USING FUNCTIONAL BEHAVIOR ASSESSMENT AND DIFFERENTIAL REINFORCEMENT TO DECREASE PROBLEM BEHAVIOR IN A PRESCHOOLER: A CASE STUDY

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Abstract

Applied Behavior Analysis (ABA) is the single most empirically supported intervention for individuals affected by autism spectrum disorders (ASDs). In this case study, ABA techniques were employed to address the problem behaviors (aggression, tantruming, and self-injury) of a preschooler with developmental delays. First, a functional behavior assessment was used to identify the variables causing and maintaining the student's disruptive behavior. Then, a token system intervention was implemented, incorporating extinction and differential reinforcement in order to reduce the frequency and duration of the problem behavior. The effectiveness of this intervention was monitored to determine whether it could be used to manage this particular student's behavior in a typical school setting.

Using Functional Behavior Assessment and Differential Reinforcement to Decrease Problem Behavior in a Preschooler: A Case Study

Autism Spectrum Disorders (ASDs) are characterized by core deficits in communication and social interaction, as well as a fixation on routine that leads to restrictive or repetitive behaviors. These symptoms are present in early development, and cause impairment in important functional areas. The disorder presents as a series of atypical behaviors (aggression, self-injury, stereotypy, echolalia, hyper- or hyposensitivity to sensory stimulation, etc.) and lack of developmentally appropriate behaviors (eye contact, joint attention, pretend play, verbal communication, development and maintenance of social relationships, etc.). Though ASD and intellectual disabilities often co-occur, an autism diagnosis is given only when an "intellectual disability" diagnosis cannot explain the individual's full range of symptoms. Symptoms fall on a continuum, with high-functioning individuals exhibiting very mild symptoms and low-functioning individuals exhibiting much more severe and debilitating symptoms (*DSM-V,* 5th ed., American Psychiatric Association, 2013).

Etiology

The etiology of autism spectrum disorder remains a mystery. Much of the current research has focused on identifying genetic markers of autism, as well as the structural and functional abnormalities that characterize the autistic brain. However, it is likely that a number of different factors contribute to the disorder, making it difficult for researchers to pinpoint any single cause (Strathearn, 2009). Historically, the general public has accepted numerous flawed theories concerning the etiology of autism. Some examples include Kanner's "refrigerator mother" theory and Wakefield's vaccination theory. Kanner (1949) theorized that a child

develops autism due to a lack of maternal warmth and care, which causes the child to become withdrawn and antisocial. This theory has since been rejected. Wakefield et al. (1998) hypothesized that there was a link between the MMR vaccine and autism, a theory that created a huge stir in the autism community in the early 2000's. However, it was later revealed that Wakefield had knowingly published fraudulent data as a moneymaking scheme (Deer, 2011). Investigators found evidence that many of Wakefield's subjects exhibited symptoms of developmental delay prior to receiving the MMR vaccine, though Wakefield attributed those symptoms to the vaccine itself. Ultimately, Wakefield's study was retracted and his medical license revoked (Deer, 2011). While Kanner and Wakefield's research has now been discredited by more recent empirical research, there are still a number of diverse theories concerning the etiology of autism that deserve attention and further investigation.

There is a dichotomy in the literature between "nature" and "nurture" theories, as some researchers argue that autism is inborn whereas others propose that it is caused by environmental factors (Strathearn, 2009). The heritability of the disorder as demonstrated by monozygotic twin studies has led many psychologists to believe that ASD has genetic origins (Strathearn, 2009). Concordance rates of the disorder are up to 60% in monozygotic twins in contrast with only about 5% in dizygotic twins, which strongly indicates a link between an individual's DNA and autism (Bailey et al., 1995). On the other hand, trauma and neglect during childhood have been associated with the development of autistic traits, lending credence to the influence of environmental factors (Rutter et al., 1999).

Contemporary research points to a combination of genetic and environmental causes, particularly the idea that an inherited "autism phenotype" is either magnified or minimized by the social and physical environment (Strathearn, 2009). However, in a recent study

approximately 96% of the lay population attributed the disorder to environmental causes (including medical technologies, pollution, radiation, maternal stress and diet, etc.), suggesting that most of the general public believes the disorder to be caused by external factors (Russell, Kelly & Golding, 2009). These widespread beliefs about the etiology of autism likely exist because the media has repeatedly sensationalized environmental causes such as the MMR vaccine, though it has been thoroughly discredited.

Currently respected theories. Most of the currently respected theories concerning the etiology of autism posit that the disorder has some sort of biological basis. To date, researchers have been largely unsuccessful in their efforts to locate a distinct "autism gene" (Strathearn, 2009), except in rare cases where autism co-occurs with fragile X syndrome. However, many psychologists suggest that autistic symptoms may be a product of genetically determined structural or chemical abnormalities in the brain (Inui, 2013; Iseri et al., 2010). Sound empirical evidence for many of these biological theories has emerged in recent years due to the advent of new technologies in the growing field of neuroscience.

Fragile X syndrome. Fragile X syndrome, a syndrome that causes intellectual disability, is the most common known genetic disorder associated with the autism diagnosis. As many as 50% of individuals diagnosed with fragile X are also diagnosed with ASD, though fragile X makes up only about 5% of cases of autism (McCary & Roberts, 2013). Individuals with fragile X syndrome exhibit behavioral profiles that are very similar to those of individuals with ASD, including social and communication deficits and restricted and repetitive behaviors. Research shows that a dual diagnosis of fragile X syndrome and autism magnifies these symptoms, with dually diagnosed individuals exhibiting more severe behavioral difficulties than those with either fragile X or ASD alone (Smith et al., 2012). While fragile X elucidates the genetic basis of some

cases of autism, it probably cannot explain the many other cases of autism that do not co-occur with fragile X syndrome.

Structural abnormalities. Though ASD is defined and diagnosed strictly based on behavioral symptoms, recent developments in neuroimaging have allowed scientists to examine structural and functional abnormalities in the autistic brain (Inui, 2013). It is thought that atypical development of certain brain structures may produce some of the behavioral symptoms associated with ASD. For example, studies have found volume reduction in the amygdala and reduced connectivity of the amygdala to the orbitofrontal cortex (OFC) in subjects with autism. The amygdala codes for the emotional significance of people, objects, and events in the environment and communicates this information to the OFC for planning purposes. Dysfunction in this neural pathway could account for the increased anxiety and inappropriate emotional reactions to environmental events often experienced by individuals with autism (Inui, 2013).

Other studies have found reduced activation of the superior temporal sulcus (STS) region of the brain in individuals with autism (Inui, 2013). The STS is responsible for detecting biological motion and gaze direction. Reduced activation of this region could explain why individuals with ASD do not attend to social stimuli and have trouble making eye contact. Additionally, fMRI studies have shown that the posterior STS (pSTS) and the dorsal medial prefrontal cortex (dMPFC) are engaged in joint attention tasks. Individuals with autism exhibit reduced activation of the pSTS and dMPFC during these tasks, which may explain why these individuals have severe deficits in joint attention and gaze following (Inui, 2013).

