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RESEARCH****Review****Toward a technology of treatment individualization for young children with autism spectrum disorders**Aubyn C. Stahmer<sup>a,b,\*</sup>, Laura Schreibman<sup>b</sup>, Allison B. Cunningham<sup>b</sup><sup>a</sup>Child and Adolescent Services Research Center, Autism Discovery Institute, Rady Children's Hospital, San Diego, CA, USA<sup>b</sup>Psychology Department, University of California, San Diego, CA, USA**ARTICLE INFO****Article history:**

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**ABSTRACT**

Although the etiology of autism spectrum disorders (ASD) and early development of the ASD are not yet well understood, recent research in the field of autism has heavily emphasized the importance of early intervention (i.e. treatment before the age of 4 years). Currently, several methods have been demonstrated to be efficacious with some children however no treatment completely ameliorates the symptoms of ASD or works for all children with the disorder. The heterogeneity and developmental nature of the disorder make it unlikely that one specific treatment will be best for all children, or will work for any one child throughout his or her educational career. Thus, this paper examines early research validating different technologies for individualizing treatment. A discussion of current research on pre-treatment characteristics associated with differential outcomes in treatment, including child, family, and practitioner variables; and how specific intervention techniques address each of those pre-treatment characteristics is provided. The ultimate goal of this line of research is to enable practitioners to prospectively tailor treatments to specific children and increase the overall rate of positive outcomes for children with autism. Research that furthers understanding of how to match clients with efficacious treatments will decrease the outcome variability that characterizes early intervention research at present, and provide for the most efficient allocation of resources during the critical early intervention time-period. This type of research is in its infancy, but is imperative if we are to determine a priori which treatment method will be most effective for a specific child.

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\* Corresponding author. 3020 Children's Way, MC 5033, San Diego, CA 92123, USA. Fax: +1 858 966 7704.

E-mail address: [astahmer@casrc.org](mailto:astahmer@casrc.org) (A.C. Stahmer).URL: <http://www.casrc.org> (A.C. Stahmer).

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## 1. Introduction to psychosocial intervention for children with autism spectrum disorders (ASD)

Although the etiology of ASD and early development of the disorder are not yet well understood, recent research in the field of autism has heavily emphasized the importance of early intervention (i.e. treatment before the age of 4 years). This emphasis may be attributed in part to results of treatment studies suggesting substantial gains may be achieved when treatment is provided at a very early age (National Research Council, 2001). Although children with ASD may face significant limitations (i.e. mental retardation, delays in social interaction and communication, challenging behaviors), and the initial causes of the disorder are believed to be biological, it is important to remember that the environment has a significant influence on the outcome of the child, including the development of the brain (Shonkoff and Phillips, 2000). Gains made by children with ASD in early intervention programs may result in a cost savings of nearly one million dollars by the time a person with ASD reaches 55 years of age (Columbia Pacific Consulting, 1999).

Currently, no treatment method completely ameliorates the symptoms of ASD and no specific treatment has emerged as the established standard of care for all children with ASD. However, several methods have been demonstrated to be efficacious with some children in research settings. The most well researched programs are based on the principles of applied behavior analysis (e.g., Dunlap, 1999; National Research Council, 2001; Schreibman, 2000). These range from highly structured programs that are conducted in a one-on-one treatment setting to behaviorally based inclusion programs that include typically developing children as models. Some of these programs are distinguishable by “brand names,” such as Discrete Trial Training (DTT) and Pivotal Response Training (PRT), while other programs use the principles of applied behavior analysis more generally. A few programs that are not based on behavioral principles are beginning to demonstrate effectiveness as well. These include functional techniques that use structured environments, visual cueing, developmental models and other strategies to assist children with ASD in navigating their environments. Case studies and studies of components of these techniques are supportive of treatment efficacy (e.g., Panerai et al., 2002). Developmental and relationship-based models have also shown some promising results (Greenspan and Weider, 1997). In addition, many “model programs” for early intervention have shown success using the techniques described above or a combination of techniques (for a complete description of several model programs, see Handleman and Harris, 2001).

The heterogeneity and developmental nature of the disorder make it unlikely that one specific treatment will be best for all children with ASD, or will work for any one child throughout his or her educational career. Research points to the inadequacy of one single treatment approach for all areas of learning for children with ASD (National Research Council, 2001; Schreibman,

2000, 2005) and, there is now a consensus that there is no “one-size-fits-all” treatment for this population. Differential response to treatment is common for all of the evidence-based approaches, in that up to 50% of children show substantial positive response, and the other 50% make progress at varying rates, some with extremely limited skill development. Moreover, evidence suggests that treatment providers working in community settings do not select just one intervention but rather report using a combination of evidence-based and non-evidence-based interventions to teach these children (Stahmer et al., 2005). Although treatment providers are combining interventions, very little is known about how to individualize treatment protocols or how to best determine *a priori* which intervention is most likely to benefit individual children (Schreibman, 2000; Sherer and Schreibman, 2005; Yoder and Compton, 2004).

