Best Practices in Child and Adolescent
Behavioral Health Care
Series Editor: Fred R. Volkmar

Giacomo Vivanti
Kristen Bottema-Beutel
Lauren Turner-Brown *Editors*

Clinical Guide to Early Interventions for Children with Autism

Springer

Best Practices in Child and Adolescent Behavioral Health Care

Series Editor

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Yale University
New Haven, CT, USA

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Series Editor Preface

It is my great pleasure to write an introduction to this much needed book. Nearly 20 years ago, it was my privilege to serve as one of the authors of the ground breaking report from the National Research Council on *Educating Children with Autism* (National Research Council, 2001). At that time, the field was in its infancy with about ten programs around the United States that each had at least one published study on the efficacy of their intervention program for young children with autism. Of course, at the time, the "young child" with autism was usually 4 years of age, sometimes three, and rarely two or under. That situation has, fortunately, now changed with much greater interest being focused on infant siblings and at-risk populations leading to much earlier identification of cases and risk for autism. Greater urgency has also arisen since it now appears that, with early intervention, some students are improving substantially and indeed, many now go to college (Magiati & Howlin, 2019). The body of evidence-based research on treatment has also increased substantially (Odom, Morin, Savage, & Tomaszewski, 2019; Reichow & Barton, 2014). Unfortunately, this substantial body of work has often not been translated into usable form for health care providers and early educators. This volume is intended to address just this need.

The first chapter provides a very helpful overview of changes over time in our conception of autism and its treatment. The second chapter helps us understand the quality of evidence as we evaluate treatments. The third reviews the nature of evidence-based treatments. The fourth chapter addresses understanding the basic social communication problems in autism and is followed by a chapter review the restricted repetitive behaviors that are also ubiquitous to the autism spectrum. The next set of chapters address the major treatment models: ABA, naturalistic methods, and the pioneering Division TEACCH program. The final chapters focus on helping to understand the problem of matching children to treatment programs (a frequent problem in the country as schools often will have one program that may not necessarily be right for a given child). The final two chapters of the book address issues of early intervention and social policy—a growing concern around the world as more awareness of autism and the importance of instituting effective treatments has grown so dramatically.

The authors and their chapters truly represent the entire range of scientifically based disciplines involved in research and clinical practice in early intervention in autism. They include clinical psychologists, behavior analysts, and special educators—all of whom bring complementary perspective to an area that has sadly often been divided into factions that may have little interaction with each other. In all, this is a profoundly helpful and much needed book. It is a great pleasure for me to introduce it.

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Chapter 1
Autism and Autism Treatment: Evolution of Concepts and Practices from Kanner to Contemporary Approaches

Giacomo Vivanti

Autism spectrum disorder (ASD) is a developmental disorder that requires lifelong support. As is often the case for conditions of uncertain etiology, many intervention approaches for ASD exist, only a minority of which have been empirically validated. Evidence-supported early interventions can result in substantial improvements in language, cognitive, social, and adaptive functioning, holding the potential to promote positive long-term outcomes, mitigate lifespan disability, reduce societal costs, and improve personal well-being and productivity of individuals with ASD and their families.

However, advising families in search for the best intervention to help their young children with ASD is challenging, due to the proliferation of intervention options and the heterogeneity of intervention needs within the ASD population. Additional elements of complexity include the striking variability in treatment response, with even the most established interventions producing different levels of success across individuals and contexts, as well as challenges with access to services and the financial impacts on families (Nahmias et al., 2019; Vivanti et al., 2014). Finally, scientific and philosophical divergences across the scientific community, advocacy groups, and practitioners further contribute to a difficult terrain for navigating intervention options. The aim of this book is to provide practical information to navigate this chaotic landscape, starting with an analysis of how knowledge and concepts about ASD and ASD treatment have evolved over the past decades.

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From Kanner to the DSM-5: Evolution of the Diagnostic Concept of Autism and Current Diagnostic Issues

The diagnostic concept of autism was originally formulated in 1943 by an Austrian psychiatrist of Ukrainian origin, Leo Kanner. In his seminal report (1943), Kanner described 11 children affected by what he defined as "autistic disturbances of affective contact," a syndrome characterized by diminished or absent interest in other people, reduced social communication, and a striking "insistence on sameness." Although clinical reports of children with similar characteristics were published before Kanner's report (e.g., De Sanctis, 1906; Klein, 1930/1975; Ssucharewa, 1926), or at around the same time (most notably by Hans Asperger; 1944), Kanner's conceptualization of autism as a distinct clinical syndrome characterized by early onset social communication abnormalities and behavioral rigidity has proven the most influential and enduring.

The validity of autism as a distinct diagnostic entity separate from schizophrenia, language disorders, or general intellectual disability has been supported by subsequent research (Volkmar & McPartland, 2014). Five decades after Kanner's original description, autism was described in a report of the National Institute of Health Autism Working Group as "one of the most reliable diagnoses in psychiatric or developmental research" (Bristol et al., 1996). Following Kanner's first report, the diagnostic definitions of autism in subsequent decades have continued to include the notions of early emerging impairments in social communication (with a discrepancy between social and nonsocial abilities and deficits encompassing both verbal and nonverbal communication) as well as insistence on sameness/resistance to change. Despite this continuity, numerous shifts in the conceptualization and operationalization of autism have occurred, reflecting cultural changes as well as research advances.

In the decades after Kanner's report, the concept of autism was considered by most scholars to be overlapping with childhood psychosis or schizophrenia, with the terms "psychotic" and "autistic" being used interchangeably in research and practice throughout the 1950s, 1960s, and 1970s. Following research by Rutter (1972) and others documenting critical differences between autism and schizophrenia, autism was first included as a separate diagnostic category in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* in 1980, under the definition of "infantile autism" (DSM-III, APA, 1980). This was later changed to "autistic disorder" in 1987 in the revised edition (DSM-III-TR, APA, 1987). Asperger's disorder, a related diagnostic category described as being characterized by higher intellectual functioning and better language abilities compared to autistic disorder, was added in the fourth edition of the *DSM* (DSM-IV, APA, 1994) as part of five mutually exclusive diagnostic subcategories under the umbrella diagnosis of "pervasive developmental disorders" (APA, 1994). This category also included Rett syndrome, childhood disintegrative disorder, and pervasive developmental disorder—not otherwise specified.

In 2013, the DSM-5 grouped the diagnostic criteria for autism in two clusters that are reminiscent of Kanner's original description: "social communication deficits" and "fixated interests and repetitive behaviors." Additionally, the different subtypes of autism defined by mutually exclusive subcategories used in the previous DSM editions were replaced by a single diagnostic label, "autism spectrum disorder" (ASD). This conceptualization reflects the homogeneity in the core impairments, as well as the continuum of variability in the presentation of the clinical features (i.e., the notion of autism as a "spectrum," originally introduced by Wing and Gould in 1979). Additionally, the DSM-5 includes designations for the level of severity for each symptom cluster (on a 3-point scale ranging from "requiring support" to "requiring very substantial support") as well as relevant clinical "specifiers," including language and cognitive ability levels.

The terms autism and autism spectrum disorder (ASD) are now used interchangeably. The term "Asperger," while no longer used clinically, continues to be present in the mainstream vocabulary, most frequently as a cultural identity concept (e.g., "Asperger culture" or "Aspie culture"; Giles et al., 2014). The terms "high functioning" and "low functioning" autism are not formal diagnostic concepts, but are colloquially used in clinical practice to describe individuals with ASD with less severe versus more severe symptomatology and/or cognitive impairment. Importantly, however, both the DSM-5 and the autistic community suggest that "low support needs" and "high support needs" are more accurate and less stigmatizing, as functioning is often proportional to the amount of support provided.