Scanning studies suggest that there is localized overconnectivity in the autistic brain, causing the hyper-activation of certain areas (Inui, 2013). However, most research has focused on examining the long-range underconnectivity between areas, which weakens important neural

networks. Most notably, there appears to be reduced connectivity of the amygdala to other important brain areas including the STS, temporoparietal junction (TPJ), inferior frontal gyrus (IFG), and OFC in individuals with ASD (Inui, 2013). Because the amygdala has been implicated as one of the most important structures in "social brain" networks, it is clear that dysfunction of the amygdala may contribute to some of the socially inappropriate behaviors characteristic of ASD. Neuroimaging studies revealing impaired neural networks in the autistic brain provide convincing evidence for the argument that autism has a genetic or biological basis.

Growth factors. Other evidence for a genetic basis of autism comes from growth factor studies. A number of different *growth factors* (typically proteins or hormones) are known to stimulate cell proliferation and differentiation in the nervous system. These growth factors play an important role in brain development and the maintenance of neurons and neuronal connections throughout the lifespan. It has been hypothesized that abnormal levels and functioning of growth factors might contribute to the atypical development of the autistic brain (Nickl-Jockschat & Michel, 2011). For example, researchers have found higher serum levels of epidermal growth factor (EGF) in subjects with autism, supporting the hypothesis that increased EGF levels may contribute to certain structural abnormalities in the brain associated with ASD (Iseri et al., 2010). While serum levels of EGF in autistic individuals were significantly higher than in control subjects, levels of EGF did not vary with the severity of autistic symptoms (Iseri et al., 2010). Current research suggests that the effects of growth factors on the autistic brain could be evidence of an underlying biological basis for the disorder. However, further investigation is needed in this area.

Extreme male brain. It is known that autism is much more common in males than females, with a diagnostic ratio of about 4:1 (male:female). This fact supports the idea that

autism is genetically determined. Simon Baron-Cohen and colleagues developed the Extreme Male Brain (EMB) theory of ASD in an effort to link the preponderance of males diagnosed with the disorder to its etiology. EMB theory is derived from the Empathizing-Systemizing theory of sex differences, which proposes that females have a tendency to empathize while males have a tendency to systemize (Baron-Cohen & Belmonte, 2005). A male advantage in systemizing and deficit in empathizing could contribute to the relative gender imbalance in ASD incidence, as both systemizing and lack of empathy are characteristics of ASD. Baron-Cohen et al. (2011) propose a few different biological mechanisms by which the autistic brain becomes "extremely male." One is fetal testosterone theory, which posits that exposure to excess testosterone during development leads to greater brain masculinization and a subsequent diagnosis of autism. Baron-Cohen et al. (2011) also propose the X and Y chromosome theories, which suggest that genes related to autism might be sex-linked.

Currently disputed theories. There are a number of disputed theories about the etiology of autism that deserve some attention. These theories do not yet have enough supporting evidence to be considered valid, but may prove to be important factors that contribute to the manifestation of the disorder in certain individuals.

Vitamin D. One theory of etiology suggests that a vitamin D deficiency during the gestational period may bring about the development of autism in individuals with a genetic predisposition for the disorder (Cannell, 2010). This theory stems from research showing that autistic symptoms associated with the disease rickets are diminished with increased vitamin D. Additionally, it has been shown that there are higher rates of autism among the children of wealthy college-educated parents. Cannell (2010) suggests that educated mothers are more aware of the dangers of sun exposure and are therefore more likely to use sunscreen and other forms of

sun protection. This increased sun protection reduces the amount of vitamin D exposure in the womb, perhaps leading to increased incidences of autism. However, the vitamin D theory is still very novel and not widely accepted. More research is needed in this area.

Exposure to mercury. Exposure to environmental toxins has also been thought to contribute to the development of ASD. In particular, research has shown that there are higher rates of ASD in areas where there is a large amount of air pollution containing high levels of methyl mercury (Leslie & Koger, 2011). There are especially high rates of autism in urban areas and areas located near factories and power plants, as methyl mercury is produced when coal and other fossil fuels are burned. Oxidative stress and reduced levels of antioxidant activity have been observed in individuals with ASD, which are conditions typically associated with exposure to environmental pollutants. Thus, there is potentially a link between methyl mercury exposure and autism mediated by oxidative stress (Leslie & Koger, 2011). However, this research is purely correlational in nature. It is likely that mercury co-occurs with other potentially harmful pollutants, making it difficult isolate methyl mercury as a risk factor for autism. More compelling evidence is required before this theory can be widely accepted.

Treatments

A plethora of different treatments have been developed and tested on individuals with autism spectrum disorder. Some, such as Applied Behavior Analysis and the Floortime model are backed by sound empirical evidence and have proven to be very successful in treating some of the symptoms of ASD. Others, like holding therapy, facilitated communication, and sensory integration therapy are considered by the scientific community to be ineffective fad treatments. Some of the available treatment methods for individuals with ASD will be reviewed below.

Behavioral therapies. Behavioral treatment is considered to be the single most effective and empirically supported intervention for children with autism available today. This type of therapy is based on principles of behaviorism, and typically uses operant conditioning to modify behavior through reinforcement and/or punishment. Behavior modification methods help individuals with autism acquire new behaviors or change existing behaviors. Some behavioral interventions focus on the antecedents of behavior and some focus on the consequences. Techniques include discrete trial training, shaping of successive approximations, and extinction of unwanted behaviors, among many others. Behavioral treatment is always highly individualized for the specific child (New York State Department of Health, 1999).

Applied behavior analysis. The field of Applied Behavior Analysis (ABA) is based on Skinnerian principles of behaviorism, particularly the use of positive and negative reinforcement and punishment in operant conditioning paradigms. The first therapeutic applications of behaviorism involved using electric shock to reduce self-stimulation and tantrums in a group of children diagnosed with schizophrenia, as well as to teach those children to approach and interact with adults appropriately. Electric shock was administered whenever the children engaged in self-stimulation or tantruming (positive punishment), weakening those inappropriate behaviors. The children avoided electric shock by interacting appropriately with adults, strengthening socially appropriate behaviors (Lovaas, 1965). Despite the historical success of punishment (whether through forceful reprimands or more physically) in some cases, it is rarely used in current behavioral applications.

