The Most Commonly Reported Behavior Analytic Methods in Early Intensive Autism Treatments

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Abstract Early intensive behavioral interventions have become a very popular treatment in the field of autism spectrum disorders. Given the rapidly expanding use of these methods and the amount of money and resources being devoted to these programs, analyses of these practices is warranted. This paper looks at treatment studies on the topic. The children treated were largely diagnosed with pervasive developmental disorder not otherwise specified or autism diagnoses. One-to-one training was typical as were structured curriculums. The implications of these practices are discussed along with assertions about future direction for research.

Keywords Early intervention · Autism · PDD-NOS · Applied behavior analysis · Discrete trial training

Autism spectrum disorders (ASD) have become a very popular area of study, particularly in the last two decades (Matson et al. 2012). The reasons for this development are multifactorial but include active parent groups, the increased prevalence of the disorder, and the seriously debilitating and lifelong nature of the problem (Hattier et al. 2012; Matson and Kozlowski 2011). The most recent prevalence study estimated that 1 in 88 children in the US have been identified with an ASD (Center for Disease Control and Prevention 2012), which is a 78 % increase compared to a decade ago. Core deficits of ASD include problems with communication, socialization, stereotypies, and rituals (Fodstad et al. 2009; Matson et al. 2009a; Matson et al. 2009c). Additionally, the presence of ASD is often accompanied by a variety of comorbid conditions such as intellectual disability, challenging behaviors, mental health concerns, and medical problems such as sleep problems,

epilepsy, and feeding disorders (LoVullo and Matson 2009; Matson et al. 2005a; Matson et al. 2006; Matson and Rivet 2008; Matson et al. 1998b; Smith and Matson 2010a; Smith and Matson 2010b; Smith and Matson 2010c; Worley and Matson 2011).

These multiple and interlocking behavioral excesses and deficits create incredible challenges for parents and professionals. Coordinating factors such as the need to employ multiple professional and interventions, target large numbers of target behaviors simultaneously, and commit to many hours of intervention per week (Matson et al. 2009b; Matson et al. 2010) is also a great challenge. Having said that, it is critically important to prioritize interventions and targets for interventions. Assuming that only evidence-based methods are used, it is important to employ the techniques that are most likely to be effective while producing the fewest side effects.

Psychotropic medications are often effective but are of concern due to potential adverse side effects. These concerns are greatest for children and those persons with health problems (Matson and Dempsey 2008; Matson and Wilkins 2008; Singh et al. 2005).

Within the context of behavior analytic methods, there is great variability among procedures used. Techniques that have been used in past research and clinical practice include contingent restraint, shaping, chaining, fading, and a host of reinforcements methods (Fodstad and Matson 2008; Matson and Boisjoli 2009a, b; Matson et al. 2005a, b; Matson et al. 2008a; Sturme et al. 2005). Trends in intervention methods have been changing, as more and newer types of behavioral methods come on line, or as older methods are enhanced, modified, or combined with preexisting technologies.

The biggest change has been the development and widespread use of functional assessment/analysis and the teaching of positive responses to replace challenging behaviors using functional assessment. Secondly, the goal of early intensive behavior intervention (EIBI) is to provide a comprehensive

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service that involves the modification of multiple simultaneously targeted behaviors, rather than targeting two to four behaviors at a time; however, while a major “makeover” of the child’s behavioral repertoire may be the goal of EIBI, some prioritizing is needed. There is a recognized high comorbidity of psychopathology and challenging behaviors with ASD as well as high rates of physical conditions such as cerebral palsy, as we have previously noted. As a result, methods and procedures to rank order target behaviors for intervention have become more critical. How this is done and who is responsible for these decisions is haphazard at present. Additionally, as skills are mastered, what methods and procedures will be used to transition to other targets for intervention has yet to be worked out and await further study. The point is that treatment methods, goals, and priorities are evolving at a rapid pace and warrant further study. Summaries of studies to help researchers understand and adjust to evolving patterns of intervention practices are, as a result, quite important.

One of the newer approaches to treat children with an ASD is EIBI. This approach has gained popularity rapidly, largely because few other treatments have emerged as viable, empirically supported approaches for young children. However, applied behavior analysis (ABA) is not a monolith. Rather, it is constructed with many components and techniques, which can be combined in an almost infinite number of treatment packages.

