
A COMPARISON OF DIFFERENTIAL REINFORCEMENT AND NONCONTINGENT REINFORCEMENT FOR THE TREATMENT OF A CHILD'S MULTIPLY CONTROLLED PROBLEM BEHAVIOR

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Noncontingent reinforcement (NCR) and differential reinforcement of other behavior (DRO) with escape as the reinforcer were evaluated after an initial functional analysis indicated the problem behaviors exhibited by a 7 year old child were maintained by escape. When NCR and DRO did not decrease the problem behaviors, a second functional analysis was conducted and showed that the behaviors were maintained by attention and escape. DRO with attention and escape as reinforcers was compared to NCR with attention and escape as reinforcers for the treatment of the child's multiply controlled behavior problems. Results showed that DRO and NCR were both effective at reducing the problem behavior to low levels and increasing compliance. Copyright © 2003 John Wiley & Sons, Ltd.

INTRODUCTION

In a functional approach to treatment for problem behaviors, a functional analysis is conducted and treatments are developed to alter the reinforcement contingency maintaining the behavior (see, e.g., Iwata, Vollmer, Zarcone, & Rodgers, 1993). Functional treatments have been shown to be more effective than treatments that are arbitrarily chosen (Carr & Durand, 1985; Iwata, Pace, Cowdery, & Miltenberger, 1994). In a functional treatment, the reinforcer maintaining the problem behavior is withdrawn in an extinction procedure and is then provided (i) independent of the problem behavior in a noncontingent reinforcement (NCR) procedure (Lalli, Casey, & Kates, 1997), (ii) for the absence of the problem behavior in a differential reinforcement of other behavior (DRO) procedure (Mazaleski, Iwata, Vollmer, Zarcone, & Smith, 1993), or (iii) for some alternative behavior in a differential reinforcement of alternative behavior (DRA) procedure (Vollmer, Roane, Ringdahl,

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& Marcus, 1999). For example, when using DRO for problem behavior maintained by escape, escape (a brief break) is provided contingent on the absence of the problem behavior, whereas for problem behaviors maintained by attention, attention is provided contingent on the absence of the problem behavior (Iwata et al., 1993). Likewise, when using NCR, escape is delivered noncontingently for problem behaviors maintained by escape and attention is delivered noncontingently for problem behaviors maintained by attention (Iwata et al., 1993).

Both differential reinforcement and noncontingent reinforcement have been shown to be effective in reducing a variety of problem behaviors. However, few studies have compared NCR and DRO (Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993; Vollmer, Marcus, & Ringdahl, 1995). Vollmer et al. (1995) showed that DRO and NCR were both effective in the treatment of self-injury maintained by escape for one individual and Vollmer et al. (1993) showed that DRO and NCR were both effective in the treatment of self-injury maintained by attention for three individuals, although DRO was a more efficient treatment for one of the individuals. Based on the limited research comparing DRO and NCR in the treatment of self-injury, it remains unclear whether one treatment would be more effective or efficient in decreasing other problem behaviors. Additionally, previous research has evaluated these treatments with children or adults with mental retardation who had self-injury maintained by only one function. More research is needed to evaluate reinforcement-based treatments for children with multiply controlled problem behaviors to see whether NCR or DRO may be more effective or efficient.

In the present study NCR and DRO were evaluated in the treatment of a child's problem behaviors maintained by both attention and escape. During both NCR and DRO, attention and escape were provided to address the problem behaviors' multiple functions. Furthermore, compliance was evaluated in order to assess whether NCR and DRO would produce increased compliance as well as reductions in problem behaviors.

METHOD

Participants, Target Behavior, and Setting

Katie was 7 years old and had been diagnosed with a mood disorder, not otherwise specified, and a seizure disorder, and exhibited behaviors consistent with attention deficit/hyperactivity disorder. She attended school in a regular education, second grade classroom. Her problem behaviors occurred in every setting, although there was an extremely high rate of problem behaviors when asked to do school work at home.

Katie's target behaviors were assessed during one-to-one teaching interactions with a researcher (first or third author) in which Katie was asked to participate in

academic tasks. The target behaviors included inappropriate vocalizations (i.e. saying no when asked to do a task, crying, growling at the researcher, and swearing), aggression (i.e. biting or attempting to bite and hitting the teacher), and destruction (i.e. grabbing, ripping, or throwing task materials off the table). Compliance during trials was measured as the number of trials in which Katie attempted to do the task following the researcher's demand but before any additional prompts were delivered, divided by the number of trials.