As no biological marker for ASD has been validated to date, ASD diagnosis is based on the ascertainment of the behavioral manifestations listed in the DSM-5, or other formal classification systems such as the International Classification of Diseases (World Health Organization, 1993), which is largely overlapping with the DSM definition. When diagnostic referral occurs in childhood, this is achieved through a combination of direct observation and parent reports focused on the child's developmental history, often supported by standardized protocols such as the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2012) and the Autism Diagnostic Interview (ADI-R; Le Couteur, Lord, & Rutter, 2003).

In most cases, a diagnosis of ASD can be made at 18–24 months, although some children might not be fully symptomatic until 36 month and, more rarely, until school age (Lord et al., 2018; Ozonoff et al., 2018). Once a diagnosis is made, it is generally stable, (Ozonoff et al., 2015; Talbott & Rogers, 2016; Zwaigenbaum et al., 2015). However, cases of children who lose their ASD diagnosis at school age have been reported, although the frequency and nature of this phenomenon remain unclear (Fein et al., 2013; Moulton et al., 2016).

Epidemiology

ASD was once considered a rare disorder, with estimates in the 1960s suggesting 4–5 cases in 10,000. Currently, however, ASD is considered to occur in about 1:59 cases (Baio et al., 2018). While the steady rise in the prevalence of ASD in the last decades has been described by some as an "autism epidemic," it is still debated whether the changes in prevalence rates reflect a true increase in ASD cases. Factors such as the progressive broadening of the diagnostic criteria, improvements in diagnostic procedures, and increased awareness as well as the changes in policies for access to services might have contributed to the apparent "epidemic."

The sex ratio (male:female) is 4.3:1, but there is suggestion that females are more likely to remain undiagnosed (Bargiela et al., 2016; Giarelli et al., 2010). In the United States, there is evidence of ethnic and racial disparities in the identification of ASD (Durkin et al., 2017; Mandell et al., 2009). Little is known about other parts of the world in this respect.

Clinical Characteristics

Autism is a developmental disorder originating in infancy. Behavioral manifestations of ASD are affected by and affect the developmental level of the individual (verbal ability and mental age), and the way symptoms manifest themselves at different times is also influenced by the child's chronological age, history of interaction with the environment (including intervention history), and the presence of co-occurring conditions.

Early clinical presentations of ASD as well as changes in the symptomatology over the course of the lifespan are reviewed below.

Social Communication and Social Interaction

Impaired social communication and social interaction are a defining feature of ASD (Carter et al., 2005; see Chap. 3). While early abnormalities in the social domain have been documented as early as the first 6 months of life (Jones & Klin, 2013; Chawarska et al., 2013), in most cases social symptoms become fully manifest during the second year, with research showing that by 18 months of age children with ASD show reduced eye contact (Chawarska et al., 2014); reduced responsivity to human voices, including to their name being called (Miller et al., 2017); reduced interest in observing social scenes (Chawarska et al., 2013); and reduced frequency of imitation (Vivanti & Hamilton, 2014) as well as impairments in joint attention (i.e., the ability to shift attention between a referent and a social partner; Adamson, 1995; Scaife & Bruner, 1975). Joint attention behaviors that are reduced or absent in ASD include using gestures and eye contact to direct another person's attention to an object or event (e.g., looking at the caregiver and pointing to a butterfly), as well as using others' gaze and head turns to identify the target of their attention (e.g., looking at a flower that the caregiver is pointing to). These behaviors, referred to as initiation and response to joint attention, respectively, are linked to subsequent communicative, social–emotional, and cognitive development in typical and atypical development (Bottema-Beutel, 2016; Mundy, 2016). Children with ASD show deficits in both initiation and response to joint attention (Sigman, 1998; Jones et al., 2014), with more pronounced impairments in the initiation component (Mundy, 2011). Recent research has documented that 10-month-old infants later diagnosed with ASD show fewer episodes of initiation of joint attention compared to their peers (Nystrom et al., 2019).

Importantly, many children with ASD show behaviors that are consistent with a classification of "secure attachment" with their caregivers, such as responding differently to caregivers as compared to strangers (Kasari et al., 1993; Sigman & Ungerer, 1984), seeking and maintaining proximity with caregivers after separation (Sigman & Mundy, 1989), engaging in more proximity-seeking behaviors toward their caregiver, and engaging in fewer explorative behaviors in the presence of a stranger (Dissanayake & Crossley, 1996). The presence of these social and affective manifestations toward caregivers may contribute to lower than expected referrals for evaluations by physicians even after a child screens as being at risk for ASD (Pierce et al., 2011). However, proximity-seeking behaviors with caregivers in children with ASD may be less frequent, less sustained, or less conducive to rich social exchanges (Vivanti & Nuske, 2017). Young children with ASD also show diminished engagement in social play routines such as peekaboo (Bolton et al., 2012), as well as reduced pretend and imaginative play (e.g., Barbaro & Dissanayake, 2013).

Additional features include reduced interest in and engagement with peers (McGee et al., 1997), reduced responsivity to others' emotions (Hutman et al., 2010), difficulties interpreting other people's behavior (such as incorrectly predicting behavior based on their own knowledge, rather than others' knowledge; Baron-Cohen, 1995; Senju, 2012), and fewer expressions of pleasure during social interactions (Wan et al., 2013). In many cases, children with ASD do initiate and respond to social contact but their interactions are idiosyncratic or "on their terms" (e.g., approaching unknown people to do "high five" multiple times; Rapin, 2002).

Spoken language is often delayed—and in approximately 25–30% of cases never develops (Tager-Flusberg & Kasari, 2013). While delayed or absent verbal communication does not discriminate ASD from other conditions, a distinctive feature of children with ASD is a lack of attempt to compensate speech deficits with gestures or other forms of nonverbal communication. Abnormal speech patterns, odd words or phrases, echolalia, and unusual tone or pitch in vocalizations or words are other distinctive characteristics of early language in ASD and may persist throughout the lifespan (Kim et al., 2014). Many children with ASD show an increase in their use of communicative speech from childhood to adolescence and adulthood, although the social use and social understanding of communication (pragmatics) is likely to remain impaired. For example, children with ASD might fail to understand others' communication when the communicative intent differs from the literal meaning of a sentence (e.g., irony and sarcasm; Happé, 1994).

Similarly, social and communicative deficits may manifest differently at different developmental stages and in different contexts. At school age, as the child is exposed to increasingly complex social demands, deficits in developing, maintaining, and understanding relationships with peers (such as friendship) become more relevant. Many individuals with ASD learn coping strategies to adapt to their social environment, but social symptoms typically continue to persist throughout the lifespan. For example, in adolescence and adulthood, social interactions may increase in frequency but retain a qualitative impairment (stilted, exaggerated, or "socially awkward" behavior). For many individuals with ASD interest in social contact increases during adolescence and adulthood, including the desire to have friends and romantic relationships, and difficulties with accomplishing these social goals might cause frustration and affect well-being (Sperry & Mesibov, 2005). Experiencing the social world as indecipherable, frustrating, or rejecting can lead individuals with ASD to "give up" on social interactions, which leads to fewer opportunities for developing social skills, further limiting social opportunities and exacerbating social difficulties. See Chap. 3 for an in-depth overview of social communication development and intervention in ASD.

Restricted, Repetitive Patterns of Behavior, Interests, or Activities

Repetitive and restricted behaviors (RRBs) are a heterogeneous group of symptoms characterized by rigidity and resistance to change. These symptoms include behaviors characterized by stereotyped or repetitive movements (such as hand-flapping and repetitive use of objects) or repetitive speech (echolalia and idiosyncratic phrases) and restricted, fixated interests that are unusual in their intensity or focus (such as strong attachments to a specific object, circumscribed or perseverative interests, and excessive focus on one conversation topic). Other features of ASD that fall within this domain are the "insistence on sameness" originally described by Kanner (such as the desire to watch the same episode of a TV show repeatedly or to eat the same food every day) and the rigid adherence to routines or rituals (e.g., singing the song "five little monkeys" while lining up five objects every morning at childcare). Seeking of specific sensations (such as deep pressure), unusual sensory interests (such as peering at or smelling objects), and hyper- or hyporeactivity to sensory inputs (e.g., experiencing everyday sounds as being excessively loud or imperceptible) are also classified as RRBs.