The purpose, then, of the current paper is to provide a review and analysis of commonly used methods of behavior analytic methods of behavior analytic interventions in the early years. Other factors addressed include where intervention was provided, what the staffing/teaching ratios looked like during intervention, where treatment occurred, and the type of ASD the child presented during training.

Because of EIBI’s rapid expansion and growing popularity, many more resources are being expended on these treatments. For example, one recent development has been the passage of laws and policies codifying the use of EIBI for young children with ASD. Additionally, in many cases, these programs are supported by insurance coverage. As a result, a better understanding of what interventions are substantiated best by the research literature is a critical enterprise. In addition, understanding practice patterns for these methods is one element of evidence-based practice that is highly desirable. The purpose of this paper is to describe and summarize some of these developments.

Methods

Scopus was searched using the terms autism, early intervention, and intensive treatment. Reference sections for each article identified in this manner were then searched as a secondary source. All reviews of interventions, follow-ups studies that assessed factors that affected outcome (e.g., age, I.Q., severity of autistic symptoms) were excluded. The studies had to be intensive, which was defined as at least 20 h of intervention per week, provided largely on a one-to-one basis. Also, treatment had to focus on a broad skill set such as attention, symptoms of autism, developmental skills, and other adaptive living skills. Studies which focused on a specific behavior or a set of behaviors in a highly defined area such as joint attention or communication were excluded; this approach mirrors real-world training models for children, which currently focus on these broader skill sets. A total of 21 studies were included in this review (Table 1).

Table 1 Treatment studies using the early intensive behavioral interventions

Study	Participants	Setting	Structured curriculum system	Teacher/student ratio	Techniques
Bibby et al. 2002	66 children with ASD, 3–5 years of age	Unspecified	No	1:1	Discrete trial training, incidental teaching, and other behavior analytic methods based on UCLA model
Cohen et al. 2006	21 children with ASD, 2–5 years of age	Home, school	UCLA multisite young autism project	1:1	Reinforcement, stimulus control, motivational operation, task analysis, discrete trial training, incidental teaching
Eikeseth et al. 2007	13 children with ASD, 4–7 years of age	School	UCLA multisite young autism project	1:1	Reinforcement, stimulus control, motivational operations, task analysis, discrete trial training, incidental teaching
Eikeseth et al. 2012	35 children with autism, 2–6 years of age	School	UCLA multisite young autism model	1:1	Discrete trial training, natural environmental teaching, and other ABA procedures
Eldevik et al. 2006	13 children between 3–6 years of age; autism and intellectual disabilities were diagnosed for all	School	UCLA multisite young autism model	1:1	Reinforcement, stimulus control, motivational operations, task analysis, discrete trial training, incidental teaching

Table 1 (continued)

