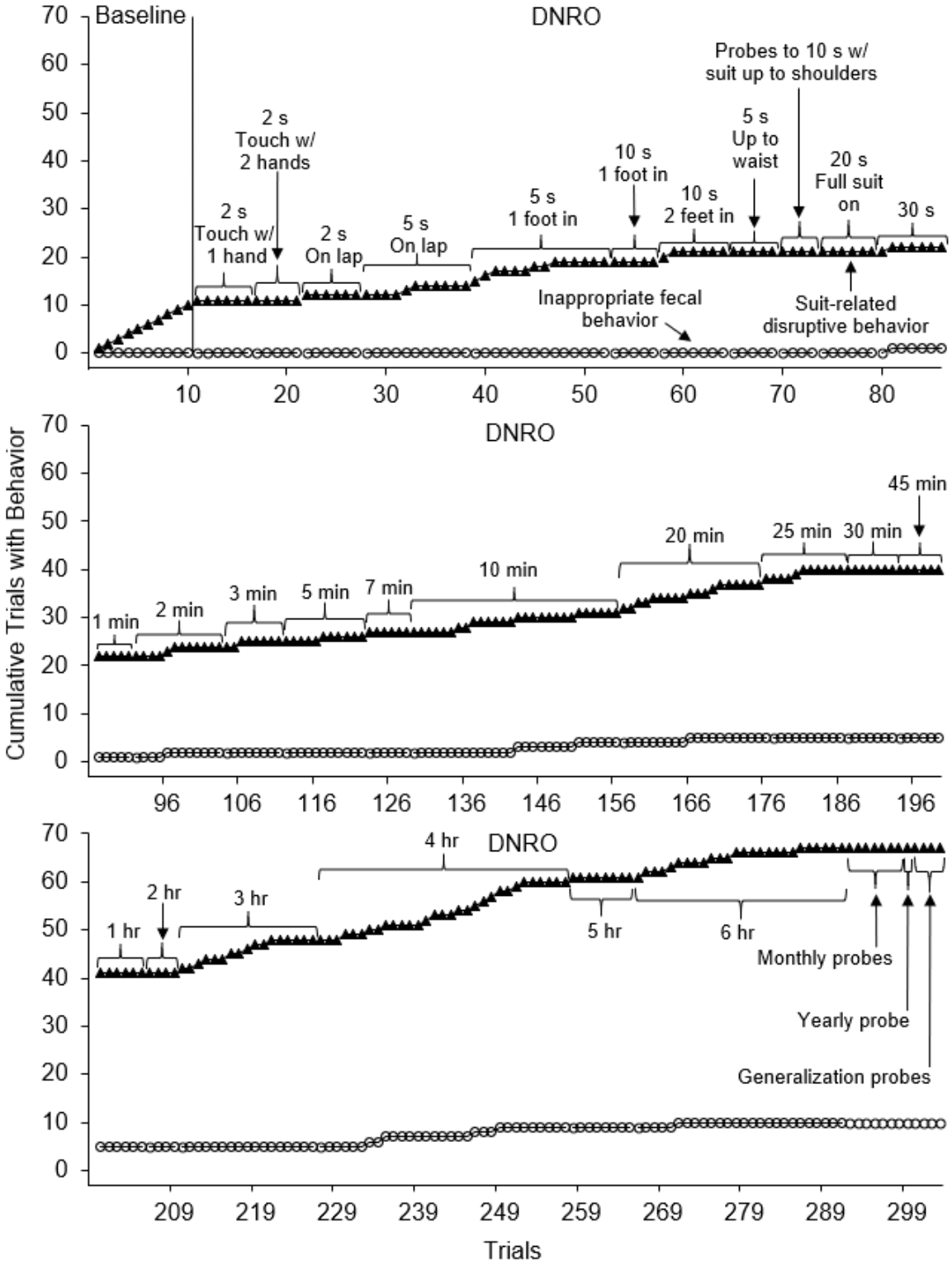

Figure 2. Cumulative trials with suit-related disruptive behavior and inappropriate fecal behavior during baseline and differential negative reinforcement of other behavior (DNRO) phases. Schedules and response requirements are noted above the data points.