RRBs appear to emerge during infancy and persist across the lifespan, although they might manifest differently at different ages, and their prevalence and severity are extremely variable in the ASD population (Ozonoff et al., 2008; Uljarević et al., 2017). Unlike social symptoms, RRBs are not a distinctive feature of ASD, as some types of repetitive behaviors are observed in intellectual disabilities, psychiatric disorders, neurological conditions, and other clinical conditions with sensory deficits, as well as in typically developing toddlers (Evans et al., 1997). However, individuals with ASD appear to engage in RRBs more frequently compared to those with other conditions, and their RRBs are expressed across a wider range of behaviors (Leekam, Prior, & Uljarevic, 2011).

Several criteria have been proposed to classify RRBs into specific subtypes, such the distinction between lower order (which include finger flicking, body rocking, and hand flapping) and higher order RRBs (including circumscribed interests and fascinations/preoccupations for particular topics, such as trains, wasps, or the French Revolution; Bodfish, 2007) as well as the distinction between repetitive sensory-motor (such as motor body mannerisms, repetitive use of objects, and unusual sensory interests), and "insistence on sameness" behaviors (including rituals and resistance to change; Richler et al., 2007; Prior & Macmillan, 1973). Rather than being mutually exclusive, the proposed subtypes appear to be characterized by permeable boundaries, with cognitive and language functioning influencing the manifestations of different RRBs (Leekam et al., 2011). For example, repetitive use of objects (e.g., spinning the wheels of a toy car) or motor stereotypies such as finger flicking or hand flapping are more likely to occur in children with ASD with lower versus higher cognitive functioning, whereas circumscribed interests are more prevalent in individuals with normative IQ (Bishop, Richler, & Lord, 2006). There is emerging evidence that repetitive behaviors might decrease in frequency and severity with age, independently of the cognitive level, with the exception of stereotyped movements that tend to be more persistent in individuals with co-occurring autism and intellectual disability (Esbensen, Seltzer, Lam, & Bodfish, 2009). See Chap. 4 for a detailed review on the nature and treatment of RRBs in ASD.

Gender Differences in Clinical Presentation

Research on gender differences in ASD phenotypes has mixed evidence, partly because fewer female participants have been involved in research studies compared to males. Evidence from large twin studies suggests that males may require greater familial etiologic load to manifest the ASD phenotype (Robinson et al., 2013). Consistent with this notion, a more severe presentation has been reported in females compared to males (Christensen et al., 2016; Lord & Schopler, 1985) and the sex ratio has been reported to be <2:1 in more severely impaired cases (Loomes et al., 2017). There is some evidence of increased social interest and approach in females versus males as well as female superiority in executive function and visuospatial processing tasks (Bölte et al., 2011; Dean, Harwood & Kasari, 2017; Harrop et al., 2018; Koyama et al., 2009)—however, counterevidence exists (see Ferri, Abel, & Brodkin, 2018, for a recent review). It is possible that gender differences in behaviors related to ASD diagnosis (e.g., social approach) and camouflage of autistic symptoms (i.e., imitation of neurotypical peers to mask ASD symptoms) may result in under- or misdiagnosing among females on the milder end of the spectrum (Mandy et al., 2012), although more research is needed to corroborate this notion.

Co-Occurring Conditions

Autism frequently co-occurs with other developmental, psychiatric, or medical conditions, which might exacerbate the symptoms, aggravate impairment, and complicate diagnosis and treatment. Intellectual disability, which was once thought to be present in most individuals with ASD, is now estimated to occur in 30–50% of children diagnosed with ASD (Charman et al., 2011; Christensen et al., 2018; Postorino et al., 2016; Rydzewska et al., 2018). This change might reflect advances in early detection and improved access to early intervention, as well as increased awareness and diagnostic expertise improving the identification of ASD symptoms in individuals without intellectual disability. While cognitive functioning and ASD symptomatology are conceptually distinct constructs, recent research suggests that children with more severe ASD symptoms are more likely to have co-occurring cognitive impairments (Gotham, Pickles, & Lord, 2012; Vivanti et al., 2013), potentially reflecting a link between barriers to social learning posed by severe social/communicative impairments and developmental delays (Vivanti, Dawson, & Rogers, 2017).

The extreme heterogeneity in intellectual functioning within the ASD population, ranging from severe intellectual disability to above average IQ, results in different challenges and priorities with regards to intervention. Additionally, such variation can be a source of confusion for families, especially those with more cognitively impaired children, who might fail to see the connection between the needs of their children and those expressed by cognitively able individuals with ASD (e.g., self-advocates with ASD who emphasize intelligence as a key feature of ASD and challenge the utility of interventions focused on “normalizing” behavior; Cascio, 2012).

Additionally, ASD co-occurs with several psychiatric disorders (including anxiety, obsessive-compulsive disorder, depression, attention-deficit hyperactivity disorder [ADHD], and oppositional-defiant disorder) more frequently compared to rates in the general population (Rydzewska et al., 2018; Simonoff et al., 2013). The high frequency of mental health difficulties in ASD might reflect (1) shared pathophysiology (i.e., what causes ASD also causes or increases the risk for the comorbid condition); (2) the downstream consequence of growing up with ASD (e.g., coping with social demands that exceed processing capacity, peer rejection, and other negative life experiences stemming from the stigma associated with ASD symptoms); (3) shared symptom domains or overlapping diagnostic criteria; or (4) an interplay between these different factors (Postorino et al., 2017; Uljarevic et al., 2016). Additionally, ASD co-occurs at a higher rate than the typical population with tics and Tourette Syndrome (Canitano & Vivanti, 2007; Kalyva et al., 2016), sleeping disturbances (Souders et al., 2017), eating disorders and restricted and rigid food choices (Sharp et al., 2013), gastrointestinal issues (Holingue et al., 2018), elimination problems (Gorrindo et al., 2012), and most notably, epilepsy, which might be present in up to 25% of the ASD population and is more frequently present in females and more cognitively impaired individuals (Jeste & Tuchman, 2015; Volkmar & Wiesner, 2017).

Etiology

Genetic factors play a critical role in the etiology of ASD, with recent research indicating that approximately 80% of ASD risk is heritable (Bai et al., 2019; Tick, Bolton et al., 2016). Twin and family studies suggest that siblings of children with ASD have a 20–50-fold increased risk of having ASD compared to the general population, and the risk is increased for those with more than one sibling with ASD, while the concordance rate in identical twins is up to 90% (Colvert, Tick et al., 2015; Rutter, 2000). Research has pointed to a large number of common and rare genetic variants associated with ASD risk, but none of them accounts for more than a minority of cases, suggesting that the risk of developing ASD might be predominantly related to the additive contributions from common and rare variants that, individually, are not sufficient to cause the condition (Arnett, Trinh, & Bernier, 2019; Ramaswami & Geschwind, 2018; Weiner et al., 2017).

While this body of research indicates that ASD is one of the most heritable neurodevelopmental conditions, the lack of complete concordance in monozygotic twins indicates that nongenetic factors also contribute to ASD. Environmental factors that have been associated with increased risk for ASD include advanced maternal age (≥40 years) and paternal age (≥50 years; Lyall et al., 2017) as well as preterm birth (Lampi et al., 2012). Additionally, there is some indication that short interpregnancy intervals (<24 months; Zerbo et al., 2015) and maternal hospitalization during pregnancy (Lyall et al., 2017) might be associated with the risk for ASD, although more research is needed to corroborate these initial findings.