Study	Participants	Setting	Structured curriculum system	Teacher/student ratio	Techniques
Eldevik et al. 2012	31 children with ASD, 2–6 years of age	School	Combination of behavioral treatment manuals	1:1	Differential reinforcement, shaping, chaining, task analysis, and prompt and prompt fading, discrete trial training
Fava et al. 2011	12 children with ASD, 2–6 years of age	Community, home	No	1:1	Discrete trial training, tangible reinforcers, incidental teaching, natural environmental teaching, modeling
Fernell et al. 2011	93 children with ASD, 1.5–4.5 years of age	Home, school	No	1:1	Discrete trial training and other unspecified behavior analytic techniques
Flanagan et al. 2012	61 children with ASD, 4–6 years of age	Community	No	1:1	Discrete trial training, naturalistic approaches, and other unspecified behavior analytic techniques
Green et al. 2002	1 child at risk for ASD	Home, school	Published curriculum guides on applied behavior analysis; UCLA and others	1:1	Prompts, social reinforcements, imitation, verbal prompts, role playing
Grindle et al. 2012	11 children with autism, 43–68 months old	School	Combination of behavioral treatment manuals	1:1	Shaping, chaining, prompting, fading, modeling, discrimination learning, task analysis, functional analysis, differential reinforcement, discrete trial training
Hayward et al. 2009b	Unspecified, program description paper	Home, community, school	UCLA multi-site Young Autism Project	1:1	Reinforcement, stimulus control, motivational operations, task analysis, discrete trial training, incidental teaching
Howard et al. 2005	29 children with ASD, 2–4 years of age	Home, school, community	Combination of behavioral treatment manuals	1:1	Discrete trial training, incidental teaching, most-to-least prompt, prompt-fading, reinforcers, instructions, pacing of learning opportunities
Lovaas 1987	19 children with ASD, 2–7 years of age	Community	Yes	1:1	Reinforcement, contingent loud noise, contingent thigh slap, discrete trial training, discrimination learning, shaping, fading
McGarrell et al. 2009	6 children with ASD, 8–10 years of age	Classroom	Yes	1:1	Reinforcement, verbal correction
Perry et al. 2008	332 children with ASD, 2–8 years of age	Home, community	Ontario Early Intensive Intervention Program-incorporating several popular behaviorally based curriculums	1:1	Reinforcement, shaping, prompting, discrete trial teaching, developmental curriculum
Remington et al. 2007	23 children with autism, average of 35.7 months old	Home	Combination of behavioral treatment manuals	1:1	Discrete trial training, shaping, chaining, modeling, fading, discrimination learning, task analysis, functional analysis
Sallows and Graupner 2005	24 children with autism, 24–42 months old	Home, community	UCLA multi-site Young Autism Project	1:1	Reinforcement, shaping, prompting, discrete trial teaching
Sheinkopf and Sigel 1998	11 children with ASD; 23–47 months old	Home	UCLA model	1:1	Reinforcement, stimulus control, motivational operation, task analysis, discrete trial training, incidental teaching
Smith et al. 2000b	15 children with ASD, 18–42 months old	Community	UCLA Young Autism Model	1:1	Reinforcement, stimulus control, motivational operations, task analysis, discrete trial training, incidental teaching
Zachor and Itzchak 2010	45 children with ASD, 15–35 months old	Community center	Combination of behavioral treatment manuals	1:1	Discrete trial training, incidental teaching, shaping, prompting, fading, discrimination learning, task analysis, functional assessment, reinforcement

Results and Discussion

Early identification and treatment have become significant topics in the mental health field (Matson et al. 2008b). This approach has led to a spate of treatment studies. Perhaps the most surprising finding for the authors was that, almost without fail, the treatment model followed the methods described by Lovaas (1987). This phenomenon shows a level of academic discipline that has rarely occurred in the treatment literature. All the studies reviewed employ standard ABA methods such as discrete trial training, modeling, prompting, social and edible reinforcers, fading, and shaping (Bibby et al. 2002; Cohen et al. 2006; Eikeseth et al. 2007; Eikeseth et al. 2012; Eldevik et al. 2006; Eldevik et al. 2012; Fava et al. 2011; Fernell et al. 2011; Flanagan et al. 2012; Green et al. 2002; Grindle et al. 2012; Hayward et al. 2009a, b; Howard et al. 2005; Lovaas 1987; McGarrell et al. 2009; Perry et al. 2008; Remington et al. 2007; Sallows and Graupner 2005; Sheinkopf and Sigel 1998; Smith et al. 2000b; Zachor and Itzhak 2010). Early studies also used punishments such as shouting at the child and contingent thigh slaps. More recent studies have dropped these aversive components.

The advantage of most studies using a similar approach to treatment is that researchers' abilities to compare data across studies are enhanced. The downside is that a good deal has been learned about more efficient methods of applying these behavioral intervention methods since this treatment package was developed. Therefore, we would urge future investigators to implement some additional components into the overall treatment package. For example, functional assessment has proven to be a very efficacious method of developing replacement behaviors for challenging behaviors (Matson et al. 2005a, b). This methodology should be a standard component of early intervention. Given that challenging behaviors occur at high rates among young children with ASD, these methods should further augment the overall intervention paradigm. Brief periods of time-out, behavioral momentum, and small peer group engagement may also be methods to consider more extensively (Matson and LoVullo 2008).

The intensity of the intervention is also an issue that warrants consideration. More intervention appears to be better, and of the studies reviewed, one-to-one intervention was the standard. But is this necessary, or more specifically, is this approach necessary for all children all the time? The answer is no, but the parameters of how much one-to-one, and how much intervention in general is needed remain in question. The notion of burn out for the child, parents, and staff who serve them is also an issue. Additionally, at what point does the factor of diminishing returns occur? Obviously, this issue would be addressed on a case-by-case basis. However, algorithms for how to make these decisions should be developed.

