

## **A Preliminary Analysis of Therapeutic Horseback Riding**

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**By**

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### **Abstract**

*We evaluated the effects of implementing therapeutic horseback riding procedures with three young children with Autism Spectrum Disorder (ASD). Three boys between the ages of two and a half and four years of age were evaluated using an ABAB single case design. Baseline data were collected prior to and after an initial treatment phase. An equine was present during baseline phases at the opposite end of an arena. During the baseline phase, the therapist engaged the participant play activities, which would later be applied when they were riding on a horse. During the treatment phase, the horse was introduced and the horse was prompted to move contingent on child behavior. The intervention contingencies resulted in a reduction of aberrant behaviors displayed by these children over time and an increase in social behavior was observed. For one child the presentation of the equine was introduced using desensitization procedures. The desensitization procedure allowed us to decrease avoidant behaviors displayed by this child and similar therapeutic effects to the other participants was obtained.*

**Keywords:** Desensitization, Therapeutic Horseback Riding, single case research design, equine

### **Introduction**

The number of children diagnosed with autism spectrum disorder (ASD) has increased substantially in the last decade. Even though the cause of autism is unknown, environmental, genetic, immunological, neurological, and biomedical factors have been shown to contribute to its occurrence (Singh, Warren, Odell, Warren, & Cole, 1993). Twin and family studies (Rutter, 2000) have shown a genetic link to autism and Vennstra-Vanderweele and Cook (2003) and Ronald (2006) reported that a large number of chromosomal abnormalities in autistic individuals are present.

The defining symptoms of autism are deficits in language, communication and socialization. Communication deficits are frequent and critical to a definitive ASD diagnosis. In addition, children with autism display deficits in imitation skills which normally developing peers typically acquire (Stone, Ousley, & Littleford, 1997). These individuals have severe difficulties in forming relationships with others, have problems with communication and perform ritualistic behaviors. By themselves and in combination, these symptoms lead to difficulty accepting changes in routine (Lovass, 1987).

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While no known cure is available for ASD a combination of behavioral, biological, and educational interventions have lead to positive outcomes (Gresham, Beebe-Frankenberger & MacMillan, 1999; Heward, 2009; Gresham & MacMillan, 1998; Williams & Williams, 2010). Most importantly, early and intensive intervention is needed to improve the long-term prognosis (McEachin, Smith, & Lovaas, 1993; Sheinkopf & Siegel, 1998). Once autism is identified, parents must choose from a number of treatment options that include: sensory-motor therapies, sensory integration training, auditory integration therapy, music therapy, applied behavior analysis, and communication training (Dempsey & Foreman, 2001). Drug interventions have also been used to alleviate some of the symptoms of autism (Fatemi, Realmuto, Khan, & Thuras, 1998; Lewis, 1996). Treatments based on applied behavior analysis have been experimentally shown to be the most effective, with its greatest success in children who initiate treatment at two to three years of age (Dempsey & Foreman, 2001; Schreibman, 2000). Eikeseth, Smith, Jahr, and Eldevik (2002) reported gains in children four to seven years old when intensive behavioral treatment is employed. Despite this broad range of treatments, the prognosis for individuals diagnosed with autism can be poor (Dempsey & Foreman, 2001). This poor prognosis is ever greater for individuals who fail to possess verbal language skills prior to age six (Koegel, 2000).

While the types of treatment vary, a key variable often measured to indicate success or failure of a treatment is an increase the social behavior of children with ASD Derby et al. (1997). For example, the basic tenet of pivotal response training (Koegel & Koegel, 2006) is to teach interaction skills with same age students. Floor time (Greenspan & Wieder, 2006) utilizes the child's self-selected activities (based on task engagement) as a beginning point to increase shared engagement between a parent and a child. Similarly, Relationship Development Intervention (RDI) (Gutstien, Burgess, & Montfort, 2007) strives to teach the parents increased sharing skills, flexibility, and self-awareness to enhance interaction between children and care providers. A key component to each of these intervention approaches is the parents' use of the child's behavioral cues to select social contexts that are reinforcing.

Horseback riding has been shown to benefit children with communication disorders (Health, & McKenry, 1989). For example, it has been shown to be recreational and socially beneficial within case study designs (All, Loving, & Crane, 1999). Lehrman and Ross (2001) reported a nine-year-old girl diagnosed with mental retardation and limited verbal behaviors increased her sound output after only ten weeks of treatment. Bass, Duchowny and Llabre (2009) evaluated the effects of horseback riding on the social functioning of children with autism. Utilizing a wait-list control design, these authors were able to demonstrate the efficacy of the intervention for increasing children's sensory seeking, sensory sensitivity, and social motivation. In addition, an inverse relationship was observed for problem behaviors such as inattentiveness and distractibility. Therapeutic horseback riding as an intervention for children with (ASD) is in its infancy, but preliminary data are promising (Bass, Duchowny, & Llabre, 2009).