Thus, research validating different technologies for individualizing treatment is important. Such research requires an understanding of the pre-treatment characteristics associated with differential outcomes of intervention, including child, family, and practitioner variables; and how specific intervention techniques address each of those pre-treatment characteristics. In addition, investigation of treatment/behavior interactions is important as different behaviors may be best approached via different treatment protocols. The ultimate goal of this line of research is to enable practitioners to prospectively tailor treatments to specific children and increase the overall rate of positive outcomes for children with ASD.

## 2. Integration of strategies

Some researchers believe that combining treatments in a systematic way may be the most appropriate way to individualize intervention (e.g., Iovannone et al., 2003; Rogers and Vismara, 2008; Schreibman, 2000; Siegel, 1996), as the exclusive use of one treatment method may ignore important aspects of social, emotional, communicative or pre-academic development. Early studies indicate that combining methods is a promising avenue to pursue (e.g., Dawson et al., 2010; Stahmer and Ingersoll, 2004), however, some researchers feel it may actually be detrimental to learning, confuse the children and reduce the fidelity with which any one treatment is administered (e.g., McGee et al., 1999).

Community programs typically report using more than one method in what are called “eclectic” programs. Indeed, the best practice committees in both New York and California recommend the use of a combination of treatments based on the needs of the child. However, there have been very few studies examining the efficacy of integrating best-practice treatment methods in community settings. Two studies comparing behavioral approaches to general eclectic approaches have found them to be lacking (Eikeseth et al., 2002; Howard et al., 2005), however the eclectic programs were

community based and the method of combining various intervention strategies was not measured.

This suggests that a specific, systematic method of combining strategies may be needed to ensure that interventions remain effective when combined in an attempt to individualize for a particular child and family. This may involve: (a) using more than one intervention for teaching multiple skill areas, but varying the proportions of time spent using each; (b) combining interventions into a modified single approach, including components of multiple modalities; (c) varying which intervention is used depending on skill area; (d) varying based on service system variables such as service settings and program availability; or (e) varying service provision based on child or family characteristics.

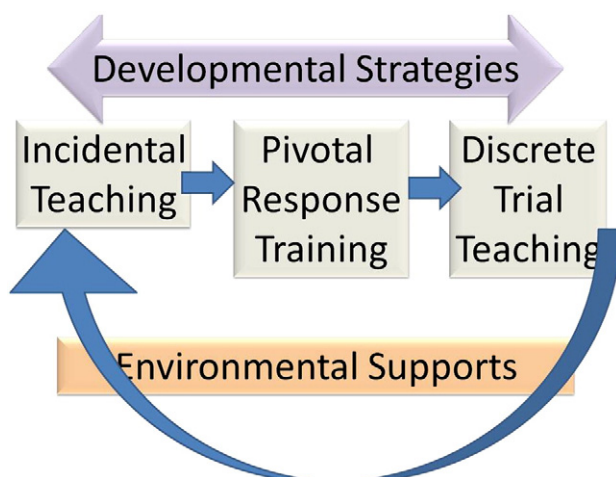
### 3. Current systematic methods of individualization and integration

