Chapter 1
Overview of Early Intensive Behavioral Intervention for Children with Autism

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Introduction

Child development typically occurs along a relatively predictable trajectory wherein the majority of children acquire motor skills, language and other behavioral and social competencies in approximately the same sequence and time frame. For example, typically developing children tend to imitate facial expressions in the first 2 months of life; produce babbling sounds around 3 months; and can play with other children and speak in coherent complete sentences before 3 years of age (Shelov & Altmann, 2009). In a general sense, autism is a condition wherein a child's pattern of development deviates from the typical course (e.g., Baird et al., 2000; Lang, Regester, Rispoli, & Camargo, 2010; Liu, 2012).

The diagnostic criteria for autism have changed numerous times since Infantile Autism was first included in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association [APA], 1980). Additionally, the World Health Organization (WHO) and the American Psychiatric Association (APA) both offer different diagnostic criteria and have updated their criteria at different times in different ways. Currently, the fifth edition of the DSM (DSM-5; APA, 2013) and the International Classification of Diseases and Related Health Problems (ICD-10) offer similar diagnostic criteria (WHO, 1992). The ICD-10 defines Childhood Autism as a pervasive developmental disorder

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involving abnormal functioning in reciprocal social interaction, communication, and restricted, stereotyped, repetitive behaviour. The ICD-10 further distinguishes between Childhood Autism and Atypical Autism, with the later diagnosed when abnormal functioning becomes evident after 3 years of age and/or when the child meets some but not all of the criteria for the Childhood Autism diagnosis (WHO, 1992). Comparably, the DSM-5's diagnostic criteria for Autism Spectrum Disorder (ASD) includes: (a) persistent deficits in social communication and social interaction across multiple contexts and (b) restricted, repetitive patterns of behavior, interests, or activities. However, the DSM-5 does not include diagnoses of Atypical Autism or Asperger's Syndrome (APA, 2013). Chapter 2 by Kuriakose and Shalev (2016) discusses the diagnostic criteria for ASD in detail and compares the most common assessments used to diagnosis autism in early childhood using the available psychometric data.

The DSM-5 and ICD-10 both describe a number of common comorbidities and deficits reported in samples of children with autism including intellectual disability, anxiety disorders and limited play skills and acknowledge that autism symptom severity ranges along a spectrum from mild (i.e., requiring some support to compensate for deficits) to severe (i.e., requiring a substantial amount of support) (APA, 2013; WHO, 1992). Without the proper level of support and effective intervention, children with autism may develop challenging behavior (e.g., self-injury, property destruction and aggression), experience academic failure and struggle to maintain meaningful social relationships (Lang et al., 2010, 2013; Tonge, Bull, Brereton, & Wilson, 2014; Watkins et al., 2015). Without successful intervention during childhood, adults with autism may experience difficulty finding employment, starting families and achieving a desirable quality of life (Brugha, Doos, Tempier, Einfeld, & Howlin, 2015; Taylor et al., 2012; Tobin, Drager, & Richardson, 2014; Walton & Ingersoll, 2013). In some severe cases, adults with autism are not able to live independent of intensive supports that require a substantial expenditure of resources (e.g., Chasson, Harris, & Neely, 2007; Cimera & Cowan, 2009; McGill & Poynter, 2012). Therefore, it is not surprising that a great deal of research has focused on developing effective interventions capable of addressing core symptoms and common comorbidities in ASD with the ultimate aim of enhancing quality of life and autonomy of people with autism.

Why Are Interventions for Autism Not Based on Etiology?