At this time, the underlying theory for why horseback riding has been beneficial appears to rely on both physiological and environmental factors (Macaulay & Gutierrez, 2004). Riding

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on the horse is believed to help an individual develop an awareness of body movement, weight distribution, improved hand-eye coordination, improved speech, a wider tactile experience, and a wider experience of sounds (Macaulay & Gutierrez, 2004). In a descriptive evaluation of therapist perceptions in Germany and Britain, Debusse, Chandler, and Gibb (2005) found that most practitioners hypothesized that being on the horse improved the rejuvenation of muscle tone, improved postural control, and resulted in psychological benefits. However, these findings relied on the self-report of practitioners. Environmentally, the positive outcomes could be hypothesized to occur based on applied behavior analysis literature. For example, Carr and Durand (1985) demonstrated that through differential reinforcement, severe behaviors are reduced and a covariant increase in severe behavior occurrences. Similarly, Derby, Wacker, Asmus et al. 1997 reported that if the child is provided an alternate form of communication to obtain identified reinforcers appropriate social behavior increases. Thus, increased social behavior could be the function of a reinforcer/behavior contingency. Within the context of riding the horse the contingency would be between horse movement and social behavior.

While several treatment methodologies have been shown to be beneficial for children with autism, one clinical abnormality that is often problematic during initial intervention is the resistance to transition often exhibited by children with ASD (Cuccaro et al., 2003; Dettmer, Simpson, Myles & Ganz, 2000; Schriebman, Whalen, & Stahmer, 2000). Specifically, autistic children often display problem behavior when changes in routine or new stimuli are presented. To date, several strategies have been developed to assist in decreasing resistance to treatment while simultaneously decreasing problem behavior including Picture Exchange Systems (Dettmer et al., 2000) and video priming (Schriebman et al., 2000). Although the underlying mechanisms responsible for the effectiveness of these procedures are unclear, each has been shown to decrease the aversiveness associated with changes in environmental events for these children. However, these procedures may not be effective in situations where the child is exposed to a treatment that might include stimuli that could result in a fear response but have been shown to have some therapeutic benefits. Germane to the current investigation would be the introduction of a two to three thousand pound horse. An alternative to these procedures, and one with a robust literature for the reduction of fear would be the use of stimulus desensitization. Desensitization is a procedure in which an individual is gradually exposed to an avoided stimulus and reinforced for compliance (Ricciardi, Luiselli, & Camone, 2006). For children with autism, it has been used to increase compliance to hospital procedures (Ricciardi, Luiselli, & Camone, 2006) and specific phobias to needles (Shabani & Fisher, 2006). Desensitization may include an escape extinction procedure when continued presentation of the stimulus is provided contingent upon problem behavior.

The purpose of the current investigation was two fold. First, we hoped to conduct a preliminary investigation demonstrating the use of therapeutic horseback riding to enhance the social behavior of children with ASD. Our second purpose was to apply desensitization procedures for one of the children that engaged in problem behavior when the equine was first introduced.

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## Method

### Participants and Settings

The participants were three boys diagnosed with ASD by a Ph. D. licensed psychologist. They were between the ages of two and four years of age. All three boys were selected for study because they were reported to engage in problem behaviors and displayed little to no social verbal behavior. None of the participants had any prior experience with equines. Each was enrolled in developmental preschool programs but none had any extensive teaching using differential reinforcement procedures.

Portions of the investigation took place in an indoor horse arena that was 120 ft. (36.57m) by 200 ft. (60.96m). The facility consisted of a smooth dirt surface, metal siding and roofing. There were no windows in the facility; however, light was able to penetrate the building through fiberglass sidings near the ceiling. During the baseline and treatment phases of the study, all the doors to the facility were closed to block out outside noise. The facility was also equipped with overhead lighting. One participant began sessions in the indoor arena, however, after three sessions his observations were moved to an outdoor arena that was 120 ft. (36.576m) by 200 ft. (60.96m). A four-foot (1.219 m) wood fence encircled the outdoor arena's perimeter. No other riders were present during the therapy sessions

### Dependent Variables and Measurement

Two different classes of dependent measures were measured, social and aberrant behavior. For Adam and Ben social behaviors included (a) imitation of verbal responses made by others; (b) verbal mands to the therapist; and (c) spontaneous verbal phrases or requests. Kyle's social behaviors differed and included (a) purposeful verbal sounds directed toward therapist and (b) imitation of sounds made by the therapist. Adam, Ben, and Kyle's aberrant behaviors consisted of crying, screaming, whining, hitting, and avoiding therapist by hiding, purposefully falling down and running away. Following each evaluation day, videotapes were scored using a 6s interval system recording system designed for the investigation. These data were scored by the first author and trained volunteers.