The hypotheses that ASD could be caused by vaccines or poor parenting have been repeatedly tested and unequivocally disconfirmed (Capps, Sigman, & Mundy, 1994; Lord et al., 2018; Parker, Schwartz, Todd, & Pickering, 2004; Ventola et al., 2017).

Neurocognitive Models of ASD

While the nature of the neurocognitive processes underlying the ASD phenotype remains unclear, several theoretical models have been proposed. Historically, these have included (a) the notion that ASD symptoms reflect difficulties in the ability to attribute mental states to others, or “theory of mind” (Baron-Cohen, Leslie, & Frith, 1985), (b) the “weak central coherence” account, i.e., a detail-focused processing style, whereby information is processed in terms of constituent parts, rather than global meanings (Frith & Happé, 1994), and (c) deficits in executive functioning which causes difficulties in the flexible organization of behavior across social and nonsocial domains (Ozonoff, 1997). While each of these accounts have contributed critical insight on several phenomena related to ASD, none of them is universally considered to provide a satisfactory account for constellation of features observed in ASD (Frith, 2012).

More recently, theoretical models have been steering away from "single deficit" explanations to focus on the developmental pathways that lead from early risk factors to specific features of ASD (Vivanti, Yerys & Salomone, 2019). Recent accounts informed by longitudinal research on infants at risk for ASD include the notion that social symptoms reflect the downstream consequence of early disruptions in the reflexive, orienting mechanisms that drive newborns' attention toward social stimuli (Di Giorgio et al., 2016), or, alternatively, disruptions in the developmental transition from reflexive orienting to volitional attentional engagement with the social world that occurs during the first 6 months of life (Klin et al., 2015; Shultz et al., 2018). Diminished attentional engagement with social stimuli has been proposed to originate either from domain-specific abnormalities in social–cognitive processing (whereby social stimuli are not experienced as meaningful or interpretable; Leekam, 2016), diminished social motivation (whereby social stimuli are not experienced as rewarding; Chevallier et al., 2012; Mundy, 1995), or widespread nonspecific abnormalities that disrupt social processing because of the inherent complexity and unpredictability of social stimuli compared to nonsocial aspects of the environment (Minshew & Goldstein, 1998; Johnson, 2017). Research does not provide unequivocal support to any of these explanations, with some findings pointing to widespread network abnormalities in infants with ASD, and other research pointing to specific abnormalities within the social brain network, including atypical brain activity in response to social versus nonsocial stimuli and rewards (Pelphrey et al., 2014).

While the causal pathways in ASD remain unclear, these converging lines of inquiry suggest that an altered engagement with social stimuli during early sensitive periods might affect neural specialization and behavioral expertise in the social domain, thus exacerbating initial abnormalities in an iterative fashion (i.e., as children with ASD are less engaged with the social world due to initial biological constraints, they have fewer opportunities to learn and practice social and communication skills, thus failing to build a behavioral repertoire from social experience). A corollary of this developmental perspective is that targeted intervention during early sensitive periods has the potential to mitigate or, according to some scholars, prevent this escalating deviance from typical social development (Dawson, 2008; Vivanti, Dawson, & Rogers, 2017). This topic will be the focus of the remainder of the chapter and of this manual.

Treatment for Autism Spectrum Disorder: Evolution of Concepts and Principles

No pharmacological treatment has been shown to address the core symptoms of ASD, and currently recommended approaches to early intervention for ASD rely on various applications of behavioral, developmental, and special education principles (Lord et al., 2018; Volkmar et al., 2014). The historical evolution of early intervention for ASD is marked by the influence of the different theoretical frameworks that have been prominent within disciplines concerned with ASD at different stages.

Influences from Psychodynamic Theory

The earliest approaches to ASD intervention, in the 1950s and 1960s, were predominantly informed by psychodynamic theory, and in particular by the notions that mother–child dynamics play a critical role in psychopathology (Freud, 1911), and that autistic symptoms are the consequence of inadequate parenting (Bettelheim, 1967; Green & Schecter, 1957; Kanner & Eisenberg, 1956; but see Anna Freud, 1969/2015 for a dissenting voice within the psychoanalytic community). Interventions derived from this framework included psychodynamic psychotherapy to the child and the child's mother, as well as "parentectomy," which involved the separation of children from their supposedly unloving families and their placement in psychiatric residential institutions. The psychodynamic approach to ASD was discredited in the following decades both because of unsatisfactory scientific support and ethical considerations, although various elaborations of the same theoretical framework continued to be perpetuated throughout the 1990s (e.g., Tustin, 1991) and continue to be influential in many countries (Severson, Aune, Jodlowski & Osteen 2008).

Influences from Applied Behavior Analysis

In the mid-1960s, applied behavior analysis (ABA; Baer, Wolf, & Risley, 1968) became a major influence on ASD intervention as Ferster (1964) and Lovaas (1968) and other ABA pioneers introduced the use of practices based on operant conditioning (Skinner, 1953) in the field of ASD. A key concept introduced by the ABA work is the notion that the behavior of children with ASD obeys the same laws that shape learning in typical development (Ferster & DeMyer, 1961; Lovaas & Smith, 1989; Mayville & Mulick, 2011), whereby behaviors followed by a positive consequence (reinforcement) strengthen and are more likely to be produced when the stimulus that triggered the behavior (antecedent) is presented, while those followed by a negative consequence result in an opposite effect. A critical corollary of this notion is that specific behaviors can be encouraged or discouraged through a careful manipulation of antecedents and consequences. Additional influential elements introduced by ABA include the emphasis on unambiguous operational definitions of intervention goals and targets (i.e., promoting the acquisition of clearly defined desirable behaviors and discouraging clearly defined maladaptive behaviors), and the use of empirical data as the platform for decision making and evaluation of outcomes. Early applications of these principles included procedures that have largely been abandoned because of ethical and scientific considerations, such as the use of electric shocks to induce behavior modifications as described by Lovaas and colleagues (1965), which was later defined by Lovaas as “a mistake based on erroneous beliefs” (Lovaas, 1989). Nevertheless, the shift in focus from the psychoanalytic emphasis on unobservable unconscious dimensions to the data-driven observation and manipulation of well-defined behaviors provided the infrastructure for most contemporary approaches to ASD interventions, becoming the foundation for the highly structured approaches known as discrete trial teaching (Lovaas, 1981), as well as subsequent applications of ABA (Schreibman et al., 2015), including the early intervention approach known as early intensive behavioral intervention (EIBI; see Chap. 5).

Influences from Developmental Psychology

The application of concepts from developmental psychology in the field of ASD became another major influence in ASD early intervention practices starting in the 1980s. A concept introduced by developmental literature that became relevant to ASD intervention is constructivism (Bruner, 1978; Montessori, 1912; Piaget, 1929; Vygotsky, 1930–1934/1978), i.e., the notion that skill acquisition during early development is built on the child’s active, self-directed engagement with a stimulating physical and social environment, with knowledge gained at specific developmental stages supporting the transition to more advanced developmental stages which enable the acquisition of complex skills. The adult’s role in this context is to facilitate skill acquisition through scaffolding (Bruner, 1978), i.e., supporting the engagement of the child in joint routines that build upon the child’s initiative and current knowledge to generate opportunities to gain more advanced knowledge (a concept analogous to the construct of ‘zone of proximal development’, formulated by Vygotsky in the 1930s; Vygotsky, 1930–1934/1978). For example, during shared storybook reading routines, adults scaffold the child’s acquisition of new knowledge by establishing a joint focus (the illustrations in the book), highlighting the relationship between the words, images, and emotions associated with the events in the story, eliciting children’s verbal and nonverbal responses (i.e., emotional expressions, gestures, words) through pauses and questions, and providing feedback, such as asking for clarification or recasting the child’s utterances (Ninio & Bruner, 1978). Pivotal skills in the domains of communication, joint attention, and imitation that are learned during joint activities provide the foundation for engagement in more complex social exchanges, which, in turn, enable the acquisition of further knowledge. A critical corollary of this framework is that advances in some pivotal or prerequisite skills will facilitate the acquisition of more advanced skills.