ABA, in its current form, emerged from Lovaas' pilot study in 1987. In this study, the progress made by a group of 19 young autistic children receiving intensive behavioral treatment (40+ hours per week) was compared to the progress made by a control group of 40 receiving

only some behavioral treatment (10 hours per week). A second control group received no treatment at all. Lovaas (1987) used discrete trial training techniques to teach language and play skills and to decrease aggressive behaviors in the participants. Ultimately, 47% of the children in the intensive treatment group achieved normal intellectual functioning and were able to enter a typical school setting by first grade, as compared to only 2% of the control group subjects (Lovaas, 1987). Though the Lovaas (1987) study provided convincing preliminary evidence for the efficacy of intensive behavioral treatment, it has since been critiqued. The experimental design was flawed, as participants were not randomly assigned to either the experimental or control group (Gernsbacher, 2003). Instead, group assignment was based on the availability of therapists at the time. Due to selection bias, it is possible that pre-intervention variables affected the outcome of Lovaas' (1987) study. Unfortunately, this limitation weakens the compelling results of this landmark study (Gernsbacher, 2003).

In a more recent study, 34 individuals with an explicitly documented history of ASD received scores on the ADOS (Autism Diagnostic Observation Schedule) that were not significantly different from scores among a group of typically developing (TD) individuals after undergoing behavioral therapy (Fein et al., 2013). These 34 individuals demonstrated social and communication skills on par with those of age-, race-, and IQ-matched TD individuals, providing evidence that it is possible for a person to lose the ASD diagnosis over time (Fein et al., 2013). In light of these findings, effective therapies like ABA are all the more valuable as they can potentially help a developmentally delayed child achieve normal functioning. Lovaas' (1987) study was the first of many to provide sound empirical evidence for the effectiveness of behavioral interventions, opening the door to a field that has since grown exponentially and helped thousands of individuals affected with ASD.

DIR/Floortime. The DIR (developmental, individualized, relationship-based) model of autism treatment is based on the theory that the symptoms associated with ASD are a result of biological processing deficits, which prevent the child from engaging in typical relationships and emotional interactions. The DIR approach couples speech therapy, occupational therapy, and other therapies with "floor time therapy" to help the child overcome his or her processing difficulties and form healthy relationships (New York State Department of Health, 1999). Greenspan and colleagues developed floor time therapy as a novel intervention intended to address the specific developmental needs of each child in a social context. Floor time addresses the three core deficits of autism through intensive, one-on-one, play-based therapy that is usually administered by a trained parent or caregiver. The therapy is tailored to each child's individual differences, and uses affective interactions to pull the child into a more advanced developmental level (Greenspan & Wieder, 1997).

Empirical support for the floor time model comes from the PLAY (Play and Language for Autistic Youngsters) Project Home Consultation program, in which parents were taught the principles of play-based intervention as well as how to respond to their child's unique needs (Solomon, Necheles, Ferch & Bruckman, 2007). Parents were given monthly support through individualized coaching, assessment, and written goals that allowed them to continuously adjust their treatment techniques. 45.5% of the children in the PLAY Project made significant functional developmental gains based on their Functional Emotional Assessment Scale scores. However, there were several critical methodological issues with the PLAY Project (no control group and lack of significant progress on more rigid clinical scales), causing the effectiveness of floor time therapy to remain in question. Floor time therapy is generally recommended as one

component of a more complex treatment package, rather than a standalone treatment for children with autism (New York State Department of Health, 1999).

Sensory therapies. Sensorimotor input during infancy is critical for healthy cognitive development. However, it is believed that infants with autism are unable to process sensory information in the same way as typical infants. The purpose of sensory therapy is to help children with autism overcome neurologically based sensory processing deficits by exposing them to a variety of extreme sensory experiences (New York State Department of Health, 1999). Over the years, a number of different sensory experiences (e.g., weighted blankets, auditory training) have been thought to ameliorate the symptoms of autism. Most of these ideas have now been discredited (New York State Department of Health, 1999), but they still play an important role in the historical context of autism treatments. Sensory integration therapy and holding therapy are examples of specific therapeutic techniques that emerged from the sensory therapy school of thought.

Sensory integration therapy. Sensory integration therapy is based on the idea that people with autism lack the neurological ability to integrate multiple sensory inputs in order to form coherent information about the world. This type of therapy usually consists of directed play activities designed to expose children to heightened sensory intake (New York State Department of Health, 1999). In a recent study, a group of autistic children were exposed to a wide variety of sensorimotor enrichments including odorants, textured objects, objects to manipulate, music, balancing activities, and more (Woo & Leon, 2013). Forty-two percent of the children who were exposed to sensorimotor enrichment exhibited significant improvement on the Childhood Autism Rating Scale (as compared to only 7% of the control group) after 6 months (Woo & Leon, 2013). This study demonstrated that sensorimotor enrichment is able to significantly reduce the severity

of autistic symptoms and improve cognitive performance. It is important to note, however, that all subjects were receiving other forms of treatment (such as ABA) simultaneously. Sensorimotor enrichment alone has not yet proven to be an effective treatment for ASD.

Holding therapy. Holding therapy is a treatment derived from attachment theory and based on the idea that a fundamental deficit of ASD is the inability to form healthy attachments to other people (Dozier, 2003). This type of therapy involves a parent or caretaker physically holding the autistic child in an embrace for a certain period of time, despite all verbal and physical resistance from the child. This forced holding is supposed to create a bond between the parent or caretaker and the child. However, this type of therapy is not empirically supported and is in fact inconsistent with many elements of the attachment perspective. Physical restraint can instead cause the child to feel shame and rage, traumatizing the child and preventing healthy attachment (Dozier, 2003). Holding therapy and other touch therapies are not recommended as an intervention for children with autism (New York State Department of Health, 1999).

Other treatments. Drug therapies and dietary modifications are other techniques that have been proposed for the treatment of ASDs. While these therapies may be useful in managing some of the symptoms associated with ASD, it is not recommended that they be used as the primary course of treatment for an individual with autism (New York State Department of Health, 1999).

Drug therapy. A number of different types of drug therapies have been used to manage the symptoms associated with autism, though these therapies are generally not recommended as overall treatments for the core characteristics of the disorder (New York State Department of Health, 1999). Psychoactive medications, including neuroleptics and mood stabilizers, have been used to reduce problem behaviors associated with ASD such as tantrums and aggression.

Stimulants, sedatives, and SSRI's have also been used to address various symptoms associated with autism (including inattentiveness, self-injury, and perseveration). Other drug therapies, including hormone therapies and immunologic therapies, are not recommended because they neither manage behaviors nor address the core symptoms of ASD. Administration of vitamin B_6 and magnesium was once thought to ameliorate neurological problems associated with vitamin deficiencies, but this type of treatment has now been discredited. Today, it is generally recommended that psychoactive medications be used with caution to manage behaviors associated with autism, but only in conjunction with a sound behavioral treatment plan (New York State Department of Health, 1999).

In the future, there will likely be efforts to develop more targeted drug treatments that can control dysfunctional neurotransmitter systems in individuals with ASD (Gürkan & Hagerman, 2012). Two classes of drugs, a $GABA_B$ agonist and an mGluR5 antagonist, have already been developed to treat symptoms of fragile X syndrome. Clinical trials are still ongoing to demonstrate the effectiveness of these new treatments in fragile X populations. Similar targeted drug therapies may also prove to be effective for individuals with ASD.