#### 3.1. Combining strategies within and between activities

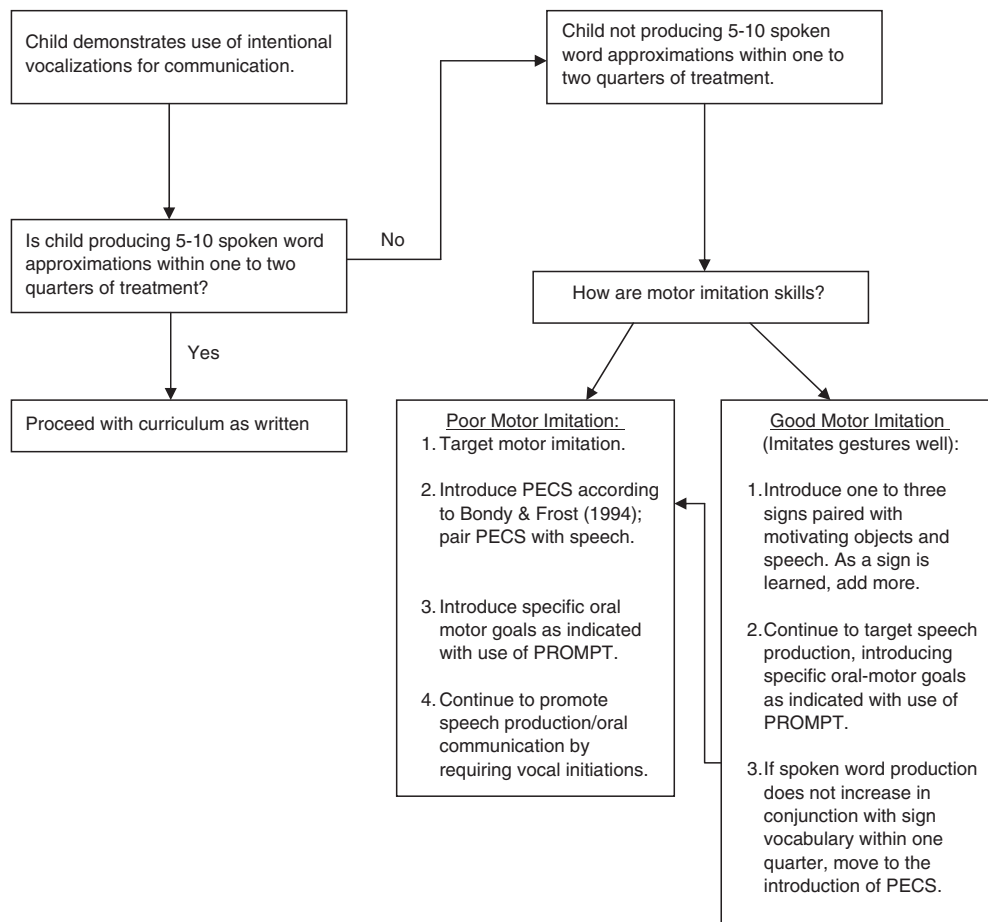
Some researchers integrate strategies within activities, during different activities and/or based on the level of support a student requires in order to learn. For example, a program might begin with a high level of structure and remove supports as children no longer need them. Alternatively, other programs begin with the use of the most naturalistic strategies and increase structure if a child does not progress. An example of this is the Alexa's PLAYC inclusion program (formerly Children's Toddler School or CTS), a community program based in Southern California in which evidence-based, developmental and behavioral techniques are combined to serve young children with autism and their typically developing peers (see [Stahmer and Ingersoll, 2004](#) and [Stahmer et al., in press](#) for a detailed description of the program. At Alexa's PLAYC, children receive a baseline level of structure (e.g., consistent

daily routine, transition signals), developmentally appropriate programming and use of developmental strategies. If children have difficulty with this level of support, more structured techniques (e.g., visual schedule, structured behavioral techniques) are added until a skill is learned. These structures are typically systematically faded as the child is able to participate independently. As illustrated in [Fig. 1](#), a clear structure, as well as developmental strategies to enhance engagement and ensure developmentally appropriate goals, is infused throughout all activities. If additional structure is needed to teach a new skill or to maintain attention, teachers use strategies based on the principles of applied behavior analysis, beginning with the least structured, and move to more structure as needed based on individual child characteristics. Additional environmental structure, such as visual support, may be added if needed. These supports may be adjusted within an activity or throughout a child's program. Supports are faded as quickly as possible to ensure independence, generalization and maintenance of new skills. For example, within activities, teachers may begin by using a less structured strategy and if a child does not respond, they may move to more structured techniques to help the child learn in that moment. This may include a transition back to less structured techniques once the child is responsive. Providers may also make more global changes to a child's program, for example, adding visual supports for a child who consistently has difficulty with transitions using the usual program procedures, or augmentative communication for a student who is not using spoken language. Data examining child progress are used to make more global program changes, and as children's learning improves, structured strategies are faded. Alternatively, some programs vary the use of certain strategies based on the specific activities or times of day. Thus, they may use highly structured behavioral strategies during one-on-one times, or select certain strategies to teach parents to use at home. Other programs make these decisions based on systematic decision hierarchies (see below) which help providers determine, based on data over time, when to move to a new (typically more structured) strategy if a child is not making progress.

In general, well-designed, programs that have used these methods to combine interventions have reported good outcomes. The Early Start Denver Model (ESDM; [Rogers and Dawson, 2009](#)), for example, uses a combination of developmental and behavioral techniques in both a therapist- and parent-implemented early intervention model. The program includes decision hierarchies to determine when to add more structured strategies or visual supports to a child's program (see [Fig. 2](#)). A recent randomized clinical trial showed significant improvements in IQ, adaptive behavior, and ASD diagnosis for young children receiving ESDM compared with children receiving "usual care" in the community. A parent implemented intervention, *Teaching Social Communication to Children with Autism*, uses developmental strategies as the base of interactions and intersperses directive behavioral techniques to teach new skills. Parents are taught to intersperse directive techniques to teach new skills while using primarily developmental strategies to increase children's engagement and initiation skills (see [Fig. 3](#)). This method has been shown, through controlled single-subject and quasi-experimental studies, to contribute to progress in the areas of expressive



**Fig. 1 – Strategy Integration at Alexa's PLAYC.** Legend: At Alexa's PLAYC a structured environmental approach and developmentally appropriate goals are infused throughout all activities. If additional structure is needed teachers add behavioral strategies, beginning with the least structured, and moving to more structure. Supports are faded as quickly as possible.