Biological and Nature-Based Etiological Theories

Ideally, interventions are developed to address the underlying causes of a disorder (etiology). Research has elucidated a number of biological (nature) and environmental (nurture) factors that may disrupt child development and lead to a presentation of symptoms similar to those observed in children with autism. In terms of nature, genetic abnormalities such as gene deletions, duplications, translocations, and inversions have been linked to intellectual and developmental delays (Percy, Lewkis, & Brown, 2007) comparable to characteristics observed in some people with autism. For example, Phenylketonuria (PKU) is a developmental disability also associated with intellectual disability, social deficits, comorbid psychiatric disorders and behavioral problems that is caused by a genetic abnormality that impedes the body's ability to process a specific type of protein (phenylalanine) found in many foods (Stemerdink et al., 2000). Treatment for children with PKU includes a phenylalanine-free diet and prevention of PKU is possible by strict adherence to a phenylalanine-free diet before and during pregnancy by women with PKU (Kohlschütter et al., 2009). PKU illustrates how an understanding of a disorder's etiology may guide the creation of effective intervention and even prevent some genetic disorders. In terms of autism, research has identified a number of genetic abnormalities that are more prevalent in children with autism (Richards, Jones, Groves, Moss, & Oliver, 2015). Unfortunately, no single gene, combination of genetic factors or other biomarkers (e.g., deficit of a specific neurotransmitter) can account for the majority of cases of autism and effective interventions cannot yet be derived from the genetic research related to autism to date (Minshawi, Hurwitz, Morriss, & McDougle, 2015; Richards et al., 2015; Ruggeri, Sarkans, Schumann, & Persico, 2013).

Additional biological causes for developmental delay include injury, illness and other factors that may negatively influence a child's physiological, intellectual or psychological development. For example, children without access to sufficient nutrition or health care as well as those exposed to toxins (e.g., Fetal Alcohol Spectrum Disorder) may present with symptoms comparable to what is observed in children with autism (Bishop, Gahagan, & Lord, 2007). A variety of hypotheses have been examined in an effort to identify such an etiology for autism. For example, the theory that vaccines may increase the risk of autism has been thoroughly tested and never substantiated (Fombonne, 1999; Offit, 2008). Other similar theories, such as heavy metal poisoning, gut abnormalities, gluten and casein peptides and virus-based theories, have also failed to be consistently supported by carefully controlled studies. Further, interventions derived solely from such hypotheses have not been demonstrated to be effective and, in some cases, may cause harm to the child and their family (e.g., Davis et al., 2013; Esch & Carr, 2004; Fombonne, 1999; Mulloy et al., 2010, 2011). Chapter 9 by Travers, Ayers, Simpson, and Crutchfield (2016) focuses on fad, controversial and pseudoscientific interventions. Many of the interventions discussed in that chapter are fundamentally flawed because they are derived from false etiological theories of ASD.

Environmental and Nurture-Based Etiological Theories

In terms of nurture, learning history and other environmental factors may impede children's language, social and intellectual development (Bijou & Baer, 1961, 1965) and lead to behavioral excesses and deficits similar to those in autism. For example, children living in spartan environments absent sufficient stimulation and those who suffer from neglect and/or abuse may experience a variety of developmental delays and detrimental psychological conditions (Ellenbogen, Klein, & Wekerle, 2014; Mills et al., 2011). An outdated etiological theory purported that unloving and emotionally distant mothers (callously termed "refrigerator mothers") were the cause of the social and language deficits observed in children with autism (Bettelheim, 1972), but this deeply insensitive and obviously inaccurate theory has now been entirely discredited (Silvermann, 2012). Parent involvement is considered a key element in many interventions for children autism, and parent training in intervention implementation is an effective approach to delivering higher doses of intervention across settings (Lang, Machalicek, Rispoli, & Regester, 2009; Machalicek, Lang, & Raulston, 2015; Makrygianni & Reed, 2010; Struass, Mancini, The SPC Group, & Fava, 2013; Tonge et al., 2014). However, these parent-based approaches to early intervention are in no way related to the rejected notion that mothers (or any other caregivers) are in anyway responsible for causing autism. In Chap. 8 Ruppert, Machalicek, Hansen, Raulston, and Frantz (2016) review research involving parent-implemented early interventions for children with ASD and discuss evidenced-based approaches to training parents to implement interventions accurately.