Where intervention should occur is also very important, but has rarely been emphasized in any systematic way. Of the studies reviewed, home (Remington et al. 2007; Sheinkopf and Sigel 1998), school (Eikeseth et al. 2007; Eikeseth et al. 2012; Eldevik et al. 2006; Eldevik et al. 2012; Grindle et al. 2012; McGarrell et al. 2009), community (Flanagan et al. 2012; Lovaas 1987; Smith et al. 2000b), or combination of multiple environments (Cohen et al. 2006; Fava et al. 2011; Fernell et al. 2011; Green et al. 2002; Hayward et al. 2009a, b; Howard et al. 2005; Perry et al. 2008; Sallows and Graupner 2005) were the most common. The research clearly shows that keeping intervention as normalized as possible promotes generalization and overall efficacy. Thus, caregivers are the best therapists when that is an option (Bibby et al. 2002; Smith et al. 2000a, b; Stahmer and Gist 2001; Szumski and Karwowski 2012), and providing training in the environments where the behaviors should be performed in the future is optimal.

Research has now been published showing that the factors most likely to result in poor outcomes for EIBI training are intellectual disabilities and severity of ASD symptoms in that order (Zachor et al. 2007). A quick assessment of the populations studied in the EIBI studies shows children who disproportionately do not evince these characteristics. Most did not display intellectual disabilities, and over a third of the children were diagnosed with PDD-NOS, which by definition consists of milder and/or few symptoms of ASD relative to persons with an autism diagnosis. Thus, the populations studied, as a whole, were biased toward individuals most likely to be treatment responders. As a result, readers and reviewers of this literature may be seeing treatment efficacy that is more optimistic than what may be evident if a more representative population of young children with ASD were studied. This assumption is underscored by the fact that in clinical practice, more severely affected children are most likely to be identified and treated. This problem is likely to be compounded further with *DSM-5*, since many of the milder cases, particularly persons with PDD-NOS, will no longer be diagnosed with ASD, and in many cases will no longer be eligible for services (Gibbs et al. 2012; Worley and Matson 2012). Thus, the overall treatment cohort will be even more severely impaired as a whole. This phenomenon will make generalizations of efficacy with current studies even more difficult.

A more direct link between the assessment of the child and the methods used and behaviors targeted is needed in EIBI research and practice. The current state of the literature shows that a child has been diagnosed with an ASD, thus meeting criteria for inclusion in the study. Often, the diagnostic methods used to make this determination and the processes followed are described; however, how targets for intervention are selected is not discussed. This omission is a major issue since it is typically not possible to treat all the potential problems a child with ASD may display.

There are qualitative as well as quantitative factors that also argue for tying assessment and EIBI treatment more closely together. The type of deficits and excesses that are present drive the types of interventions used and how target behaviors should be ranked and clustered. Social deficits, communication, stereotypies, self-help skill deficits and rituals, and feeding problems are among these behaviors (Matson et al. 1998a; Matson et al. 1997; Matson and Kuhn 2001; Matson et al. 1998a, b). However, even within one of the aforementioned categories, considerable variability exists from one child to another. Therefore, treatments need to be better tailored for each child. Given that most intervention is based on one-to-one treatment, this goal does not seem unreasonable.

The need to link assessment and treatment and then tailor EIBI to each child is further underscored by the common problem such as comorbid psychopathology and challenging behaviors (Matson et al. 1999). The notion of so many other serious conditions clustering with ASD is a relatively new development. There is no doubt that understanding this broader context of difficulties has a major impact on the selection of target behaviors and the intervention strategies used (Matson and Boisjoli 2007; Matson et al. 2007; Matson and Minshawi 2007). These types of assessments are virtually nonexistent in the studies we reviewed. And, while some challenging behaviors are discussed with respect to EIBI, the link between assessment and intervention is not provided.

As noted, psychopathology occurs at high rates among children with ASD. While the disorder may not be diagnosable in 2–4 years old, many of the symptoms of the disorder may be developing. While we are not advocating medication for these symptoms at such early ages, it is still extremely important to distinguish between which symptoms are distinct to ASD and which ones are not. These distinctions should ultimately be an important factor in determining which behaviors respond best for EIBI. Efficiency and precision should be long-term goals when delivering these treatments. However, we are just beginning to ask these types of questions. Thus, additional research will be needed on these topics for years to come.

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