### Experimental Design and Conditions

Single case reversal designs (Kazdin, 2010) were used to evaluate treatment effectiveness. An initial baseline evaluation was conducted prior to the implementation of treatment for all children. Treatment was then implemented with a return to baseline and treatment conditions made contingent upon behavioral trends. Specifically, decreasing levels of aberrant behavior needed to occur with a covariant increase in social behavior for a treatment contingencies to be discontinued.

**Baseline:** The baseline sessions took place in the horse arena with the horse on the opposite side of the arena. Four therapists engaged the participants in play and social behavior by using the same balls and toys used when the child was introduced to the horse. Specifically,

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the therapist counted, tossed, and kicked balls, ran, and played games non-contingent of participant behavior. The therapist engaged in interactive praise contingent on the child emitting verbal or gestural social interaction. However, there was no contingent praise or access to activities provided contingent on the child engaging in manding or aberrant behavior.

**Treatment:** The participants were placed on the horse with two side walkers, one on either side of the horse for safety. The side walkers had one hand positioned over the subject's leg and the other hand was holding on to a safety belt worn by the participant. A certified horse handler led the horse. This allowed the therapist to freely engage the participant in activities while riding the horse. These activities included track left around arena, track right around arena, stop/go right, stop/go left, play ball (using an 8"inch ball, a cage ball, and sensory balls), reach for rings, rear facing tracing left, rear facing tracking right, stop and go rear facing, alternating position or trot, finish with tracking right/left, and dismount. The therapists verbally prompted each participant to say or sign "please" and "stop" to begin and end one of the therapy activities. For example, if the equine was at a stand still, the participant was prompted to sign "please" which resulted in the horse beginning to walk.

**Desensitization for Kyle:** Kyle displayed an increase in both his aberrant and communicative behavior during the first three days of treatment. It was hypothesized that the horse was an aversive stimulus. At that time, Kyle was moved to an outdoor arena and desensitization to the large horse was initiated for him. This involved a series of specific steps. First the therapist introduced a miniature horse. Kyle watched as the therapist lead the miniature horse past him. When Kyle's behavior changed from crying to smiling, the therapist gave Kyle the end of the lead rope the therapist was holding. Kyle helped lead the miniature horse around with the therapist while holding his fathers hand. As Kyle's aberrant behavior decreased and communicative behavior increased, his father removed his hand. He continued to lead the horse with the therapist for an additional 15 minutes. Kyle was then placed on the miniature horses back; the side walkers were placed on either side of him. He stayed on the horses back for one minute. Next, Kyle then helped lead the large horse around the arena with the therapist and horse handler. The therapist then held him so he could touch the horse while the horse walked around the arena. After touching the horse for one minute he was placed on the back of the horse with the side walkers placed on either side of him. Kyle's progressive treatment lasted for three observations. After desensitization, Kyle started riding the large therapy horse.

### **Reliability of Measurement**

Inter-observer agreement was gathered by having an additional observer view video taped sessions simultaneously but independently with the primary data collector. Agreements (e.g. an identical mark in the interval for each response recorded) were then divided by the agreements plus disagreements (e.g. no mark or different mark in the interval for each response recorded) and then multiplied by 100. Interobserver reliability for Adam was collected for 37% of the sessions and with mean agreement of 88.4% (range 82 to 100%). For

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Ben interobserver reliability was collected for 39% of the sessions and the mean inter-observer agreement was 86.7% (range 80 to 92%). Kyle's inter-observer reliability was taken for 36% of the sessions with a mean agreement ratio of 92.3% (range 80 to 100%).