The best available evidence suggests the etiology of autism is some unknown combination of an innate genetic disposition involving multiple genes and some unknown environmental trigger (Fakhoury, 2015; Kohane, 2015; Richards et al., 2015; Ruggeri et al., 2013). In any case, research into autism's etiology has not yet been able to meaningfully guide the development of effective interventions. Despite the absence of a clear etiology, a number of interventions demonstrated to be capable of ameliorating symptom severity and potentially improving long-term outcomes for people with autism have been developed. These interventions tend to be most effective when they are early, intensive and behavioral (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009; Ramey & Ramey, 1998; Reichow, 2012).

Early Intervention

Results from some studies suggest that outcomes tend to be better the earlier in a child's life intervention is initiated (e.g., Bradshaw, Steiner, Gengoux, & Koegel, 2015; Harris & Handleman, 2000; Smith, Klorman, & Mruzek, 2015). However, results of other studies suggest that the child's age may not be of particular importance (e.g., Makrygianni & Reed, 2010; Virués-Ortega, 2010). The differences in conclusions regarding the significance of age may be due to (a) the large range of symptom severity inherent to the autism spectrum; (b) differences in research designs; (c) differences in setting (e.g., home or clinic-based); and/or (d) different types of outcome measures (e.g., school placement, target skill mastery, parent report, and standardized assessments) across intervention studies (Fava & Strauss, 2014; Virués-Ortega, 2010; Warren et al., 2011).

Although the debate regarding child characteristics (e.g., age, language proficiency and IQ) that can predict response to intervention continues (Camarata, 2014; Charman, 2014), there are a number of reasons why interventions may be more efficient or effective early in life that can be discussed. From a biological perspective, it is possible that the rapid and radical brain development that occurs during the first years of a child's life offers a window of opportunity for optimal intervention timing (Pickles, Anderson, & Lord, 2014; Webb, Jones, Kelly, & Dawson, 2014). Specifically, the brain's ability to change (plasticity) in terms of how it responds to environmental stimuli appears to be greatest in most individuals early in life (Holland et al., 2014). For example, ongoing brain development may account, at least in part, for the relative ease with which children of typical development acquire a staggering amount of language during early childhood (Ambridge, Kidd, Rowland, & Theakston, 2015).

Another complimentary explanation for increased efficiency and effectiveness of early intervention relative to intervention delivered later in life is that learning new skills may allow children to experience a wider variety of learning opportunities and more complex environmental contingencies. For example, a child with autism who learns to play with toys in a way that looks like the way a child of typical development plays with toys (e.g., rolling a car along the ground as opposed to spinning and staring at a wheel) may be more often approached by other children to play, creating more opportunities for social interaction (Hine & Wolery, 2006; Lang et al., 2014). Similarly, a child who learns to ask for a drink during early intervention would seem more likely to be asked by caregivers whether or not they would prefer water or milk. Exposure to more questions may facilitate acquisition of question-asking skills and the ability to ask questions could assist with learning even more skills (Raulston et al., 2013). If acquiring these types of pivotal skills results in increased opportunities for learning and, if at least some of those opportunities eventual facilitate the acquisition of even more skills and so on, it stands to reason that this process should begin during the period of time associated with the greatest plasticity (Webb et al., 2014) and before decisions determining future environments that will influence learning opportunity (e.g., school placement) are made.

In the same way that changing the angle of a projectile's trajectory only slightly makes a large difference in where the projectile lands after traveling a long distance; acquiring fundamental skills at an early age may result in greater outcomes when considered across a lifespan. Figure 1.1 visually represents the potential for a small change to result in a large difference in outcome. However, the stylized figure represents the rate of development as a straight line and, of course, the actual rate of human development is far more variable (Klintwall, Eldevik, & Eikeseth, 2015; Mawhood, Howlin, & Rutter, 2000; Webb et al., 2014).