Dietary modifications. It has been suggested that elimination of gluten (wheat products) and casein (dairy products) from the diet can improve the symptoms associated with ASD. The theory behind this type of elimination diet is that children with autism are more likely to have food allergies, a point that is controversial and not empirically supported. Supposedly, food allergies exacerbate the symptoms of autism by causing higher blood levels of opiate-like chemicals (New York State Department of Health, 1999). A recent review of the research on gluten-free casein-free (GFCF) diets for individuals with ASD concluded that there is very little

scientific evidence that GFCF diets are effective for individuals with ASD. The evidence that does exist is generally either flawed or inconclusive (Zhang, Mayton & Wheeler, 2013).

Functional Behavior Assessment

The term *functional analysis* was first used by Skinner to describe demonstrations of the cause-and-effect relationship between environmental variables and specific behaviors (Schlinger & Normand, 2013). Skinner described environmental variables as the "independent factors" and behavior as the "dependent factor" in a functional relationship. In Skinner's view, the function of a behavior could only be understood in light of the variables that cause it. In other words, certain behaviors occur only when particular environmental factors exist. Thus, a functional analysis must take place before behavior can be predicted and controlled (Schlinger & Normand, 2013).

Today, the term *functional behavior assessment* (FBA) is commonly used in the field of ABA to refer to an important method of clinical assessment. FBA allows clinicians to identify the antecedents and reinforcing consequences for a particular behavior before creating a treatment plan (Schlinger & Normand, 2013). Iwata et al. (1982) first used the methods of FBA on a group of subjects with autism in a study that analyzed the precursors to self-injurious behavior episodes. The researchers placed subjects in a variety of different stimulus conditions, including "social disapproval," "academic demand," "unstructured play," and "alone." In the "social disapproval" condition, the experimenter expressed disapproval and concern each time the subject engaged in self-injurious behavior, approximating an attention-maintained positive reinforcement contingency. In the "academic demand" condition, the subject was presented with an appropriate educational task. The task was removed if self-injury occurred, approximating an escape-maintained negative reinforcement contingency. In the "unstructured play" condition, the experimenter occasionally interacted with the subject but ignored all self-injurious behavior

episodes. This condition was meant to serve as a control for the presence of the experimenter. Finally, in the "alone" condition, the subject was placed alone in a room without any toys or other materials in order to approximate an "impoverished" environment. The researchers observed the frequency with which self-injury occurred in each condition, isolating various variable-behavior contingencies. This method allowed the researchers to identify which variables most effectively maintained the self-injurious behavior (Iwata et al., 1982).

Functional behavior assessment has become a fundamental component of ABA therapy, as it allows clinicians to determine what variables are causing and maintaining a problem behavior. This information enables the clinician to devise a treatment plan addressing those antecedents and consequences, and providing the individual with more adaptive ways to respond to environmental events. The principle of *extinction* states: "if a response has been increased in frequency through positive reinforcement, then completely ceasing to reinforce the response will cause it to decrease in frequency" (Martin & Pear, 2003). Extinction is often incorporated into ABA treatment plans because if an individual emits a response that was once reinforced but is no longer followed by its reinforcing consequence, then the individual will be less likely to emit that response again in the future (Martin & Pear, 2003). Thus, if the reinforcing consequences of a problem behavior can be identified and removed from the environment, that disruptive behavior should begin to decrease. Another technique often used in ABA treatment is *differential reinforcement*, which can involve either the selective reinforcement of alternative "good" behaviors or reinforcement of the absence of problem behaviors (Martin & Pear, 2003). Differential reinforcement results in an increase in desirable behaviors and decrease in the targeted behavior, making it a useful treatment for problem behavior.

The Present Study

The present study focused on how empirically supported treatments can be used to address some of the undesirable behaviors associated with a diagnosis of ASD. Specifically, ABA techniques were utilized to reduce the disruptive behavior of a 4-year-old girl with developmental delays. First, a functional behavior assessment was conducted to determine what variables were causing and maintaining the subject's problem behavior. Then, a behavior modification plan was proposed to reduce the frequency of the behavior and teach the subject to act in a more socially appropriate manner. Ultimately, the present case study sought to demonstrate how FBA, extinction, and differential reinforcement can be practically applied in a clinical setting to reduce undesirable behavior and help an individual function in a more socially appropriate manner.

Method and Results

Participant

The participant in the present study was a 4-year-old female student with developmental delays similar to those associated with ASD. The student was recommended for this study by the teaching staff at her school, a program that primarily uses ABA techniques to teach young children with ASD the skills they need to enter an integrated school setting. The subject was verbal and relatively high functioning, but engaged in tantruming behavior, aggression, and self-injury throughout the day. This behavior was disruptive not only to the child's own academic and therapeutic activities, but also to other students and staff. The subject was not compensated for her participation in any way, as the study was incorporated into her regular programming throughout the school day.

Behaviors. Three of the subject's disruptive behaviors were isolated and operationalized for the present study. "Tantruming" was defined as "task avoidance including, but not limited to, lying on the floor, screaming, dropping to the floor." "Aggression" was defined as "any aggression towards others including, but not limited to, hitting, [and] kicking." "Self-Injurious Behavior (SIB)" was defined as "including, but not limited to, slapping face, slapping head, head banging, [and] slapping hands."

Materials

A-B-C Behavior Card. ABC data were collected using a form developed by *The PDA Center, Professional Development in Autism* (provided by The Promise Program at Upstate Cerebral Palsy). The form included a checklist of possible antecedents to the problem behavior, such as demand/request, attention given to others, transition, new task, preferred object/activity removed, unpreferred activity/object, difficult task/activity, told "no," and other. There was space for a description of the disruptive behavior. The form also included a checklist of possible consequences, such as verbal redirect, physical redirect, ignored, activity/materials/task taken away, calming/soothing of student (verbal/physical/both), physical restraint, help/assistance given, and other. An ABC form was filled out for each episode of problem behavior that occurred during school hours for approximately one month.

Motivation Assessment Scale. *The Motivation Assessment Scale* (Durand & Crimmins, 1988) was used to assess three of the subject's operationally defined behaviors, including "task avoidance," "aggression towards others," and "self-injurious behavior." The MAS is a questionnaire designed to identify what variables are typically present when a given behavior occurs. The rater answers a series of questions about the behavior, assigning a score from 0 ("Never") to 6 ("Always") to each item. Questions include items such as: "Does the behavior

occur following a request to perform a difficult task?" "Does the behavior occur when you take away a favorite toy, food, or activity?" "Does this person seem to do the behavior to upset or annoy you when you are trying to get him or her to do what you ask?" Subscale scores can be computed for four categories of consequence: "Sensory," "Escape," "Attention," and "Tangible."