**Fig. 2 – Early Start Denver Model (ESDM) Alternative Communication Decision Tree.** *Legend: In the ESDM model the team (which includes a speech language pathologist) follows the decision tree to alter the teaching approach for children who appear unable to produce speech with the typical intervention model. The decision tree is used in decision making about what alternative or augmentative system to use. From: Early Start Denver Model for Young Children with Autism, Rogers and Dawson, 2009. Copyright Guilford Press. Reprinted with permission of The Guilford Press.*

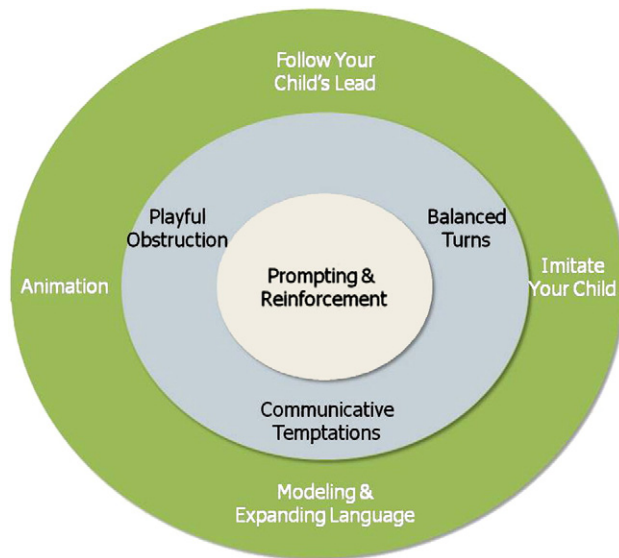
and receptive language and play skills (Ingersoll et al., 2005; Ingersoll and Dvortcsak, 2010).

Group inclusion programs that systematically combine strategies have also provided support for combining methods. For example, one study examined outcomes for a group of 102 children diagnosed with an ASD at age 2 who attended an inclusive toddler program, Alexa's PLAYC until age 3. In quasi-experimental pre/post studies of 100 children who participated in the program, significant improvements, with large effect sizes were found in developmental level, adaptive behavior and communication (Stahmer et al., in press). Thirty-one of the children (31%) were functioning in the typically developing range when they exited the program at age 3, after an average of 8 months of intervention. A recent study of long-term outcome in 29 children who participated in the program (1–5 years after exit) found that initial gains in cognitive and language functioning continued over time and the majority of children (over 60%) were in regular classroom placement at elementary school (Akshoomoff et al., 2010). Project DATA at the University of Washington integrates behavioral strategies with early childhood special education methodologies, providing inclusion as well as individualized instruction, and parent education. Chil-

dren in this inclusive group program also showed impressive improvement across curriculum areas, including communication, imitation, self-care, and play skills. Eighty one percent of the ten children in a pre-post study of outcomes exited the program with some functional language (Boulware et al., 2006).

All of these programs use data collection to examine progress and changes are made to specific strategies used with each child based on these data. However, the choice of the next strategy to implement and program procedures describing how to move through the various strategies are often based on clinical judgment or recommended best practice, rather than research suggesting systematic steps for making these decisions. Thus it is not clear what would happen if the program providers began with the most structured strategy instead of a less structured approach, or if certain child characteristics could be used to determine the most effective strategies *a priori*. It must be emphasized, however, that these programs combined strategies in a systematic way, and examined fidelity of implementation of the model, rather than simply using many strategies haphazardly. This is an important distinction from community programs that have used “eclectic” practices. Studies examining eclectic models have not identified the specific components





**Fig. 3 – Integration of teaching techniques from *Teaching Social Communication Skills to Children with Autism*. Legend: *Teaching Social Communication to Children with Autism* calls for the use of both Interactive Techniques and the Direct Teaching Techniques together. The figure illustrates that the interactive techniques provide the background for all of the teaching techniques, with more directive techniques being used within the interactive techniques to teach new social-communication skills. From: *Teaching Social Communication to Children with Autism*, Ingersoll and Dvorszak, 2010. Copyright Guilford Press. Reprinted with permission of The Guilford Press.**

making up the model (Eikeseth et al., 2002; Howard et al., 2005) therefore poor results may simply represent a lack of a specific methodology for combining techniques or limited fidelity of implementation across the approaches used.

### 3.2. Combining strategies based on curriculum area

Other programs combining interventions have based the use of various strategies on the target skill or curriculum area. This may provide a systematic, yet simpler, way to pre-determine strategy use. One example of this is the STAR program (Arick et al., 2003) that combines structured and naturalistic behavioral methods. In this model, structured behavioral strategies are used to teach receptive language and pre-academic concepts while naturalistic strategies are used to teach play and spontaneous language concepts. This is based on the premise, albeit non-research based, that some strategies are better suited to teaching particular skills. Thus, some naturalistic behavioral strategies rely on a child choosing a particular activity, or having a reward directly related to the task, which may seem difficult when teaching academic skills or receptive language.