### Results

**Adam and Ben:** Results for Adam and Ben are displayed in Figures 1 and 2. Both Adam and Ben demonstrated very low levels of social behavior during the initial <Figures 1 and 2 here> baseline sessions (Adam  $M = 4\%$ ; Ben  $M = 11.33\%$ ). In addition, Adam demonstrated an increased level of aberrant behavior in baseline ( $M = 34\%$ ). Treatment contingencies were initiated in session four for both Adam and Ben. An initial increase in aberrant behavior occurred for both of these participants when treatment was initiated. For Adam, the occurrence of aberrant behavior decreased to near zero levels following five treatment sessions ( $M = 39\%$ ), with a concomitant increase in social behavior ( $M = 17\%$ ). Conversely, Ben's aberrant behaviors remained high for the first nine sessions of treatment with varying levels of social behavior. Ben's parents requested a change in his helmet after Session 13. Thereafter, Ben's aberrant behavior occurred at near zero levels for the remainder of the investigation ( $M = <1$ ). There was also a concomitant increase in his social behavior ( $M = 22\%$ ). During the reintroduction of baseline for both Adam and Ben, increases in aberrant behaviors (Adam  $M = 64\%$ ; Ben  $M = 42\%$ ) were observed with a co-varying decrease in social behavior (Adam  $M = 3\%$ ; Ben  $M = 9\%$ ). For both Adam and Ben, positive treatment outcomes were reestablished with the reapplication of the intervention contingencies. For example, an increase in social behavior to mean of 41% for Adam was observed. Also, Ben's social behavior increased to a mean of 34%. For both Adam and Ben concomitant decreases in aberrant behavior ( $M = 3\%$  for Adam and  $M = 0\%$  for Ben) occurred.

**Kyle.** The results for Kyle are shown in Figure 3. Kyle displayed very low levels of social behavior during baseline and a slight increase in aberrant behavior. When treatment was instituted in the fourth session, a dramatic increase in aberrant behavior with variable levels of social behavior was observed. Systematic desensitization resulted in near zero levels of aberrant behavior with an increase in non-verbal and verbal social behaviors. Therapy was then reinstated during session 39 with a large horse. His aberrant behaviors remained at zero

<Figure 3 here>

levels with increases in verbal and non-verbal social behavior ( $M = 16\%$  and  $8\%$  respectively). A change of horses had to be made in session 46. This was due to horse becoming ill. This change had little impact on Kyle's behaviors. Baseline conditions were reimplemented in during Session 50. Return to baseline did not result in any increase in aberrant behavior and non-verbal social behavior remained somewhat stable. However, near zero verbal social behaviors occurred. Treatment was then reinstated in Session 56. This resulted in a dramatic increase in Kyle's social behavior ( $M = 17\%$ ).

### Discussion

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Overall, the results provide some evidence that hippo-therapy can be beneficial to children with autism. However, because the therapy was provided within the context of reinforcement contingencies, we do not know the impact of the equine alone on the participants' behavior. In addition, because baseline sessions were conducted without reinforcement contingencies in place, we do not know if alternative stimuli would have also served as a reinforcer. Nevertheless, our findings suggest that the equine was essential in the increased social behavior displayed by the participants. However, the exact nature of the reinforcement obtained (i.e., either social or sensory) cannot be determined given the preliminary nature of the data provided. The reduced the problem behaviors displayed by Kyle indicate that desensitization procedures can reduce the fear that might be associated with the presentation of the equine.

A number of limitations to this study should be noted. First, the study did not provide a direct comparison between differential reinforcement of alternative behavior with and without the equine. Additional research should include a direct comparison between these two reinforcement contingencies. Second, we did not evaluate the possible generalized effects of the intervention. Thus, additional research is needed to evaluate outcomes in a novel setting and across time. Third, increased social behavior and decreased aberrant behavior for Ben could be contributed to the use of the new helmet. His decreasing trends in aberrant behavior and co-varying increase in communication was observed prior to Session 13. Lastly, we do not know if the results obtained are unique to equines. Specifically, research with more accessible animals (i.e. e., common household pets) is needed.

The current investigation represents how we can apply behavioral analytic principles and techniques to better understand current treatments used for autistic children. Specifically, the use of sensory integration (Arendt, MacLean, & Baumeister, 1988), social stories (Thierman & Goldstien, 2001), and sensory diets (Biel & Peske, 2005) needs to be evaluated using single case methodology. This study is similar to an earlier investigation by Thiemann and Goldstein (2001) on the use of social stories with video feedback, which, despite a lack of empirical evidence, has been employed on a wide scale by professional and parents to increase the social skills of children with autism. Using reversal designs, the authors were able to demonstrate that the combination of social stories and video feedback could increase the social skills of five students with autism. Given the current increased diagnoses of autism (Chakrabarti & Fombonne, 2005), we are entering a period in the history of the disorder where treatment selection is based on parents being desperate rather than on empirical evidence. The use of single subject technology can allow for data based decision-making; which, in turn would provide a better understanding the variables responsible for treatment success. Overall, our results are promising and support the need for additional research using single subject designs to evaluate alternative treatments that do not have a robust research literature by are being used in applied settings.