Method: Functional Behavior Assessment

An FBA was used to identify the antecedents and consequences of the subject's disruptive behavior. The subject was observed in her normal school environment while she engaged in discrete trial training sessions as well as physical, speech, and occupational therapy. Antecedent-Behavior-Consequence (ABC) data were collected for each occurrence of the subject's problem behavior (tantruming, aggression, and/or self-injurious behavior [SIB]). Details were recorded about the events taking place just prior to the behavior, the nature of the behavior itself, and how the teaching staff responded to the behavior. Then, the environmental events that most commonly preceded the behavior and how the staff typically responded to the behavior were computed.

Results: Functional Behavior Assessment

A-B-C data. A total of 50 problem behavior episodes were observed for the FBA. All observed disruptive behavior episodes could be characterized as including SIB, aggression, tantruming, or any combination of the three. Of the three types of disruptive behavior, tantruming was the most prevalent, occurring during 94% of the total episodes. Aggression occurred during 38% of the total episodes. SIB occurred during 18% of the total episodes.

Antecedents. SIB was most commonly preceded by "told 'no'" (44% of episodes) and "demand/request" (33%). Aggression was most commonly preceded by "demand/request" (63%), "transition" (26%), or "preferred object/activity removed" (26%). Tantruming was most

commonly preceded by “demand/request” (34%), “told ‘no’” (30%), or “preferred object/activity removed” (21%). Over all categories of disruptive behavior, the most common antecedents for episodes of problem behavior were “demand/request” (36%), “told ‘no’” (30%), and “preferred object/activity removed” (20%). See Table 1 for more information.

Consequences. SIB was most commonly followed by “verbal redirect” (100% of episodes), “physical redirect” (78%), and “verbal and physical calming/soothing of student” (44%). Aggression was most commonly followed by “verbal redirect” (74%), “physical redirect” (37%), or was “ignored” (26%). Tantruming was most commonly followed by “verbal redirect” (70%), “physical redirect” (34%), or was “ignored” (21%). Over all categories of disruptive behavior, the most common consequences for episodes of problem behavior were “verbal redirect” (68%), “physical redirect” (32%), and “ignored” (22%). See Table 2 for more information.

In summary, episodes of problem behavior were typically initiated when the subject was given a demand or a request, the subject was told “no” for some reason, or a preferred object or activity was taken away from the subject. Problem behavior episodes appear to have been maintained by attention given to the subject through verbal and/or physical redirection from staff members.

Motivation Assessment Scale (MAS). For all three types of problem behavior (SIB, tantruming, and aggression), the subject received the highest scores for “Tangible” and “Escape” functions on the MAS. “Sensory” and “Attention” functions were not motivating for the subject. See Table 3 for a complete list of the subject’s scores.

Method: Intervention

Informed by the FBA and MAS, an intervention was developed to reduce the frequency of the subject's disruptive behavior and allow her to develop more socially appropriate patterns of behavior. The intervention to reduce problem behavior incorporated two common ABA techniques: extinction and differential reinforcement of other behavior (DRO). The staff aimed to extinguish the subject's problem behavior by ignoring the behavior when it occurred, thus eliminating the maintaining consequence of attention. Additionally, a token system was introduced and used consistently throughout the school day during all of the subject's activities, therapies, and DTT sessions. During each half-hour period, the subject had the opportunity to earn ten "tickets" for engaging in appropriate behavior and remaining free of problem behavior. These tickets were distributed on an informal variable ratio schedule of reinforcement, in which not every appropriate response was reinforced, but good responses were reinforced periodically at the discretion of staff members. The delivery of each ticket was contingent upon the spontaneous emission of a desirable response (e.g. "good waiting" or "good working"). Disruptive behavior postponed the opportunity to earn a ticket and only appropriate behavior was rewarded, making the token system a DRO procedure.

Over the course of several sessions, the rate of reinforcement was reduced twice. Initially, the subject earned all ten tickets over the course of a half hour period and was then allowed to spend 5 minutes playing games on her iPad (Phase 1). The staff ensured that the subject earned all of her tickets during the half hour period by reinforcing successive approximations of good behavior or prompting appropriate responses during Phase 1. After 3 weeks spent in Phase 1, the period over which the tickets were earned was increased from one half to one hour (Phase 2). The staff again ensured that the subject earned all 10 tickets over the course of the hour. After 4

weeks spent in Phase 2, the restriction on the period was further relaxed, so the subject earned the ten tickets at the discretion of the staff without any time limitation (Phase 3). It typically took just over an hour to earn all 10 tickets during Phase 3. Disruptive behavior was ignored as much as possible throughout the intervention. Problem behavior episodes continued to be recorded to determine whether the intervention was effective. Data on the frequency and duration of problem behavior episodes as well as the types of behavior occurring during each episode were collected during two-hour time samples throughout the subject's typical school day.

Results: Intervention

Frequency. At baseline, the subject exhibited high rates of problem behavior (see Figure 1). After the token system intervention had been implemented and the subject was receiving reinforcement (access to her iPad) at half-hour intervals (Phase 1), the frequency of problem behavior decreased. As commonly occurs, the frequency of problem behavior first increased when the reinforcement interval was increased to one hour at the beginning of Phase 2. Such a transient increase in a behavior when it is first ignored (extinguished) is known as an *extinction burst*, or an initial increase in response frequency and/or duration at the beginning of extinction (Lerman & Iwata, 1996). After a few days, the rate of problem behavior dropped again. There was an unusual spike in problem behavior on Day 8, but the frequency of behavior episodes generally decreased during Phase 3.

Duration. The total duration of problem behavior episodes was shorter during Phase 1 and the beginning of Phase 2 than it had been at baseline (see Figure 2). Near the end of Phase 2 and during Phase 3, there was an increase in the duration of problem behavior episodes. Though there were fewer episodes of disruptive behavior during these phases, some of the tantrums were lengthy (greater than 12 minutes).

Types of problem behavior. Over time, across all experimental phases, there was a steady increase in the occurrence of SIB during the subject's problem behavior episodes (see Figure 3). There was a decrease in aggression during Phases 1 and 2, though the prevalence of aggression increased once again during Phase 3 (see Figure 4). Tantruming was consistently the most common type of problem behavior, occurring during almost every episode across all 3 phases.

Discussion

Consistent Findings

The purpose of functional behavior assessment is to identify the variables causing and maintaining a particular behavior so that those variables may be addressed by an appropriate treatment plan (Schlinger & Normand, 2013). In the present study, the FBA revealed that the most common antecedents of the subject's problem behavior (overall) were the presentation of demands and requests or the subject being told "no." The token system intervention was designed with this information in mind, rewarding the subject with tokens when she complied with demands or appropriately responded to the word "no." A token system such as the one used in this study reinforces good behavior and extinguishes bad behavior.