While it makes intuitive sense that some strategies may be better suited to specific target areas than others, there are very little data to support specific guidelines. Some recent preliminary data may call these ideas into question, at least for some

children. Pilot data evaluating structured versus naturalistic behavioral interventions for teaching expressive and receptive language in younger children with ASD do not support this method. Cunningham et al. (2010) used a single-subject alternating treatments design, whereby three children (28–35 months) received both structured (Discrete Trial Teaching; DTT) and naturalistic interventions (Pivotal Response Training; PRT) for specific expressive and receptive language targets. As has been found in previous research with older children, these younger children learned expressive language in both treatment conditions, but demonstrated greater generalization and maintenance of gains when taught via PRT in the majority of cases. For receptive language, which has not been studied in this manner, treatment conditions were similarly effective in the acquisition of receptive language for two children, but the naturalistic intervention appeared superior for the generalization of these skills. One child demonstrated a distinct pattern of responding, whereby the structured intervention was superior. Children also showed two distinct patterns of disruptive behaviors during treatment sessions, with the children seeming to have different intervention style responses. That is, one child exhibited increased disruptive behavior in the PRT condition, one child had more disruptive behavior in the DTT condition, and the last child showed little disruptive behavior overall. The relationship between child intervention style response and rates of learning did not consistently match, and further analysis of these data will be important in determining the utility of these variables in treatment individualization methods. What these preliminary data do suggest, however, is that observing differences in child response patterns early on in treatment (i.e. by providing two interventions to the same child for comparison) may be more useful in individualizing treatment than using only curriculum guidelines.

## 4. Individualization based on service setting and system

Another decision that needs to be made when determining individualization of intervention for children with ASD is the intervention setting. Although researchers and educators alike typically agree that children with ASD benefit from early identification and intervention services, disagreement arises regarding the appropriate setting for early intervention (e.g., in-home or inclusion programming). In addition, most intervention researchers recognize the importance of social integration for children with ASD, but there is little consensus as to what point in intervention it should occur. Some researchers would argue that inclusion is appropriate for higher-functioning or older children with ASD, but is not appropriate for preschoolers who may not be “behaviorally ready” to benefit from an inclusion environment (Strain et al., 2001). Others have suggested that preschoolers with ASD will not get appropriate services in inclusion settings or may be socially rejected by their peers (e.g., Lowenthal, 1999). Programs supporting this philosophy typically advocate a period of individualized and small group instruction prior to placement in an inclusive setting (Anderson and Romanczyk, 1999; Harris and Handleman, 1994) in order to work on these prerequisite skills.

Strain et al. (2001) have emphasized the fact that although the commonly held assumption of “behavioral readiness” greatly influences early intervention programming for young children with ASD, there are no data to support this claim. Several inclusive early intervention programs have documented excellent child progress, and report that the majority of children who exit their programs have functional verbal communication skills and are mainstreamed into typical school environments (McGee et al., 1994, 2000; Schwartz et al., 2004; Stahmer et al, in press; Stahmer and Ingersoll, 2004; Strain and Cordisco, 1994). Of course, as is the case for most programs for children with ASD, there is a great deal of variability across children in program outcome in all settings that have been studied and a dearth of data to inform differential placement for individual children. No studies have directly compared in-home or inclusion-based treatment settings in a randomized comparison design.

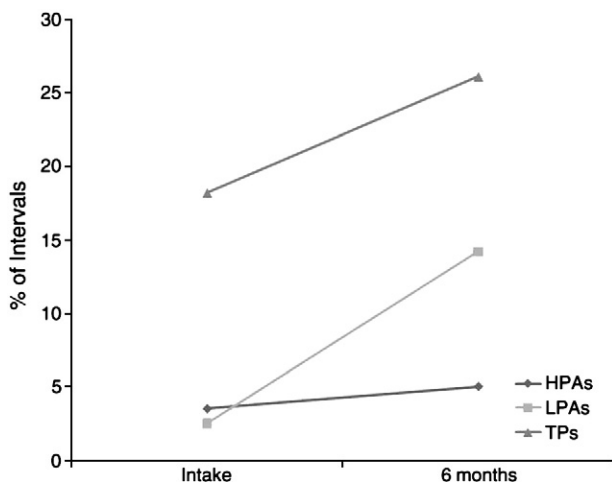
It is probable that the effectiveness of a particular setting may vary depending upon the characteristics of the children entering the program. One study looked at the effect of peer avoidance at entry in predicting outcome in an inclusion program (Ingersoll et al., 2001). The study looked at six children with ASD entering a toddler inclusion program. Children were matched for language and developmental level. Although no children were interactive with peers at entry, three children were highly avoidant of peers (actively avoiding proximity) and three children were low avoiders (did not avoid proximity). The children demonstrated significant variability in outcome that could not be attributed to mental age equivalent or language level. Pre-treatment peer social avoidance appeared to predict outcome for subsequent peer

avoidance and language use. Low peer avoiders made significant progress in language and social interaction while high peer avoiders remained avoidant of peers and made limited progress in their use of language (see Fig. 4). It is possible, then, that peer avoidance may provide one method of determining service setting.