These concepts from developmental literature became increasingly influential in ASD intervention as research started to show that developmental sequences of skill acquisition in children with ASD appear to follow the same path observed in those with typical development. For example, development of verbal language is predicted by joint attention skills both in typical children and in those with ASD, and improvements in joint attention result in language improvements (Bottema-Beutel, 2016; Kasari, Sigman, Mundy, & Yirmiya, 1990; Sigman et al., 1999; Whalen, Schreibman, & Ingersoll, 2006). Developmental concepts that continue to be prominent in ASD early intervention include the use of "developmentally appropriate" treatment targets and procedures (e.g., teaching developmental prerequisite to facilitate acquisition of more complex skills), the involvement of families and daily routines as a privileged context for learning, and the focus on scaffolding over didactic teaching to promote skill acquisition in early development (Rogers, 1999; Schreibman et al., 2015).

Influences from Neuroscience

Starting from the late 1990s, ASD intervention has been influenced by social neuroscience research in typical development and ASD—i.e., the study of how social information and social experiences shape and are shaped by brain development (Lieberman, 2007). A notion from this field that is of prominent relevance in ASD early intervention is that the neural infrastructure of human sociability relies on an "experience-expectant" process. This means that "hardwired" brain mechanisms bias children to actively seek out opportunities for social engagement during early development. These early social experiences, in turn, provide the input needed for the brain to become specialized in social information processing, which then enables participation in and learning from more sophisticated social interactions (Brownell, 2013; Sullivan, Stone, & Dawson, 2014).

While research in this area is in its infancy, several interconnected brain areas and circuitries involved in this iterative process have been identified. This includes social–cognitive structures responsible for the quick processing of social–emotional cues such as gaze direction and emotional expressions (Frith & Frith, 2010), the social reward system, which underpins the experience of pleasure associated with social interaction (Dolen, Darvishzadeh, Huang, & Malenka, 2013), and the mirror neuron system (Rizzolatti & Sinigaglia, 2008). The mirror neuron system consists of a set of brain regions that activate during action execution as well as during the observation of the same action. This mechanism is thought to enable the observer to understand others' actions and emotions as if she/he would be doing a similar action or experiencing the same emotion, thus facilitating the processing of shared experiences. While the translation of neuroscientific findings into treatment practices is in the very early stages, the influence of social neuroscience perspectives on intervention includes the emphasis on engaging the child in typical social routines during early critical periods of brain plasticity, increasing the reward value of social exchanges, and supporting the child to register the correspondences between his/her and others' actions during shared experiences (Rogers, Vivanti, & Rocha, 2017; Vivanti & Rogers, 2014).

Influences from Implementation Science

A more recent influence on ASD early intervention is the emerging field of implementation science, which studies the factors that facilitate adoption and successful implementation of interventions in the "real world" (Eccles et al., 2009; Green, 2012). This field focuses on features such as organizational systems of the context in which interventions take place, as well as beliefs, cultures, and the "buy-in" of professionals involved in the intervention. A critical notion derived from this research is that the commitment to use intervention techniques and implement them as intended is not only dependent on the level of evidence supporting the intervention, but also on the perceived fit between features of the intervention and stakeholder attitudes (whether they think that using the intervention is the right thing to do), norms (the extent with which they feel they are expected to use the intervention, or believe that their peers are using it), self-efficacy, and the perception of the cost-benefit of adding new approaches to their standard practice. These factors will affect the initial uptake of the intervention, maintenance over time, and the degree of integrity to which it is delivered, thus affecting intervention outcomes. Recent early intervention practices for ASD influenced by implementation science include the introduction of participatory research methods, in which administrators', practitioners', and end users' resources and preferences are examined and taken into consideration from the early stages of designing and piloting new interventions (Dingfelder & Mandell, 2011; Locke et al., 2016; Smith et al., 2007).

Influences from the Neurodiversity Framework

A recent societal influence that has affected debate on intervention for ASD is the concept of neurodiversity, which refers to the notion that neurological differences are to be recognized and respected as any other human variations (den Houting, 2019; Baron-Cohen, 2017), rather than being seen as indicators of a pathology to be corrected or eradicated. Some self-advocates with ASD who adopt this perspective question the need for curing or "normalizing" autism, arguing that the goal of increasing "desirable" and decreasing "undesirable" behaviors in intervention reflects the parameters of what is desirable or undesirable set by a "neurotypical" majority. Further, this approach to treatment has been criticized as being designed to achieve conformity at the expenses of diversity, rather than serving the best interest of those with ASD. According to this perspective, ASD is a way of being in the world, or a culture, which requires support and appreciation, rather than prevention or treatment (Norbury & Sparks, 2013; see also Mesibov, Shea, & Schopler, 2004, for an early application of the concept of autism as a culture for treatment).

Importantly, other advocacy groups are not opposed to the idea of intervention per se, but emphasize the importance of practices aimed at increasing opportunities for self-determination and eliminating environmental and social barriers to civil rights and inclusion in individuals in the autism spectrum. While the positions expressed by neurodiversity advocates are multifaceted and highly debated, especially in the context of the heterogeneity of intervention needs within the ASD population, there is a growing focus on researching treatment methods and outcomes that include preferences and perspectives of individuals with ASD (Pellicano & Stears, 2011; Vivanti, 2020).

Conclusions

Despite the tremendous increase in research in the past decades, many aspects of ASD continue to remain enigmatic. As it has become clear that ASD does not result from a single disruption or etiological pathway, the challenge for early intervention research is to derive practical knowledge from the examination of the interplay between biological, neuropsychological, and environmental factors underlying the heterogeneous and seemingly unrelated clusters of symptoms and associated features that characterize the autism spectrum. Additionally, issues on appreciation of diversity, human rights, and self-determination are increasingly stimulating societal debate and challenging the established intervention paradigms. Despite these challenges, it can be concluded that the current landscape of early intervention for ASD has been shaped by progression from the widespread use of unethical and unsupported treatments to the increasing appreciation and integration of evolving scientific knowledge and more inclusive views on ASD.

While no area of early intervention for ASD is free from debate, and divergences among different schools of thought continue to exist, early interventions for ASD that have proven to be effective converge around a set of key features. These include the engagement of the child in a planned educational/psychosocial intervention that (1) starts early in life, (2) is developmentally appropriate, (3) is implemented throughout the child’s day, (4) uses well-defined instructional strategies to target the core features of autism and address functional/adaptive skills, (5) includes systematic assessment procedures to define individualized sets of goals tailored to the individual child’s profile of strength and needs, (6) includes a data collection system to monitor progress, and (7) involves caregivers in establishing treatment goals and delivering intervention strategies. Within this framework, different interventions exist, which will be described in detail in the following chapters.

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Chapter 2
Criteria to Evaluate Evidence in Interventions for Children with Autism

Lauren Turner-Brown and Rachel Sandercock

Introduction

What is the best intervention for a child with autism? This question has been asked by parents, professionals, and researchers for decades. Many voices answer this question, insisting that approach A can cure ASD, that approach B is useless, and approach C is harmful. At the same time, others insist that approach A is harmful, approach B is the best for everyone, and approach C is useless. The challenge for parents and professionals asking this question is knowing who to believe and how to interpret claims. Fortunately, considerable research and rigorous reviews of that research exist to help in the process. The results of this research have shown that there is not one answer to the question asked. In this chapter, we introduce common terminology for different treatment approaches, ways their strength of evidence have been tested, and guidance on how to interpret research findings on early intervention for children with ASD.