The FBA also showed that verbal and physical redirections by the staff were the most common consequences of the subject's problem behavior. Additionally, the MAS results suggested that the subject was motivated by a desire to obtain something ("Tangible") or to avoid an undesirable task or situation ("Escape"). Informed by these observations, the extinction procedure aimed to eliminate problem behavior by removing its maintaining consequences and ignoring it. Ignoring the behavior prevented the subject from obtaining the object or attention she wanted and also precluded her from escaping the task or situation she was trying to avoid.

Differential reinforcement of good behavior combined with a lack of reinforcement for problem behavior was meant to extinguish the subject's poor behavior while strengthening her repertoire of appropriate behavior.

With this behavior plan in place, the frequency of problem behavior episodes decreased as expected. In fact, the intervention was effective even when first introduced in Phase 1. The bursts of bad behavior at the beginning of Phases 2 and 3 were not unexpected and can be explained by the longer time intervals between reinforcement eliciting an extinction burst. Both were followed by a subsequent decrease in the frequency of behavior. Additionally, the total duration of problem behavior decreased as expected during Phases 1 and 2.

Unexpected Findings

The intervention was less effective in decreasing the frequency and duration of problem behavior when the time interval between reinforcement was no longer predictable, in Phase 3. During Phase 3, the subject was rewarded after 10 occurrences of unprompted good behavior – regardless of how long it took for her to engage in those 10 behaviors. Typically, it took over an hour for the subject to earn all 10 tickets during this Phase. The lack of a predictable interval of reinforcement was accompanied by an increase in the total duration of problem behavior (see Figure 2). Though problem behavior episodes were less frequent during Phase 3, they lasted longer and were more intense.

It is also important to note that Day 8 of data collection was an outlier in both the frequency and duration data (see Figures 1 and 2). Though the subject was still earning her iPad once an hour, she had more problem behavior on Day 8 than at any other point in Phase 2. Due to a combination of the subject's own poor behavior and other demands in the classroom that prevented the teachers from distributing all of her tickets, the subject only received 8 out of 10

tickets by the end of the first hour and therefore was denied access to her iPad. Withholding the iPad and restarting the token board was disruptive, resulting in an increase in problem behavior during the second hour on day 8.

Finally, it is interesting that self-injurious behavior increased and aggressive behavior decreased over time. This shift in the *type* of problem behavior could be part of an extinction burst, which often includes an initial increase in the variability of a response during extinction (Lerman & Iwata, 1996). The subject's problem behavior seemed to become more self-directed and less other-directed over time, which was not the intent of the intervention. However, this outcome could be beneficial for the subject, as aggression towards others is probably the most alienating of her problem behaviors in any given social environment. Nevertheless, it is also potentially dangerous and unhealthy for the subject to be engaging in negative self-directed behaviors, so this outcome is not necessarily desirable.

Limitations

The biggest limitation of the present study was overall inconsistency in implementing the token system. It was impractical to be perfectly consistent with the reinforcement procedure, as the subject worked with many different staff members and participated in a variety of activities each day. There was inconsistency across staff members, as staff members had different levels of familiarity with the subject and the intervention itself. Because it was at the discretion of the staff to reward "good" behaviors with tokens, reinforced behaviors varied greatly. The prevalence of "good" versus "bad" behavior was also dependent on the activity the subject happened to be engaging in and the availability of the staff to pay close attention to the subject during that activity.

It was also impractical to be perfectly consistent with the extinction procedure. Due to the nature of the classroom setting and the proximity of other students, it was not always possible to ignore problem behavior. Sometimes it was necessary for teachers to redirect the subject for the safety of themselves, other students, and the subject herself. In particular, the staff could not ignore self-injurious behavior such as head banging, as it was very risky. Staff members physically redirected self-injurious behavior to prevent the subject from injuring herself. Thus, whenever the subject engaged in SIB, she immediately received attention from the staff. The attention she received through physical redirection could have been helping to maintain the self-injurious behavior, possibly explaining why the prevalence of SIB increased over time.

Additionally, the token system itself changed several times as the staff learned new information about the subject and tried to make the intervention as potent as possible. Furthermore, the reward for earning all 10 tokens was not always consistent. Because the token system was repeatedly altered, its effectiveness as a conditioned reinforcer may not have been fully realized.

Suggestions for Future Research

In the future, a more traditional DRO procedure might be a very effective intervention for this particular subject. The token system used in the current study might have been more potent if it was required that the subject maintain her good behavior for a certain interval of time before receiving each token, rather than specific appropriate behaviors being immediately reinforced. This interval of good behavior could then be gradually increased. In a more traditional DRO, it would essentially be the *absence* of problem behavior that would be rewarded with each additional token. The subject would only gain access to her reinforcer by remaining completely

free of problem behavior for a certain interval of time. This design could be more effective at reducing problem behavior in the subject's repertoire.

Additionally, it would be useful to consider some alternative consequences that could be applied to the problem behavior in order to reduce it. Since the disruptive behavior cannot always be ignored, perhaps some undesirable consequence could be applied when the bad behavior does occur and must be redirected. For instance, rather than just physically redirecting her SIB (which is a maintaining consequence of the behavior), the staff might redirect the behavior when necessary but also remove one of the tokens from the subject's token board whenever she engages in SIB. Negative punishment (removing something desirable from the environment in order to reduce the frequency of a behavior) could be an effective tool in this particular intervention.

Implications of the Current Study

Overall, the token system intervention and extinction procedure effectively reduced both the frequency and duration of problem behavior in a preschooler diagnosed with developmental delays. The subject's disruptive behavior decreased once the behavior modification plan was in place, particularly when she received reinforcement on a half-hour or one-hour schedule. The present study provides support for the efficacy of ABA assessment and treatment techniques, including FBA, extinction, and differential reinforcement. This study demonstrates how these techniques can be used to reduce problematic behaviors such as aggression, tantruming, and self-injurious behavior so that individuals with ASD and related disorders may engage in more functional and socially appropriate behaviors. With a few adjustments to the current intervention, it is likely that a token system could be used to manage this student's problem behavior in a typical school setting. These findings are promising for the future success of this student.

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Appendix
Parental Permission Letter and Form

Dear Parent(s),

My name is Nicole LaPan and I am a Psychology major at Hamilton College. I am currently working on my senior thesis project with a focus on how the technique of Functional Behavior Assessment is used to identify the causes and consequences of problem behavior.

The teaching staff at the Promise Program has suggested your daughter as a possible participant in my study. This project will be completed in conjunction with her teachers. With your permission, I will collect and analyze data pertaining to behaviors observed by myself and Promise Program staff.

All information will be handled in a way to protect the identity of you and your daughter. The information acquired in the project will be available for your inspection at any time. My project will entail using the well-established technique of Functional Behavior Assessment to identify why your daughter may engage in challenging behavior in the school setting and what types of consequences maintain that behavior. I will observe your daughter in her regular academic and therapeutic activities and collect data about her behavior. Then I will analyze the data and collaborate with staff on a plan of action for improving her behavior. This process will allow us to develop possible interventions that will lead to the most positive educational outcomes. Identities will remain confidential throughout the research and in the final paper. There should be no negative consequences to your daughter from participation in this study. A summary of the results will be made available to you upon request at the end of the study.