However, a limitation of this study was the lack of a group of children in one-on-one intervention. Previous research has suggested that low initiations (Koegel et al., 1999) and avoidance of therapist (Sherer and Schreibman, 1999) may suggest poor prognosis in any treatment model. Future research that investigates whether peer avoidance is associated with poor outcome in general should be conducted. Additionally, other research looking at other predictors of differential response to service settings would be important.

Service system constraints available in community settings often determine the interventions used. ASD interventions, therefore, need to be individualized and adapted to fit the resources available to the programs in which they will be implemented. However, there have been very few efforts put forth to examine how evidence-based interventions are implemented in the real world. The limited research that has been conducted indicates that practitioners are not implementing interventions developed as intended by researchers. Stahmer et al. (2005) found that 22 practitioners participating in focus groups about early intervention for autism reported using modified versions of interventions, often combining elements of multiple practices or applying adaptations to those practices based on child and/or program characteristics. Practitioners likely are recognizing that interventions designed by researchers in academic settings have to be individualized for use in applied settings.

In fact, individualization research may be informed by methods experienced practitioners use to individualize interventions. Recently, mental health researchers have recognized the need to improve evidence-based practice by complimenting traditional studies with “practice-based evidence” which involves gaining a better understanding of what works in community practice. Garland et al. (2006) suggest that evidence-based practice research would benefit from studies of “practice-based evidence” (Margison et al., 2000), which can be useful for identifying effective and ineffective elements of usual practice. In a qualitative study interviewing 80 teachers regarding their use of evidence-based practices, providers consistently reported the importance of individualizing treatment methods and strategies based on the needs of the child (Stahmer, 2007). The majority of participants reported that they chose specific interventions based on characteristics related to each individual child’s strengths and weaknesses. One participant explained, “Depends on the child. You know, so much of the therapy is responding to the child and not responding the way that the book says to do it.” Because researchers have not yet determined methods for individualized treatment, we feel that this may be an area where providers can contribute significantly through their experiences. A collaborative move toward individualization may be needed to develop a clear roadmap for developing evidence-based interventions designed for specific children.



**Fig. 4 – Mean percentage of language use at intake and 6 months for high peer avoiders (HPA), low peer avoiders (LPA) and typical peers (TP).** Legend: In the Alexa’s PLAYC program, children who were less avoidant of peers had greater improvement in language skills than children who were avoidant of peers at entry. With kind permission from Springer Science + Business Media: *Journal of Autism and Developmental Disorders*, Differential treatment outcomes for children with autistic spectrum disorder based on level of peer social avoidance, 31, 2001, 347, Brooke Ingersoll, Aubyn C. Stahmer and Laura Schreibman, Fig. 2.

## 5. Individualization based on child characteristics

Because of the wide heterogeneity of treatment outcomes in children with ASD, a number of studies have identified child characteristics associated with positive developmental and treatment gains. Developmental studies have used cross-sectional and longitudinal study designs to identify early child variables associated with later child outcomes in general and also in relation to response to a specific intervention. Early language ability and cognitive ability have emerged as the strongest predictors of overall prognosis for ASD during childhood, adolescence, and adulthood (Howlin et al., 2004; Sigman and Ruskin, 1999; Venter et al., 1992). Standardized communication and nonverbal IQ scores from children as young as 3 years old predict later language abilities (Stevens et al., 2000; Tager-Flusberg et al., 2005; Thurm et al., 2007). However, these predictors are not as robust prior to the age of 3 (Charman et al., 2005), making prediction of response to intervention difficult for children receiving this early diagnosis. Also, some studies have reported that early social behaviors such as joint attention, motor imitation and toy play predict outcome in children with ASD (e.g., Anderson et al., 2007; Tager-Flusberg et al., 2005; Thurm et al., 2007). Despite the fact that these data may provide information regarding long term outcome, they do not assist with making specific intervention choices for individual children. Researchers have yet to exam of the influence of physical, genetic or medical conditions on treatment outcomes for children with autism.

More recently, researchers have begun to look for variables that may differentially predict child response to treatment. Studies identifying predictors of treatment response continue to be important, but they are only able to identify child variables associated with response to one specific treatment. This is problematic, as there is no consensus on the specific treatment model of choice for these children (National Research Council, 2001; Schreibman, 2005). While some single-subject and group comparison designs have argued for the superiority of one treatment over the other (Delprato, 2001; Smith et al., 2000), few investigators have examined the possibility that different treatments might be most appropriate for different children and at different points in the treatment process. Improved understanding of child variables associated with differential treatment outcomes may enable researchers and practitioners to prospectively tailor treatments to specific children. This will likely increase the overall rate of treatment effectiveness across children with ASD. This research is becoming even more important as intervention approaches integrating non-behavioral components are gaining support and other treatment options become available (e.g., Dawson et al., 2010).