The functional analysis and treatment conditions were conducted in a quiet, private room in Katie's home with only the researchers and Katie present. The room contained various session materials, a desk and chair for Katie to work at, and a video camera for recording the sessions.

Data Collection and Interrater Agreement

All baseline and treatment sessions were videotaped. Data on the rate of problem behaviors and level of compliance were collected from the videotapes using real time recording of the onset and offset of each behavior. Rate was calculated by counting the total number of problem behaviors during the 15 min sessions and dividing by 15. Compliance was reported as a percentage of trials attempted.

Two independent observers scored target behaviors and compliance for approximately 25% of baseline and treatment sessions. Agreement between the observers for the onset and offset of the target behaviors was recorded when the raters were within one second of each other. The mean agreement score for problem behaviors was 96.1% (range, 91–99.8%) and for compliance was 96.8% (range, 91.2–100%). Treatment integrity was also assessed for 23% of DRO sessions and 25% of NCR sessions. Treatment integrity levels were 97.2 and 99.6%, respectively. In both forms of treatment the therapist provided the reinforcer (attention and/or a break from task) at the correct time during treatment sessions.

Procedure

An initial functional analysis was conducted followed by the implementation of NCR and DRO with escape as the reinforcer. Shortly thereafter, a second functional analysis was conducted, followed by the implementation of NCR and DRO with attention and escape as reinforcers.

Functional Analysis I

Four functional analysis conditions were evaluated in a multielement design. During the *attention* condition, Katie was allowed to play with a variety of toys while

the therapist sat on the other side of the room and read a book. Contingent on the problem behavior, the therapist provided a verbal reprimand. During the *escape* condition, Katie was instructed to engage in an academic task that was appropriate for her grade level (i.e. spelling three to six letter words). The therapists used a sequence of verbal, modeling, and physical prompts if Katie failed to engage in the task within 3 s. Contingent on the problem behavior, the therapist removed task materials and provided a brief break for 10 s. During the *control* condition, the therapist played with toys with Katie and provided noncontingent attention. If problem behaviors occurred during this condition, they were ignored. During the *alone* condition, Katie was in a room alone with a coloring book. All functional analysis conditions were 15 min in length and were conducted in random order. Demand sessions were conducted with both therapists in order to assess problem behavior with both of the therapists who would be conducting treatment sessions. Sessions were conducted approximately 1–4 times per day, 3–6 times per week. Five minute breaks between functional analysis conditions were provided when numerous conditions were conducted during the same day.

Treatment I

Initially, treatment consisted of NCR and DRO with escape as the reinforcer evaluated in an alternating treatments design. Baseline for the initial treatment consisted of sessions from the demand condition of the first functional analysis. All treatment sessions were 15 min. Therapist 1 conducted all NCR sessions while therapist 2 conducted all DRO sessions.

NCR

Therapist 1 instructed Katie to engage in an academic task similar to the task during the demand condition of the functional analysis (i.e. spelling). A three step prompt procedure was implemented if Katie did not comply with demands within 3 s. After 10 s of work time had elapsed, a 10 s break was provided. If Katie engaged in fewer than 0.8 problem behaviors per minute for one session, the interval between breaks was increased by 10 s. However, due to high rates of problem behavior in the first three treatment sessions, treatment was terminated and a second functional analysis was conducted.

DRO

Therapist 2 instructed Katie to engage in the academic task. Initially, contingent on 10 s of work with no problem behavior, a 10 s break was provided. If problem behavior occurred within the work time period, the clock was reset. If Katie engaged

in fewer than 0.8 problem behaviors per minute the work interval was to increase by 10 s. Only two sessions of DRO were conducted before the second functional analysis was conducted.

Functional Analysis II

During the second functional analysis, control conditions described above were alternated with a modified attention condition (attention during demand). During the *attention during demand* condition, Katie was given the same academic task described during the previous demand condition while the therapist sat on the other side of the room reading a book. However, if a target behavior occurred, attention was provided in the form of a verbal reprimand. The three step prompt procedure was not implemented during this condition. Demand and control sessions were conducted with both therapists in order to assess problem behavior with both of the therapists who would be conducting treatment sessions.