If you have any questions about this research project, please feel free to contact me at (781) 354-6531 or nlapan@hamilton.edu, or my faculty supervisor, Professor Jonathan Vaughan, at (315) 859-4719 or jvaughan@hamilton.edu. Questions or concerns about institutional approval should be directed to Sharon Rivera, Chair of the Institutional Review Board for Human Subjects, (315) 859-4223 or srivera@hamilton.edu. Thank you for your time and cooperation with this project!

Sincerely,

_____ _____ _____

Student Researcher Jonathan Vaughan, Senior Project Supervisor Date

PERMISSION TO PARTICIPATE IN RESEARCH FORM

I (We) give permission for my (our) daughter, _____, to participate in the research study conducted by Nicole LaPan, a student at Hamilton College, between December 2013 and May 2014. I understand the study will require observation of her behavior in order to develop possible interventions that will help lead to the most positive educational outcomes. All information relating to her will be coded to de-identify the information, viewed only by the Senior Project student and her supervisor, and will be available for my inspection at any time. Identities will remain confidential throughout the research and in the final paper. No information about my (our) daughter will be taken from the program without my (our) written permission.

The researcher has explained the proposed methodology to me (us) and I (we) understand that all involved in the research will work to minimize any potential harm to my (our) child. Further, I (we) understand that the risk of harm is anticipated to be very low. I (We) hereby give permission for my (our) daughter to participate in the above described study as evidenced by my (our) signatures below:

_____	_____
Signature	Signature
_____	_____
Relationship to Program Participant	Relationship to Program Participant
_____	_____
Date	Date

** If you have any questions about this research project, please feel free to contact Nicole LaPan at (781) 354-6531 or nlapan@hamilton.edu, or her faculty supervisor, Professor Jonathan Vaughan, at (315) 859-4719 or jvaughan@hamilton.edu. Questions or concerns about institutional approval should be directed to Sharon Rivera, Chair of the Institutional Review Board for Human Subjects, (315) 859-4223 or srivera@hamilton.edu. Thank you for your time and cooperation with this project!

Tables

Table 1. Number of problem behavior episodes preceded by various antecedents

Antecedent	*Episodes with SIB*	*Episodes with Aggression*	*Episodes with Tantruming*	*Total Episodes*
Demand/Request	3	12	16	18
Attention given to others	0	1	1	1
Transition	2	5	7	7
New task	1	1	1	1
Preferred object/activity removed	2	5	10	10
Difficult task	0	0	1	1
Told “no”	4	4	14	15
Other	0	2	10	10

Table 2. Number of problem behavior episodes followed by various consequences

Consequence	*Episodes with SIB*	*Episodes with Aggression*	*Episodes with Tantruming*	*Total Episodes*
Verbal redirect	9	14	33	34
Physical redirect	7	7	16	16
Ignored	2	5	10	11
Activity/materials/task taken away	1	2	3	3
Verbal calming/soothing	1	0	2	2
Verbal & physical calming/soothing	4	4	5	5
Blocked	0	4	2	4
Other	1	0	1	1

Table 3. Motivation Assessment Scale scores

	SIB	*Aggression*	*Tantrum*
Sensory	0	0	0
Escape	3.35	3.5	3.75
Attention	0.25	0.25	0.5
Tangible	3.75	4	4

Figures

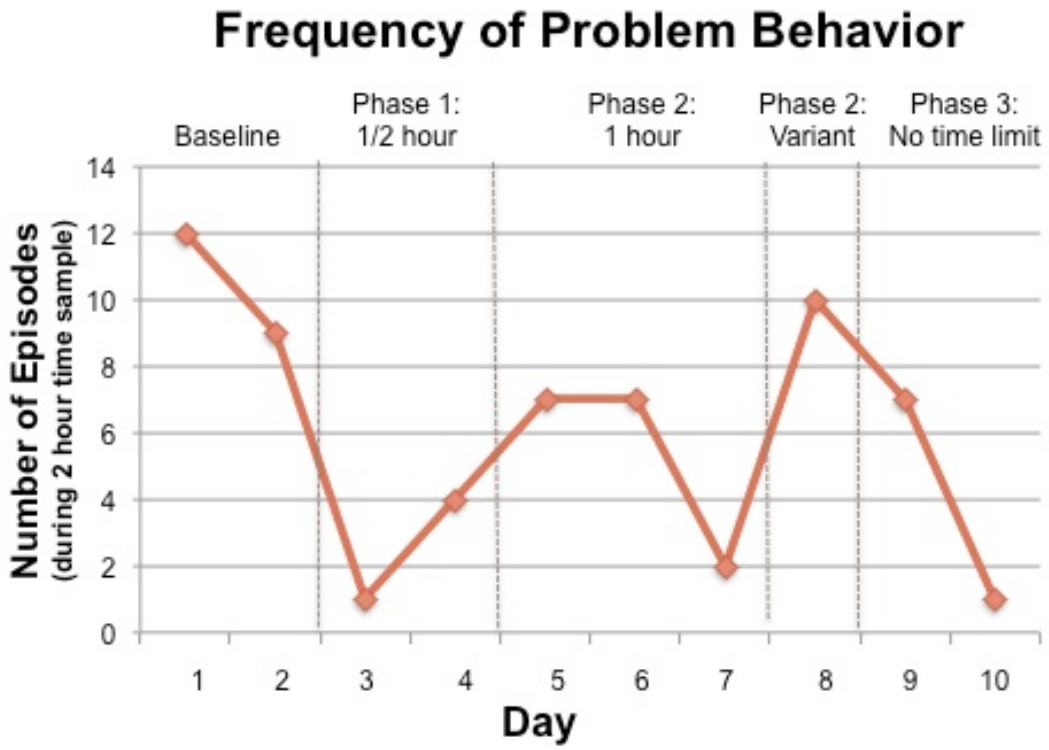

Figure 1. Frequency of problem behavior episodes (per two hour time sample) across experimental phases