Two prospective studies have examined child variables associated with differential responsivity to one specific naturalistic behavioral intervention, Pivotal Response Training (PRT). The first study, a multiple baseline design reported that three 3- to 5-year-old children demonstrating high levels of non-verbal stereotypy and avoidance, as well as low levels of verbal stereotypy, toy play, and approach behaviors, were less likely to show positive response to PRT than three

children exhibiting the opposite behavioral profile (i.e. low non-verbal stereotypy and avoidance and high levels of verbal stereotypy, toy play and approach behavior) prior to treatment (Sherer and Schreibman, 2005). A follow-up study multiple baseline design study of six children suggested that this predictive profile was specific to PRT and not predictive of response to other more structured, behavioral interventions, such as Discrete Trial Teaching (DTT; Schreibman et al., 2009). Although each of the profile behaviors have not been examined in isolation, toy play and approach behaviors may lead to a better response to a play based intervention that requires interaction with toys and an adult. Verbal stereotypy is a less likely predictor; however it appears that it may lead to shaping of more appropriate verbal skills. More recent data have suggested that the PRT predictive profile may not be predictive of treatment response in a younger-aged sample of children, thereby indicating the need for varying standards with child age (Cunningham, 2007). Together, these initial studies provide evidence that specific behavioral profiles may be useful in identifying which children are likely to respond to particular treatments and therefore in making treatment decisions.

A recent study evaluated the differential effectiveness of two communication training strategies commonly used to teach early communication skills to nonverbal and minimally verbal young children with ASD (Cunningham et al., 2008). Specifically, this randomized trial addressed the differential effects of a language-based approach (PRT) and a visually based approach (the Picture Exchange Communication System, PECS; Bondy and Frost, 2001) on the communication, social, and cognitive functioning of 34 very young (i.e., 2–4 years-old), minimally verbal children with ASD. Both programs were found to result in substantial spoken language gains for approximately 50% of the children. While early word use was highly predictive of verbal gains in both treatment conditions, it was not predictive of augmentative communication gains. Children with some words (i.e. 1–9 words at intake) were equally likely to develop verbal communication skills in PECS or PRT. Children entering treatment with no words were unlikely to develop spoken language. However, over 80% of the PECS participants developed substantial augmentative communication skills. These preliminary results indicate that word use at intake may be an important and parsimonious child variable to consider when deciding between verbal and augmentative communication programs for very young children with ASD.

One other systematic comparison of the differential effects of verbally based and visually based communication training programs for young children with ASD has been reported. Yoder and Stone (2006a,b) conducted a randomized comparison experiment comparing a vocally based naturalistic intervention, Responsive Education and Prelinguistic Milieu Teaching (RPMT), to PECS in 36 children in order to examine how the relative treatment effects varied as a function of child variables. The investigators found that while both PECS and RPMT resulted in an increase in initiating joint attention across treatment, RPMT resulted in more initiating joint attention compared to PECS for those children who had at least some joint attention skills prior to intervention. Alternatively, PECS resulted in more requests in comparison to RPMT and greater gains in initiating joint attention bids for those children with little joint attention skill



at intake (2006a). In a different report based on the same experiment, Yoder and Stone (2006b) found that pre-treatment levels of object exploration moderated growth rates in the number of nonimitative words in PECS versus RPMT. Children who began treatment with low object exploration benefited more from RPMT, while children who began treatment with higher levels of object exploration benefited more from PECS. These researchers reasoned that while both PECS and RPMT involve objects as rewards for communicative attempts, only RPMT involves specifically teaching children how to play with objects. Thus, children with low object exploration at pre-treatment were more likely to benefit from intervention after learning to play with objects. Both the PECS versus PRT (Cunningham et al., 2008) and PECS versus RPMT (Yoder and Stone, 2006a,b) studies provide information about the differential effects of visually based and vocally based interventions and illustrate how detailed information about very specific behavioral effects may be identified.

Collectively, these studies serve as the foundation for research aimed at matching treatment approaches to the individual needs of different children with autism. For example, it may be that PECS may be more appropriate as a first line treatment approach for children with fewer prerequisite abilities, including early word use and joint attention initiation skills. Alternatively, verbally based programs, such as RPMT and PRT, may be appropriate for children who enter treatment with some early communication skills. It is important to emphasize that these findings must be replicated and may only apply to early communication treatment. The relative benefits of these interventions for older children or longer term treatment programs, as well as on other areas of development, are yet to be addressed.

## 6. Individualization based on family characteristics

In addition to child characteristics, it is also important to consider the characteristics of the child's caregivers. Active parent involvement in intervention is a recommended component of effective intervention for this population (Breiner and Beck, 1984; Ingersoll and Dvortcsak, 2006; National Research Council, 2001; Singh et al., 2006). Yet the field is just beginning to examine how family variables interact with treatment effectiveness. The effects of ethnicity, culture, marital status, parental attitudes, parental age, level of education, socioeconomic status, and other factors all may affect how treatment is best delivered and the ultimate effectiveness of the treatment. To illustrate, a randomized trial with 58 participating families has shown that children of more responsive and educated parents are more likely to benefit from Prelinguistic Milieu Teaching, while children of less responsive and educated mothers benefit more from responsive small group instruction (Yoder and Warren, 1998). In another example, training in self-management may be more successfully implemented by parents for whom child independence is important (Schreibman and Koegel, 1996). However, certain cultures may not place a strong emphasis on child independence; thus, the parents may not choose to use self-management with their child or may use it ineffectively.