Treatment II

After the second functional analysis showed that problem behavior was also maintained by attention, DRO with attention and escape as the reinforcers was compared with NCR with attention and escape as the reinforcers in an alternating treatments design.

NCR

During this condition, therapist 1 instructed Katie to engage in the instructional task. At the beginning of treatment, a 50 s break was provided after 10 s of work. During the 50 s break, the therapist provided attention to Katie by talking in an upbeat voice and making positive remarks. As sessions progressed, the break time interval was decreased by 10 s intervals from 50 to 40 s, eventually reaching 10 s. After achieving the criterion level of problem behavior during one session with 10 s of work with a 10 s break, the time intervals between breaks increased by 10 s intervals. The interval went from 10 to 20 to 30 s, up to 1 min. A 10 s break provided at 1 min intervals was the goal for the NCR intervention. Praise was provided on a variable time schedule of 5 s for working on the instructional task.

DRO

In this treatment procedure, therapist 2 instructed Katie to work on the educational task and provided a break and attention contingent on the absence of the problem behaviors during the work time interval. Initially, following every 10 s interval, if the

Katie had not engaged in any problem behaviors, a 50 s break was provided. If the problem behavior occurred within the working time interval, the clock was reset and the break was given after 10 s without any problem behaviors. During the break from task, the therapist smiled and provided positive remarks and upbeat conversation. As sessions proceeded, the break time interval was decreased from 50 to 40 to 30 s, eventually reaching a set level of 10 s. After achieving a 10 s break interval while maintaining fewer than 0.8 problem behaviors per minute, the DRO time interval was increased by 10 s intervals from 10 to 20 to 30 s, up to 1 min (the goal for DRO). Praise was provided on a variable time schedule of 5 s for working on the instructional task.

RESULTS

The initial functional analysis showed that problem behavior was maintained by escape from academic tasks (see Figure 1, top panel). Mean rates of problem behavior during the demand condition were 1.6 per minute for therapist 1 and 1.3 per minute for therapist 2. Problem behavior occurred at very low rates for all other conditions. In the first treatment phase the problem behaviors increased and the second functional analysis was conducted (see Figure 2). The results of the second functional analysis showed that the problem behavior was also maintained by attention (see Figure 1, bottom panel). Mean rates of problem behavior during the attention during demand condition were 5.3 behaviors per minute for therapist 1 and 4.2 behaviors per minute for therapist 2.

The second NCR treatment began with a rich schedule of reinforcement in order to minimize rates of problem behavior during the onset of treatment. Katie's first two NCR sessions had high levels of problem behavior; however, problem behavior decreased over the next three sessions. After four sessions of near zero levels of the problem behavior, the problem behaviors increased and became highly variable. During session 53, problem behavior decreased again and remained low for the rest of the treatment phase (see Figure 2). The decrease in the problem behaviors at session 53 corresponded to a modification in the treatment. Starting at this time, the therapists proceeded each treatment session with a 10 min period of play (noncontingent attention with no demands). Katie was also given candy or small treats before and after treatment in order to promote good behavior during treatment sessions. After the addition of pre-session attention and tangible items, problem behavior occurred at low rates.

The DRO treatment sessions began with high rates of problem behavior, but the rate decreased gradually over the next three sessions. After treatment session number 43, rates of behavior became extremely variable. At treatment session number 55, the