Evaluating Research

Several groups have reviewed literature on autism interventions in an attempt to establishing which approaches are effective (and which approaches are ineffective). Examples of reviews include the National Standards Project (NSP) and the National

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Professional Development Center on Autism Spectrum Disorder (NPDC), as well as reviews by the Centers for Medicare and Medicaid Services, Cochrane reviews, and the Agency for Healthcare Research and Quality (Mandell, Young, Corea, & Kimani, 2010; National Autism Center, 2009; Reichow, Hume, Barton, & Boyd, 2018; Warren et al., 2012; Wong et al., 2015). In addition to these agencies and organizations, recent reviews have also been conducted by French & Kennedy (2018) and Smith & Iadarola (2015). These reviews utilized varying criteria to evaluate evidence in the literature, with some more stringent than others, and classified intervention approaches according to the amount or strength of support determined to exist in the literature. In general, strength of evidence is determined by evaluating the *risk of bias*, i.e., the risk that a study might over- or underestimate the true intervention effect. For example, our confidence that a study provides an unbiased (and therefore credible) documentation of intervention effects is reduced when clinicians assessing intervention outcomes are aware of which intervention the participants have received, when many participants discontinue their intervention and their outcomes are not assessed, when researchers report results from some but not all outcome measures (i.e., selective outcome reporting), or when additional factors that might affect participants' outcomes are not taken into account (e.g., participants receiving additional interventions). A variety of research approaches exist to address these risks, such as "blinding" assessors, randomly allocating participants to intervention or control conditions and reporting all outcome measures for all participants even when they decide to discontinue the intervention before all the planned sessions are concluded. Box 2.1 reports common research designs to evaluate intervention effectiveness, including relevant terminology and implications for risk of bias (Barker, Pistrang, & Elliott, 2016).

Box 2.1: Key Terminologies for Intervention Research

Independent variable: The treatment or intervention that is varied by the experimenter.

Dependent variable: The measure of the independent variable's effect; in other words, the outcome measure or behaviors/skills that are changed by the intervention. (e.g., expressive language skills or frequency of aggressive behavior).

Efficacy: The performance of an intervention under ideal and controlled circumstances.

Effectiveness: The performance of an intervention under "real-world" conditions (e.g., when tested by various groups in various settings, including community settings).

Fidelity: The degree to which the intervention is delivered as described. (e.g., How well did the therapist adhere to the intended implementation of an intervention in each session?)

Intention-to-treat analysis: A conservative design approach whereby participants are compared within the groups to which they were initially randomized, independently of variations such as participants dropping out or receiving additional services. This approach protects from the risk of selectively reporting outcomes for participants who were satisfied with the intervention progress, thus inflating the intervention effect.

Quasi-experimental design: Research design that does not use random assignment to determine intervention and nonintervention groups; groups instead may be determined by naturally formed or preexisting conditions (e.g., students already attending schools A and B).

Randomized clinical trials (RCT): An experimental design that randomly assigns participants to the experimental groups or conditions (i.e., receiving the intervention vs. the control group) so that the groups will then be equivalent except for the experimental manipulation, allowing researchers to infer causality about any relationships found between an intervention and subsequent outcomes. Although this design does not eliminate external factors that contribute to variance, it eliminates the risk of a systematic bias in favor of one group through randomization.

Reliability: The degree of consistency and reproducibility of the measurement, across raters (interrater reliability) or repeated administrations (test–retest reliability); in other words, the extent to which you achieve equivalent results each time when repeating measurement in different ways.

Validity: The degree to which a tool (such as questionnaire or test) measure what it is intended to measure.

Single case/single-subject design: A research design using single participants or small groups of participants who serve as their own control to measure the effects of an intervention; outcomes are measured within-subjects (e.g., child before and after intervention begins) rather than between-subjects (e.g., comparing changes in one group that received intervention to another group that received different interventions).

Waitlist control design: A research design in which participants are either assigned to the experimental group, in which they receive an intervention immediately, or are placed on a waiting list to receive the intervention once the experimental group has completed it.

Despite the plethora of approaches used to minimize the risk that study results do not reflect true intervention effects, it is virtually impossible to eliminate all possible "confound factors" when measuring treatment outcomes, making it necessary to establish what could be considered "acceptable" versus unacceptable risks of bias in intervention evaluation research.

Notably, there is no universal consensus within the field of ASD early intervention as to what criteria should be used to evaluate the strength of evidence and determine the impact of risk of bias on the estimates of intervention effects (Vivanti et al., 2018). For example, earlier reviews of intervention approaches included single-subject or case series designs (e.g., Rogers & Vismara, 2008; see

Box 2.1 for a definition of single-subject design studies), while more recent reviews tend to exclude studies that do not have clear group comparison designs (e.g., Smith & Iadarola, 2015). While excluding single-subject designs may be more rigorous from a research methodology standpoint, many in the field take issue with this approach as the heterogeneous nature of ASD has historically lent itself to a wide body of research based on individual subjects.

Agency	Publication year	Type of review
National Research Council	2001	Broad review yielded general recommendations for types and amounts of intervention for young children with ASD.
National Standards Project	2009, 2015	Categorized interventions as *Emerging, Established,* or *Unestablished.*
National Professional Development Center	2010, 2014	Funded by Department of Education; most recently identified 24 practices as having sufficient research to be considered *evidence-based practices.*
Cochrane Reviews	Multiple	Mission to promote evidence-informed health decision-making by producing systematic reviews of research evidence. Multiple reviews on ASD treatments, including complementary treatments, medications, and behavioral interventions. For young children, one review on early intensive behavioral intervention and parent-mediated interventions.
Center for Medicare and Medicaid	2011	A review provided information to Medicaid about evidence base for a range of interventions for ASD, categorizing them as established, emerging, and unestablished.
Agency for Healthcare Research and Quality	Multiple	Comprehensive reviews of behavioral, complementary, and alternative medicine (CAM) and sensory interventions for children with ASD.

For example, the NPDC labeled an intervention approach as being an evidence-based practice if the following criteria were met in their review: at least two high-quality experimental or quasi-experimental group design articles by at least two different researchers/groups, or at least five high-quality single-subject (SS) articles by at least three different researchers with at least 20 participants across all studies, or a combination of one or more high-quality quasi-experimental or experimental group designs AND three or more high-quality SS designs by two or more researchers. Using these criteria, the NPDC identified 27 evidence-based practices (EBPs) and provided a summary table that shows for which areas of development and for which age the practices have enough evidence. Other criteria, such as the grading of recommendations assessment, development, and evaluation (GRADE system), used by the World Health Organization and Cochrane Reviews are more stringent and classifies studies that do not use randomization as at high risk of bias (see the recent review on autism early intensive behavioral intervention by Reichow et al., 2018). While each reviewing agency varied slightly in the specific criteria for setting up a practice as "evidence based," or "established," there is considerable overlap in the resulting lists of approaches with strongest research support.

These reviews are excellent places to familiarize oneself with established or promising intervention approaches. However, they exist at a certain time point and are not "living" documents. Thus, an approach may not be on the list of established practices simply because the research on that approach was conducted more recently than the review. While the number of high-quality, large studies exploring interventions for ASD is larger than for other neurodevelopmental disorders (Kasari, Gulsrud, Paparella, Hellemann, & Berry, 2015) there are considerably fewer group design studies in ASD in comparison to other mental health conditions in children. Thus, decisions about what works for children with ASD are being made based on less research than other conditions (see McGrew, Ruble, & Smith, 2016 for additional commentary).

Factors of Experimental Rigor

While the amount of research on an intervention is an important consideration, it is also important to consider the methodological strength of the existing studies when evaluating an intervention approach. This requires first assessing the research design of the studies on a particular intervention. Research design reflects the degree to which experimental control was demonstrated, which is tied to the number of participants and/or groups involved and the type of design that was used.