Efficacy studies in autism have rarely examined efficacy for ethnic groups separately, and most do not even provide information about the race/ethnicity of the subjects (Brown and Rogers, 2003). This lack of research is a concern given the widespread recognition that culture has a powerful impact on service utilization, treatment attendance, parenting and other service related factors (e.g., Hough et al., 1987; MacPhee et al., 1996; McCabe et al., 1999). Available data suggest that children from ethnic minority backgrounds are more likely to be diagnosed and receive treatment at a later age than white children for reasons that do not appear to be race alone (Croen et al., 2002; Mandell et al., 2002). There is some limited research to indicate that Hispanic children perform similarly to Caucasian children in parent education programs (Baker-Ericzen et al., 2007; McCabe et al., 2005), however, we need much more information to effectively individualize intervention based on cultural needs.

Another important family factor that may require treatment modification is the level of stress in a family. Parents of children with autism report being under high levels of stress (e.g., Koegel et al., 1992). Perhaps parents who are under a good deal of stress at a point in time would be poor candidates to implement training with their child; a clinician may then be the treatment provider of choice. Later, if the stress is reduced, these parents could perhaps very effectively implement the treatment.

Another potential candidate variable for individualization is parent gender. Typically, mothers are the primary trainees in parent education programs; although researchers have found involving fathers in parent education programs can benefit children with problem behaviors (Horton, 1984; Webster-Stratton, 1985). Research indicates that parent education programs may require modifications in order to increase father involvement. Winter (2006) examined factors contributing to increased father participation in a parent education program for children with autism. She found that modifying an existing parent education program by: (1) offering flexible days and times for training, (2) altering location of training by including home visits, and (3) adding a recreational component all influenced father participation. In light of Winter's findings, ASD researchers and practitioners need to consider parent gender when individualizing parent training programs.

In addition, collaboration between practitioners and parents is important for individualization of intervention for parents. Brookman-Frazee (2004) found when parents and practitioners collaborated on identifying target behaviors and method of treatment implementation for children with problem behaviors, parents showed reduced stress and increased confidence compared to parents who did not collaborate. The children in the collaborative group also showed greater improvement in behavior. Forehand and Kotchick (2002) provide guidelines to assess individual family variables that may influence participation before training to help practitioners determine what level of intervention parents may (or may not) be able to handle: (Level 1) Family discord is not severe: no need to target family variables directly, parent education by itself can sometimes help resolve any problems. (Level 2) Family discord is present and may interfere with treatment: modification of original parent education plan may be helpful to directly target family issues. (Level 3) Family discord is moderate: parent education for the child can be concurrent with family services provided elsewhere. (Level 4) Family discord is severe and will definitely



impede any immediate parent education efforts: encourage parents to resolve issues *before* beginning a parent training plan.

Often, parents have tried many ineffective ways of changing their child's behavior by the time the parents enter a treatment program. The practitioner can, and should help a parent to have more positive expectations about what the *parent* can do to increase child outcome, which can increase their feelings of self-efficacy. Assessing parents' expectations can also assist practitioners in knowing what behavior to expect from parents. Practitioners can use information about parent expectations to individualize interventions to better fit parents' life circumstances and lifestyles.

## 7. Conclusions and future research

While positive results have been reported for many treatment methods, there are no ASD treatments that currently meet criteria for well-established or probably efficacious, empirically supported treatment (Lonigan et al., 1998). Additionally, due to the heterogeneity and developmental nature of the disorder, it is unlikely that one specific treatment will emerge as the treatment of choice for all children. Currently, researchers and clinicians must use their judgment and training to choose the most suitable methodology or combination of strategies for a specific child.

The goal, then, is not to find the one perfect treatment for all children with ASD, but to identify the important variables that influence the effectiveness of specific interventions for each child. Research that furthers our understanding of how to match clients with efficacious treatments will enable consumers to make better choices between procedures, decrease the outcome variability that characterizes early intervention research at present, and provide for the most efficient allocation of resources during the critical early intervention time-period. This type of research is in its infancy, but is imperative if we are to determine *a priori* which treatment method will be most effective for a specific child.

This line of research may lead to guidelines similar to those available for other mental health disorders, such as childhood depression, in which practice guidelines have been developed for both adults and children with the disorder (American Academy of Child and Adolescent Psychiatry, 1998; American Psychiatric Association, 2002). Treatment recommendations vary based of many individual case factors such as the severity of the disorder, age/developmental level of the individual, family involvement, motivation for treatment, and comorbid features. These factors are considered when choosing the first route of treatment as well as in treatment adjustment and maintenance. As is the case with all childhood disorders, numerous child and environmental factors must be examined in order to obtain appropriate guidelines that have a research base, but are also flexible enough to manage complex cases complicate assessment and treatment.

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