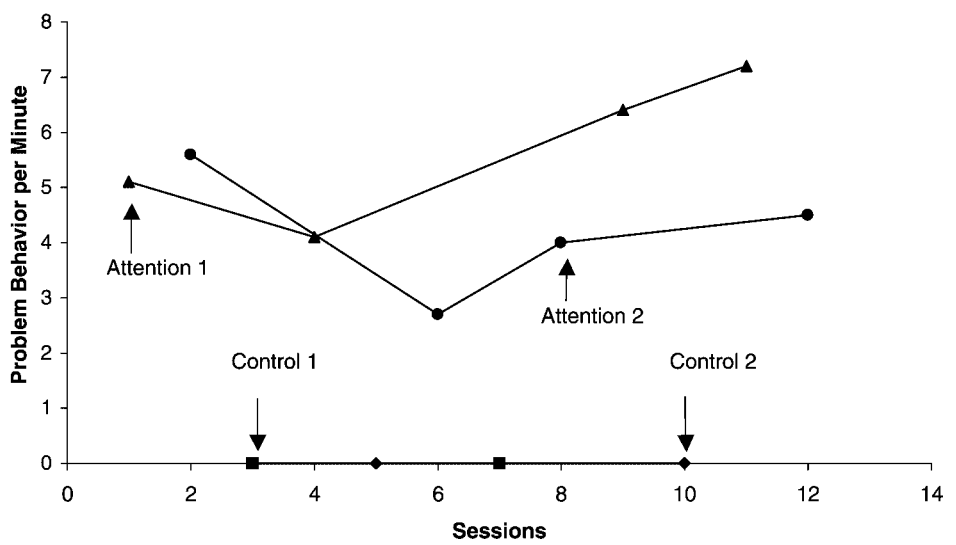
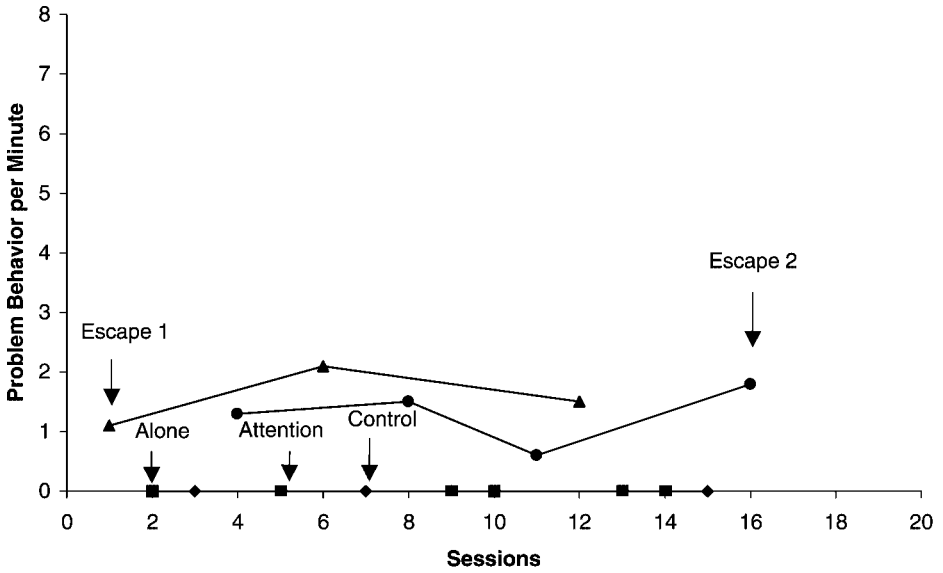


Figure 1. Rate of problem behavior during the initial functional analysis conditions (upper panel) and modified functional analysis conditions (lower panel).