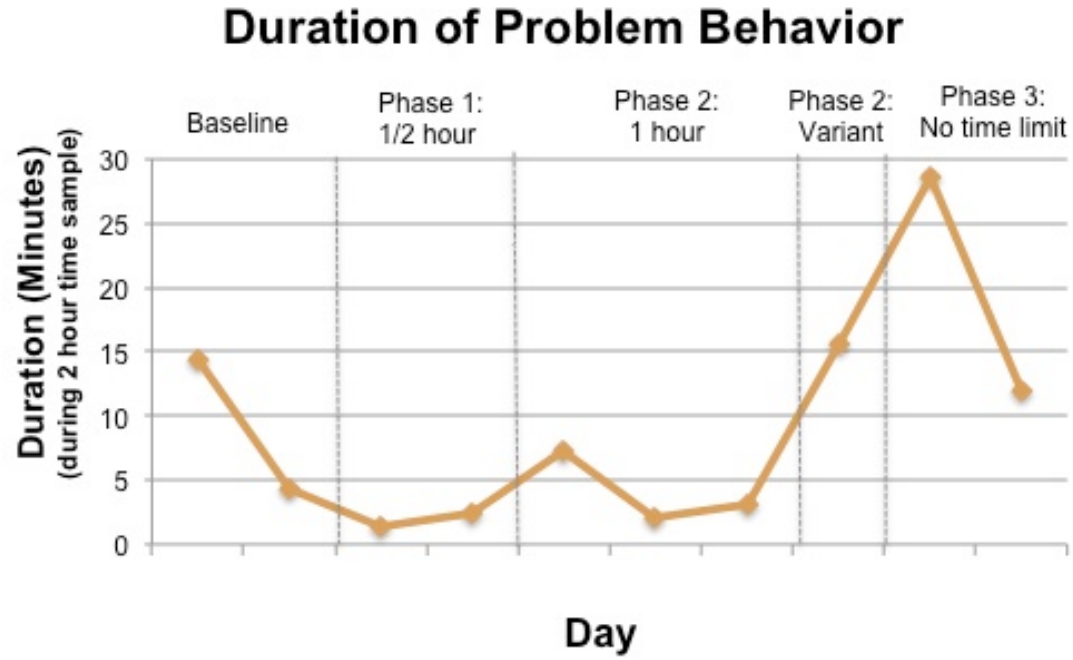

Figure 2. Total duration of problem behavior episodes (per two hour time sample) across experimental phases

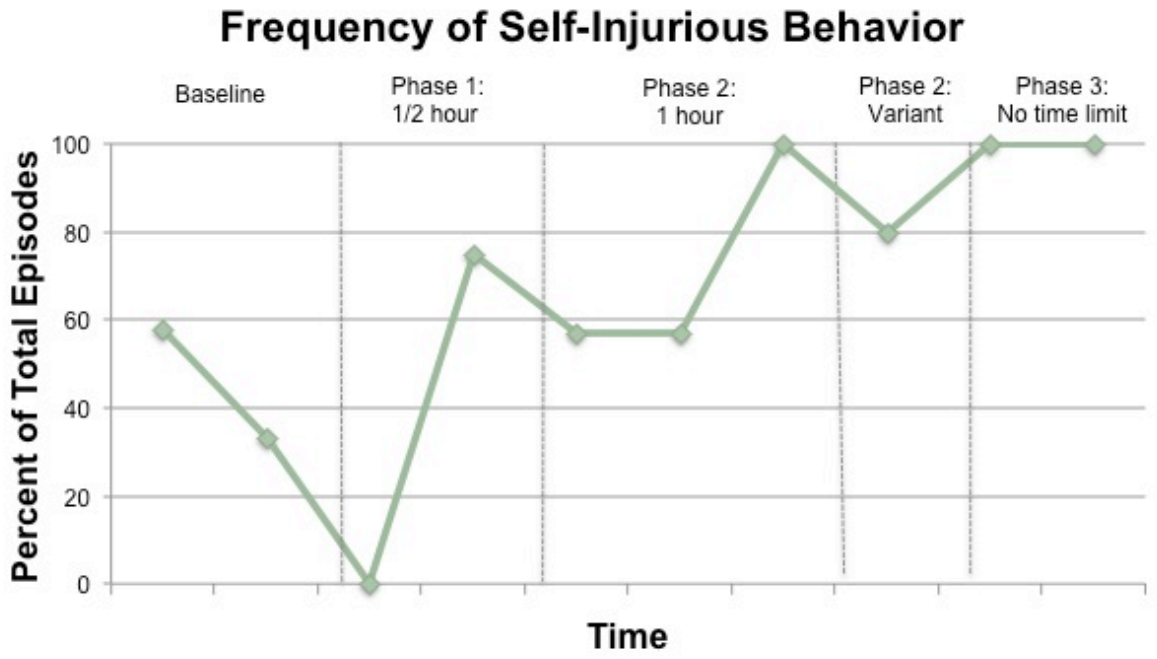

Figure 3. Percent of total problem behavior episodes that involved SIB at some point during the episode across experimental phases

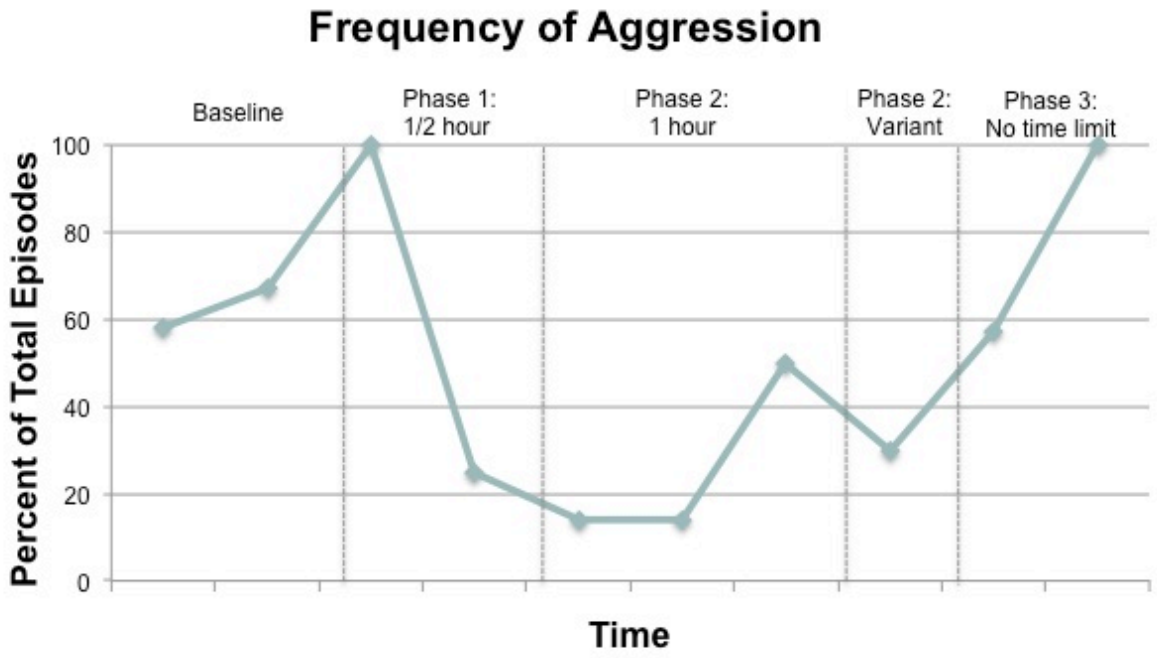

Figure 4. Percent of total problem behavior episodes that involved aggression at some point during the episode across experimental phases