Likely, nature (e.g., genetics and brain development) and nurture (e.g., learning history) interact in a variety of ways to account for any increased effectiveness of interventions delivered early in life (e.g., Kok et al., 2015; Webb et al., 2014). However, whatever the reasons, the impact of the environment on early child development is undeniable. For example, in a seminal study, Hart and Risely (1995) measured the occurrence of spoken language in the homes of 42 families with

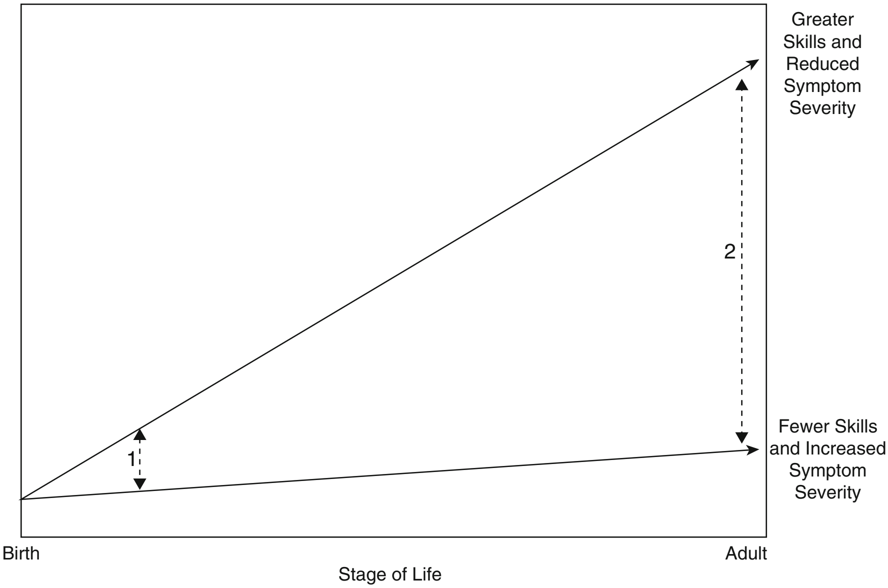

Fig. 1.1 Stylistic representation of a small change in developmental trajectory early in life (point 1) may result in a big difference in outcomes later in life (point 2)

children of typical development between the ages of 7 months and 3 years. The researchers then followed-up when the same group of children were 9 years old and found that the more language a child was exposed to before 3 years of age, the better their academic achievement. Further, and perhaps more relevant to early intervention in ASD, more exposure to language (i.e., more talking around the child) during early childhood was strongly associated with better receptive and expressive vocabularies later in life.

Comparable evidence involving language acquisition has also been reported in more recent research involving children referred for autism. For example, Pickles et al. (2014) administered multiple standardized assessments of expressive and receptive language at six time points between the ages of 2 and 19 years with 192 children initially referred for autism diagnostic evaluation. Although a notable amount of variation was reported within the sample of children, the results suggest a "greater sensitivity in the early years to environments that are more or less supportive of language development" (pp. 1354). Ultimately, their results buttress previous research suggesting that children with autism may experience the same period of sensitivity to language rich environments as children of typical development. These findings have clear implications regarding the timing of intervention initiation as well as the use of strategies designed to increase exposure to language during early interventions for children with autism (e.g., Hancock, Ledbetter-Cho, & Lang, 2016; Peters-Scheffer, Huskens, Didden, & van der Meer, 2016).