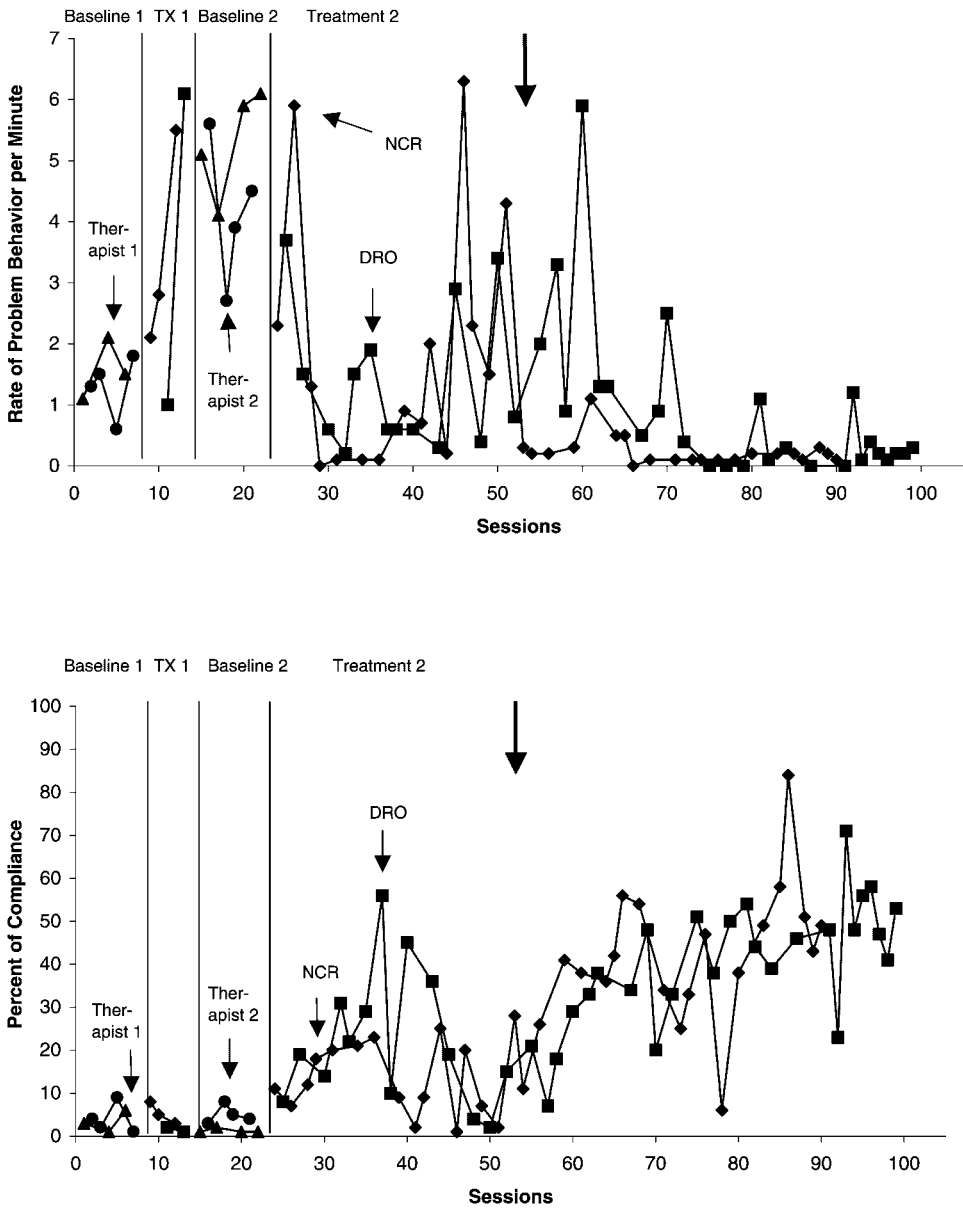


Figure 2. Rate of problem behavior during baseline and treatment sessions (upper panel) and percentage of compliance during baseline and treatment sessions (lower panel). The arrow at session 53 indicates the addition of the play period and tangible reinforcers.

therapists allowed Katie's break to be flexible so that if Katie was engaged in conversation, the break could be extended until she had completed her sentence. Also, at session 55 pre-session attention and treats were added as previously described. After treatment session 62, rates of problem behavior were lower overall, with a few high sessions interspersed in the remainder of the treatment sessions.

Although both NCR and DRO decreased the problem behaviors to low levels, NCR appeared somewhat more effective and efficient than DRO. The rate of problem behavior was usually lower for NCR, and the criterion work time (reinforcement interval) of 1 min was achieved more quickly for NCR than for DRO (session 71 for NCR versus session 93 for DRO).

Compliance was very low in the two baseline phases and the first treatment phase, with means ranging from 1 to 8%. After the second treatment phase was implemented, compliance increased and was higher for DRO for the first 10 sessions of the treatment. DRO and NCR produced similar levels of compliance after the initial 10 sessions. Near the end of treatment, when the rate of problem behaviors was low for both DRO and NCR, compliance stabilized at around 50%.

DISCUSSION

After the initial functional analysis indicated escape was the reinforcer for Katie's problem behaviors, DRO and NCR with escape as the reinforcer were implemented but did not lead to reductions in problem behavior. A second functional analysis showed that problem behavior was maintained by attention as well as escape. Results from the second treatment phase showed that both NCR and DRO were effective but that NCR was slightly more effective and efficient for lowering rates of problem behavior. Compliance was also increased for both treatments. However, the level of compliance only reached about 50% of trials. Although this is a substantial increase from the near zero level during baselines, it is still short of an acceptable level of compliance.