Importantly, however, different methodological approaches are relevant at different stages of treatment development and evaluation. The key stages in research on interventions for individuals with ASD are as follows: (a) formulation and systematic application of a new intervention technique, (b) developing a manual and research plan for evaluation of intervention across sites, (c) *randomized clinical trials* (RCT), and (d) community effectiveness studies (Smith et al., 2007; Vivanti et al., 2018). This process aims to progress steadily across a continuum of evaluation strategies, from efficacy to effectiveness trials. *Efficacy* refers to the performance of an intervention under ideal and control circumstances, while *effectiveness* refers to its performance under "real-world" conditions (Singal, Higgins, & Waljee, 2014).

The first stage in this progression aims to demonstrate that an intervention technique has the potential for therapeutic benefit. At this stage, a series of *singe-case designs* may be an appropriate approach, particularly for interventions that require significant resources or comprise novel approaches. The second and third stages focus on standardizing an intervention and then implementing the intervention in highly controlled RCTs. While efficacy studies optimize the likelihood of detecting the effects of an intervention, the use of carefully selected subject and clinicians paired with significant research oversight limits generalizability to the community. Thus, the fourth stage assesses the effectiveness of an intervention when implemented by competent clinicians in real-world settings. Finally, the last stage of intervention studies addresses the challenge of implementing findings by translating research into actual policy or practice. Additional details about these approaches follow (Fig. 2.1).

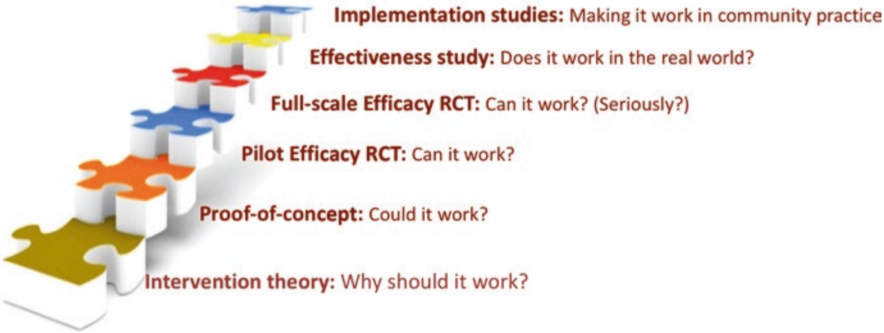

Fig. 2.1 Hierarchy of steps and associated costs of intervention, implementation, and evaluation (based on Vivanti et al., 2018). Each step is illustrated in Box 2.2

Box 2.2: Stages and Processes in Developing, Evaluating, and Implementing Interventions (Adapted from Vivanti et al., 2018)

Interventions are based on intervention *theories* which articulate the rationale for a given approach, including the definition of the hypothesized factors leading to the features being targeted and the putative processes of intervention change (Kazdin, 1999). Subsequently, *proof-of-concept* work using small-scale studies (such as single-subject designs, case series, and pilot-controlled trials) is conducted to examine preliminary evidence in support of the feasibility and potential utility of the approach, including evidence of feasible delivery, acceptability to key stakeholders and end users, as well as preliminary indication of effect in the anticipated direction. With initial support for a model, evaluation typically proceeds to *pilot testing* with larger numbers of participants, and then to *full-scale efficacy trials* with a sufficiently sized sample to establish whether or not the intervention can achieve its hypothesized effects on the target population when implemented in optimal conditions (e.g., by trained clinicians implementing the intervention to a high degree of fidelity). Interventions should then ideally be subject to tests of *effectiveness*, evaluating the extent to which the benefits documented in efficacy trials are maintained when early intervention is implemented in the “real world” (rather than artificial settings, such as highly resourced University labs), by professionals who implement the intervention in the context of the complex needs, the large caseload, and the less resources available in community settings. Finally, *implementation science* addresses how to ensure the successful implementation of the intervention within community settings by systematically examining the barriers and facilitators to adopting the intervention and delivering to a high degree of fidelity.

Research Design

Single-subject designs are tightly controlled studies that explore specific changes in observable behavior when an intervention is introduced and taken away. These designs can be quite useful if results are replicated across different participants, different conditions, and/or different measures of the target outcome(s) (Horner et al., 2005). To ensure that single-subject studies are as methodologically sound as possible, guidelines exist on how to best enact them. For example, it is important to establish a clear baseline period during which the individual receives no intervention to allow for pre-treatment measurement. Maintaining continuous data collection throughout the baseline and intervention periods then allows clear evidence that the intervention leads to changes in the outcome measures. Pre- and posttreatment assessment should also be conducted by someone with no knowledge of whether or not the individual is currently receiving the intervention and who is unaware of the target outcomes (Smith et al., 2007).

A *randomized clinical trial* (RCT; see key terminology) is the most rigorous experimental design, with multiple participant groups randomly assigned to control (i.e., nontreatment) and intervention conditions simultaneously across multiple implementation sites. Random assignment is beneficial as it increases the likelihood that experimental groups are not significantly different from one another at the outset, and thus changes that occur following the start of the intervention can be more confidently assumed to be a direct result of the intervention itself. A *quasi-experimental design* utilizes treatment and control groups but differs from an RCT in that it lacks the element of random assignment. The lack of random assignment in quasi-experimental designs makes it more difficult to assume that the intervention and control groups are similar (e.g., on levels of symptom severity or ability level on the target skill), pretreatment. However, such approaches are often more viable in clinical or community settings. For example, it can be challenging to randomly assign children to schools; thus, this approach is common for research conducted in school settings. *Waitlist control designs* are one type of quasi-experiment that functions well in such settings. Waitlist control designs allow researchers to assign participants to an intervention in accordance to need while maintaining a wait-list of individuals who will serve as the control group while they are not receiving the intervention. Those placed on the waitlist eventually receive the intervention in a later iteration. This approach allows comparisons between groups while also ensuring that all participants receive clinical services.

Measurement

It is next important to consider how the intervention and child outcomes are measured. To provide evidence in support of an intervention, a study must clearly define its *independent variable*—in other words, how the intervention is implemented.

This requires establishing and maintaining adequate levels of adherence to intervention protocols *(i.e., fidelity)* by providers, as well as having a clear system in place to reliably collect data about how those providers implement the intervention. Accurate and reliable measurement of the intervention targets (e.g., language or play or social skills) is even more essential, as outcome data provide the clearest indication of intervention efficacy. This measurement requires strong objective tests or measures. A strong measure should have established *reliability*, meaning it is consistent in what it measures across people and within the items included in the measure. It should also be *valid*, meaning it measures what intends to. For example, a strong measure of language outcomes should accurately measure language skills (as opposed to motor skills) and be consistent (the child's score would be the same if he took the test a week later). Additionally, when members of the study team are measuring outcomes, strong research ensures that the people who are measuring outcomes are not the same people who implemented the intervention (evaluators are *blind*), and, ideally, do not know whether a participant received an intervention or the hypotheses of the study. This control is critical to reducing bias in intervention research.

Many interventions target multiple skill areas. Thus, ensuring that researchers have measured outcomes for all areas targeted or hypothesized to change based on the researcher's *theory of change* is important (see Vivanti et al., 2018; Colombi et al., 2019, for additional information about theoretical perspectives). To demonstrate efficacy, the data collected must effectively capture the target skill or behavior. For example, in a study of an intervention that specifically targets receptive language, measured outcomes must include what language the child understands, as opposed to a measure of the child's vocalizations produced. Often, interventions in ASD aim to change several areas simultaneously (e.g., language, social, and cognitive skills). As such, an intervention may not be equally efficacious for all treatment targets, but we are able to glean from these studies an understanding of what aspects or domains of an intervention are and are not functioning as intended.