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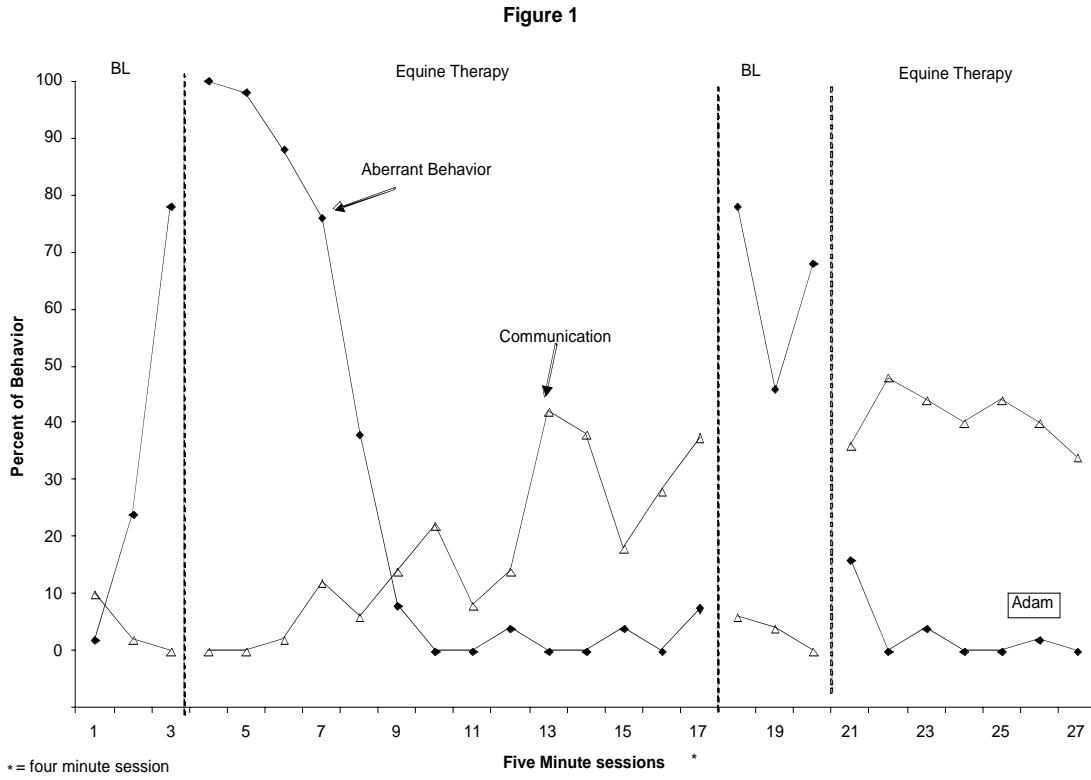


Figure 1. The percent of intervals for Adam with aberrant behavior (closed circles) and appropriate communication (triangles) for baseline and intervention.