A second functional analysis was conducted after the initial treatments did not decrease the problem behaviors and the therapists believed that Katie's problem behaviors were occurring for attention as well as escape. When the therapist provided the break in the initial NCR and DRO procedures, Katie would cry and say 'Stop ignoring me'. The second functional analysis was conducted in order to assess the possibility of an attention function. Northup et al. (1999) used a similar attention condition where participants diagnosed with ADHD were given an academic task to complete during the session. Contingent on problem behavior, the therapist provided a brief verbal reprimand. This type of modified attention condition may be necessary to assess some children with problem behaviors in academic situations. A typical

attention condition is conducted in a play setting, but the play setting may not be the environment in which problem behavior typically occurs for some children, especially in a school or academic setting. Children may be as likely to gain attention as escape from teachers when they are disruptive during academic tasks at school. In the current study, there was differential responding during the functional analysis conditions when the discriminative stimulus (i.e. the academic activity) was present (Connors et al., 2000). Future research should evaluate the use of a modified attention condition in typically functioning children in an academic situation if an attention function is suspected but the traditional attention condition does identify attention maintained problem behavior.

The second treatment was altered in the middle of the phase at session 53 for NCR and session 55 for DRO due to the high, variable rates of problem behaviors. The data led the therapists to question whether the within-session learning of treatment contingencies was not carried over days due to Katie's mother providing rich levels of reinforcement for problem behaviors outside the sessions. The therapists decided to alter the establishing operations for attention seeking and escape-maintained behaviors by having a pre-treatment session play time each day that allowed therapists to interact and provide high levels of noncontingent attention with no demands before starting the first treatment session for that day. Crying had been one of the most frequent problem behaviors during Katie's treatment sessions. Following the implementation of pre-treatment play sessions, levels of crying decreased to near zero levels. These results are similar to findings by O'Reilly (1999), who showed that when individuals had limited access to attention they may have been more likely to exhibit behaviors from a response class that had a high probability of producing attention from others. His results showed that attention maintained problem behaviors were reduced following pre-session attention. The current research results are somewhat confounded by the implementation of the pre-treatment play sessions in the middle of the second treatment phase, so the relationship between pre-session attention and lower levels of crying is one possible explanation for problem behavior reduction.

Katie's mid-treatment adjustments also included the therapists providing tangible items at the beginning and end of treatment for low levels of problem behaviors. Tangible items included candy, toys, stickers, and school supplies. The therapists noticed that when certain tangible items were offered as rewards for low levels of problem behavior, Katie would frequently ask if she was behaving well and if she could have the item when treatment was over. During these sessions, Katie's rate of problem behavior was low, and compliance was high. Lalli et al. (1999) found that escape maintained problem behaviors were lower and compliance was higher when compliance with task resulted in an edible reinforcer instead of a break from task. Therefore, an arbitrary reinforcer, instead of the functional reinforcer, was effective

in producing behavioral reduction and increased compliance. The current study is somewhat different in that Katie's problem behaviors were maintained by both attention and escape. Perhaps introducing tangible reinforcers at the beginning and end of the day's treatment sessions had the same effect as the tangible reinforcers provided by Lalli et al. (1999). This hypothesis cannot be currently assessed, however, due to the introduction of the tangible items in the middle of the treatment phase.

One limitation of the study is that, due to time constraints, the therapists did not reintroduce baseline after achieving success with DRO and NCR and then re-implement DRO and NCR. Therefore, results indicating the effectiveness of each treatment should be interpreted with caution. Additionally, NCR and DRO were only evaluated for one participant. More research is needed to evaluate whether treatments using either NCR or DRO are more effective or efficient in reducing rates of multiply controlled problem behavior.

Another potential limitation is that a tangible condition was not conducted during the functional analysis. It remains unclear whether reductions in problem behavior after the mid-treatment addition of tangible items were due to the inclusion of another functional reinforcer in the treatment. Future research should investigate the effectiveness of treatments that provide either one or all functional reinforcers identified during the functional analysis. Perhaps the inclusion of certain reinforcers in treatment is enough to lead to behavioral reductions, even if not all the functional reinforcers are provided.

While a large body of research has shown the effectiveness of treatments using either noncontingent reinforcement or differential reinforcement, it is still unknown whether one form of treatment leads to more effective and efficient behavioral reductions. Future research should continue to compare treatments in order to identify a potentially superior form of treatment.

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