Intensive Intervention

Interventions for children with autism tend to be more effective when they are intensive (Howard, Stainslaw, Green, Sparkman, & Cohen, 2014; Klintwall et al., 2015; Virués-Ortega, 2010). Intensity is usually discussed in terms of the number of hours per week intervention is delivered and an intervention is usually considered intense when it is delivered for 20 h per week or more (Matson & Konst, 2014). In a pioneering study investigating early intensive behavioral intervention (EIBI) for children with autism, Lovaas (1987) included a comparison of outcomes when intervention was implemented 10 h or 40 h per week. The 40 h group experienced significantly more improvement in IQ than the lower-intensity 10 h group. The results of Lovaas' comparison of treatment intensity have been replicated in a number of more recent studies involving different intervention dosages, for example: (a) 30 h per week was found to yield statistically better outcomes than 12 h per week (Reed, Osborne, & Corness, 2007); (b) 16–40 h of intervention was better than 1–15 h in parent-implemented interventions by parents with low levels of stress (Osborne, McHugh, Sounders, & Reed, 2008); and (c) approximately 25 h of direct intervention was found to be better than a less intense parent training control (Smith, Groen, & Wynn, 2000).

In an innovative study involving a database populated from previous intervention studies, Klintwall et al. (2015) graphed the developmental trajectories (i.e., change in age-equivalent scores over time) of 453 children 5 years of age or younger with autism who had received either EIBI, a comparable intervention, or were in a control group. For every hour the children in the EIBI group received intervention their developmental trajectories improved (see also Eldevik et al., 2010). Klintwall et al. pointed out that this relationship between dosage of intervention and outcome is comparable to the dose-response concept prevalent in medical research. Specifically, the existence of such a relationship increases certainty regarding influence of the intervention on the dependent variables. In other words, if outcomes are better when more intervention is provided, there is more certainty that it is the intervention, and not some other factor, that is responsible for the improvements (Virués-Ortega, 2010).

There is some debate regarding the seemingly obvious conclusion that the more intervention a child receives the better off the child will be. First, there is likely a point at which an additional hour per week could be counter-productive. Matson and Smith (2008) suggest children could "burn out", that is become too fatigued as a result of the intervention procedures or lose interest in the programmed contingencies intended to reinforce target behaviors. Further, parents are often asked to implement intervention as a means to increase the number of hours the child receives intervention. Osborne et al. (2008) reported an interaction between parent stress level and intervention intensity wherein more hours of parent-implemented intervention by parents with low levels of stress resulted in better child outcomes, however; child outcomes were not better when intervention implemented by parents with high levels of stress was delivered for more hours per week. Finally, Fava and

Strauss (2014) raise several important points that arise from the consideration of intervention intensity only in terms of hours per week. Specifically, they summarized findings from a number of recent meta-analyses and intervention studies and suggest that, in addition to hours per week, intervention intensity should also be considered in terms of (a) active involvement of child and implementer (therapist or parent); (b) setting (e.g., home and community); and (c) treatment fidelity variables (e.g., supervision of implementation to ensure adherence to intervention protocols).

Behavioral Intervention

An intervention can be considered behavioral when it involves the intentional use of operant principles (Skinner, 1988) via applied behavior analysis (ABA) in an effort to improve observable and measureable skills (Baer, Wolf, & Risely, 1968). In a broad sense, behavioral interventions focus on altering the interaction between the child and the child's immediate environment in order to provide specific types of learning experiences. Interventions that (a) involve only medication (e.g., secretin), diet manipulations (e.g., gluten- and casein-free diet) or medical procedures (e.g., chelation) or (b) fail to acknowledge the influence of embedded reinforcement, stimulus control and other behavioral mechanisms (e.g., Sensory Integration Therapy) would not be considered behavioral (Davis et al., 2013; Esch & Carr, 2004; Lang et al., 2012).

Lovaas' (1987) study is widely recognized as the first EIBI applied to a group of children diagnosed with autism. Prior to treatment, children in that study suffered from speech delays, intellectual disability, stereotypy, social deficits and challenging behavior (e.g., aggression and self-injury). Nineteen children received 40 h per week of EIBI for approximately 2 years. Following intervention, 47 % of those children achieved normal intellectual functioning resulting in placement in typical first grade classrooms. Of the 40 children serving as the control group, only 2 % obtained IQs in the typical range and the remainder had intellectual disability and were placed in more restrictive settings. Lovaas' (1987) study is seminal because it challenged that decade's paradigm regarding the nature of disability and the extent to which children with autism could be successfully treated.