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Figure 2

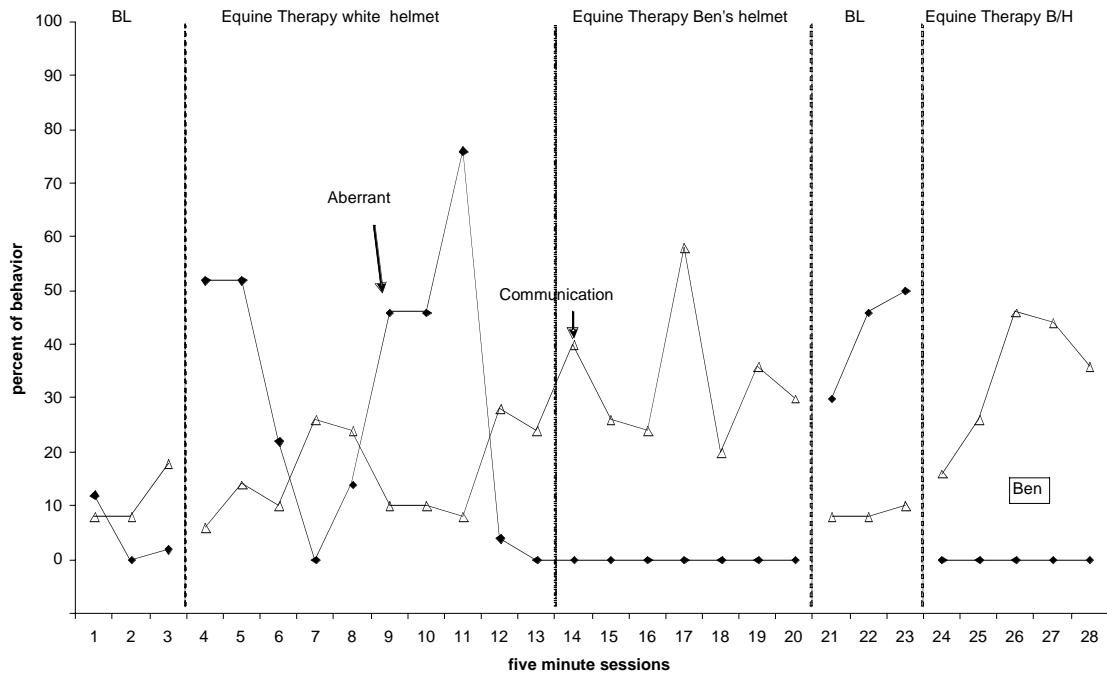


Figure 2. The percent of intervals for Ben's aberrant behavior (closed circles) and appropriate communication (triangles) for baseline and intervention.

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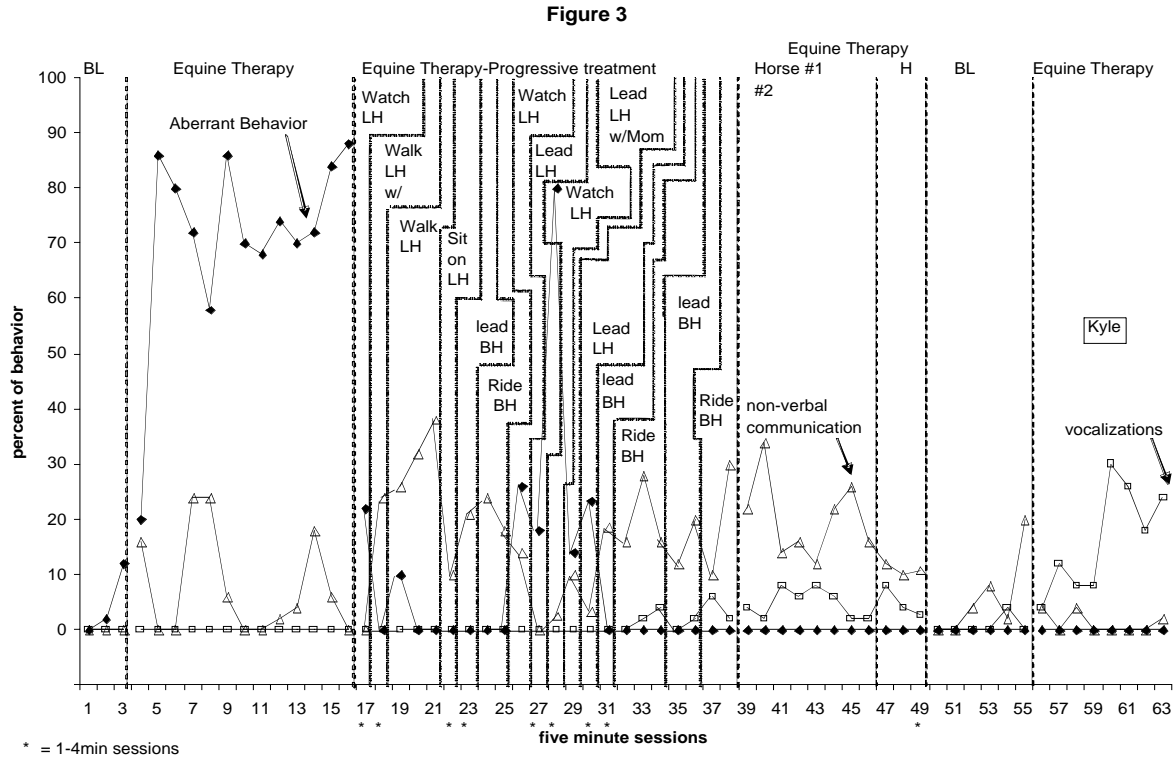


Figure 3. The outcomes for Kyle for baseline, intervention, and systematic desensitization.

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