A number of attempts to replicate the findings of Lovaas (1987) have been included in meta-analyses and systematic reviews of the literature (e.g., Eldevik et al., 2009; Makrygianni & Reed, 2010). Five or those meta-analytic reviews containing a total of 26 EIBI studies were then summarized by Reichow (2012). Reichow reported that four of the five meta-analyses concluded that EIBI was an effective approach to the treatment of children with autism. Using a variety of different definitions for what constitutes an evidenced-based practice (e.g., Silverman & Hinshaw, 2008), Riechow then concluded that EIBI could be considered an evidence-based practice for children with autism. Riechow also noted that the meta-analysis that did not report EIBI to be effective incorrectly interpreted the results of one of the included studies. The results of Riechow's overview of meta-analyses supported the findings of other systematic reviews focused EIBI research that utilized different approaches in summarizing the research base but also found EIBI to be effective (e.g., Kuppens & Onghena, 2012; Matson & Smith, 2008; Peters-Scheffer et al., 2011; Rogers & Vismara, 2008).

There are at least two notable reviews that concluded there was insufficient evidence to consider EIBI empirically-validated (i.e., Camarata, 2014; Warren et al., 2011). However, Warren et al. (2011) excluded a very large body of research involving experimental single-case designs (SCD) and Camarata (2014) built from the findings of Warren et al. and used a less systematic qualitative approach to review. Koegel, Koegel, Ashbaugh, and Bradshaw (2014) pointed out that SCDs are the most common approach used to evaluate intervention effects with children with autism and that SCDs have more internal validity than randomized clinical trials (RCT) where individual differences in response to intervention may be masked. Although one SCD study may not have the external validity (certainty effects will apply to people not involved in the study) that is obtained via one RCT, replications of effects across numerous SCDs studies does provide certainty regarding the generalizability of findings; leading some to argue that the SCD approach is preferable to RCTs given the heterogeneity of the autism population (Keenan & Dillenburger, 2011). Regardless, no other intervention approach for young children with autism has produced as much supporting research as EIBI (Howard et al., 2014; Klintwall et al., 2015; Koegel et al., 2014; Matson, Tureck, Turygin, Beighley, & Rieske, 2012).

A number of variations in EIBI have emerged since Lovaas (1987) and, although these approaches involve ABA (e.g., environmental arrangement, prompting and reinforcement), they can be distinguished by the degree to which they emphasize: (a) natural environments and routines; (b) involve parents as interventionists; (c) focus on specific target behaviors (e.g., pivotal responses and prelinguistic communications); and (d) following the child's lead as opposed to being adult-directed.

The five specific interventions included in the remainder of this book share many common core components (e.g., reinforcement) and all have been demonstrated to be effective in a variety of research designs including both RCTs and SCDs. Leading researchers in the field and, in some cases the creators or co-creators of specific intervention packages, authored the chapters. The five intervention approaches included in this text are Discrete Trial Training in Chap. 3 (Lerman, Valentino, & LeBlanc, 2016), Pivotal Response Training in Chap. 4 (Koegel, Ashbaugh, & Koegel, 2016), Early Start Denver Model in Chap. 5 (Talbot, Estes, Zierhut, Dawson, & Rogers, 2016), Prelinguistic Milieu Teaching in Chap. 6 (Peters-Scheffer et al., 2016), and Enhanced Milieu Teaching in Chap. 7 (Hancock et al., 2016). These chapters cover the theoretical underpinnings, specific procedures, research base, directions for future research, and considerations for practitioners for each of these evidenced-based EIBI approaches. The book concludes with issues related to parent-implemented intervention in Chap. 8 (Ruppert et al., 2016) and ethical issues related to fad, pseudoscientific and controversial interventions commonly used with children with ASD in Chap. 9 (Travers et al., 2016).

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