Participants

When judging the quality of intervention research, also consider how participants were ascertained. It is important to note whether participant diagnostic categorization aligns with *DSM-5* (American Psychiatric Association, 2013) and/or *ICD-10* (World Health Organization, 1992) criteria. The extent to which comorbidities that were included or excluded from research samples is an additional important consideration. Often, children with common comorbidities, such as epilepsy or intellectual disability, are excluded to create a more homogeneous research sample. However, this is problematic as it may affect how reflective these samples are of a given community or clinic population and fails to provide information about the extent to which children with more treatment needs would benefit from the intervention in question.

Another important question when evaluating intervention research is whether well-established diagnostic tools were used to determine participant eligibility. The *Autism Diagnostic Observation Schedule–2nd Edition* (Lord et al., 2012) and *Autism Diagnostic Interview–Revised* (Rutter, Le Couteur, & Lord, 2003) are typically considered "gold standard" measures for supporting diagnoses of ASD; however, these measures require significant training to administer reliably. Consequently, studies may opt to use diagnostic tools or screeners that require fewer resources. Studies that do not use ADOS-2 or ADI-R may still be very informative about an intervention's utility, but one should be aware that participant diagnostic characterization may be more limited than in studies that include more established assessment tools.

Generalization of intervention effects is also a key consideration. Examining how and to what extent researchers attempted to assess maintenance of effects, postintervention, speaks directly to an intervention's practical utility for a child. Also consider if and how intervention effects were demonstrated across settings, stimuli, responses, or participants. This is particularly relevant given the heterogeneous nature of ASD. While research provides information about whether an intervention works at the group level, these types of studies are not able to account for the individual differences that may come into play for a particular child. By keeping these factors in mind when examining the empirical support for an intervention, it will be easier to differentiate quality research from unsound or misleading research. While many emerging early intervention approaches for ASD may not have a large *quantity* of supporting research, it is as—if not more—important to consider the *quality* of the work that does exist before recommending an intervention.

Targeted Outcomes

Due to the heterogeneity of the diagnosis, ASD poses a unique challenge in determining targeted treatment outcomes, whereas some children may have average or near-average cognitive and language abilities, others may be severely impaired; the severity level of social deficits, restricted interests, and repetitive behaviors also vary widely. The prevalence of comorbid disorders, such as anxiety and ADHD, further complicates the picture. As a result, it is impossible to establish "one size fits all" goals and highlights the importance of considering the heterogeneity of the research sample used to evaluate an intervention. When recommending an intervention to a family, a primary goal should be to meet the demonstrated needs of the child. This requires selecting an intervention that is well matched to the outcomes that would be most beneficial to the child, while also considering the treatment targets the family views as the highest priority. The area of greatest impairment may not always align with the highest priority for a family at a given time point; for example, it may seem that increasing language and communication skills for a nonverbal child would be the most essential treatment target, whereas the caregivers may feel that improving independent play skills so that they are able to attend to siblings or get other tasks done is the most urgent need. It is therefore important to balance the individual needs of the child with the needs of the family.

In studying an intervention, the developmental or behavioral outcomes measured serve as the dependent variable. Developmental outcomes focus on improving functioning in the domains of cognitive ability, communication, social interaction, play, and/or motor skills. Target skills to increase can include communication, higher cognitive function, interpersonal skills, learning readiness, motor skills, personal responsibility, play, self-regulation, joint attention, school readiness skills, and self-help/adaptive behaviors. Interventions may aim to increase skills in a variety of settings, such as home, school, and in the community. These variables may be measured in a variety of ways, including discrete behaviors (e.g., verbalizations, social initiations), standardized assessments (e.g., IQ testing), or parent/teacher behavioral ratings (Wong et al., 2015). While some intervention targets aim to increase developmentally appropriate skills, others aim to improve functioning by decreasing challenging or interfering behaviors (National Autism Center, 2009). Challenging behaviors—such as noncompliance or emotional outbursts—are commonly targeted for decrease; decreasing repetitive behaviors and sensory-seeking or sensory-averse behaviors such as pinching or screaming and covering one’s ears may also be goals of intervention (National Autism Center, 2009; Wong et al., 2015).

Finally, some interventions target parents directly, whether to teach parents new skills or to improve parent and/or family well-being (Wong et al., 2015). As parent stress is typically quite high for parents of young children with ASD (Schieve, Blumberg, Rice, Visser, & Boyle, 2007), interventions that either directly target parent well-being or have established evidence to decrease parent stress may be important to consider alongside child outcomes (Kasari et al., 2015).

Individualization and Implementation Factors

Considering the fit for an individual child and the viability of implementation are key determinants in selecting an appropriate intervention. As previously addressed, it is important to select developmentally appropriate outcome targets that suit the needs of an individual child. However, it is also essential to consider the age range for which an intervention is intended, as well as the ages of the participants included in research trials. For children with ASD, developmental age may not always be equivalent to chronological age due to pervasive delays that may be present across domains. As such, consider not only a child’s numerical age and the recommended age range for an intervention but also the child’s current functioning level. Identifying the baseline skills (e.g., expressive language level) required for a particular intervention is essential to determining best fit. For example, an intervention shown to be effective with children with average to above average cognitive abilities may be less beneficial for a same-aged child with far fewer base skills; likewise, an intervention intended for toddlers may also be efficacious for an older child with profound delays. Additionally, the extent to which a treatment style matches chronological age norms should be considered. For example, an intervention that utilizes sensory games or physical contact (e.g., tickling) would not be a good fit for an adolescent, as encouraging these behaviors in an older child would be inappropriate even if the mental age is more closely aligned to an infant/toddler level of functioning.

Accessibility and implementation of an intervention are also key factors. First, recognize that access to a desired treatment may not be equally feasible for all families due to location and/or financial resources. In many cases, the intervention ultimately selected may not be the ideal; however, one should strive to recommend a treatment that is the best possible fit for the desired treatment outcomes within the limitations of access and availability. Also consider the setting in which the family is seeking treatment: is a clinic-, school-, or home-based approach most suited to their needs? If the intention is for an intervention to be moved from the setting in which it was developed into a different setting (e.g., from a clinic setting into a home setting) due to access or family preference, is it important to consider whether or that there is existing evidence to support generalization to the alternative setting (Callahan, Henson, & Cowan, 2008).

The feasibility of implementing an intervention may also be limited by resource and provider constraints. An intervention that requires highly specialized materials or equipment is less likely to be available to most families or community providers (Wong et al., 2015). The required practitioner skill level needed to administer an intervention can also be a barrier. High-quality intervention research often involves carefully trained practitioners with ongoing fidelity checks; while this provides a standard of desired competence, it may be unrealistic to expect the same level of rigorous training in the community. Research that includes generalization in the community provides a better estimate of how an intervention will perform outside of controlled settings. Moreover, it may be difficult to find a practitioner who can implement an intervention if that intervention requires extensive specialized training.

Parent involvement is another important consideration in selecting an intervention. Some interventions may require more or less active involvement from parents than others, and parent commitment to treatment and availability to take part should inform intervention recommendations. For example, an intervention that requires a parent to be present at the same time several days a week may simply not be feasible for many working families. Naturalistic approaches are often considered more "family friendly," as parents can implement strategies during everyday routines, such as meals and playtime (Mcgee & Morrier, 2005; Schreibman et al., 2015). The individual outcome goals will also determine the extent of parent involvement. Parent coaching models targeting challenging behaviors or noncompliance, for example, require the presence of a parent at each treatment session. Interventions built around developmental goals, such as communication or play skills, however, may allow for more flexibility in shaping the amount of parent involvement to fit the needs and availability of an individual family.

Unsupported Treatments

While it is useful to become familiar with up-to-date evidence about interventions, the loudest voices in many communities are proponents of interventions that may have never been studied in any formal way. These approaches are sometimes characterized as complementary and alternative medicine (CAM), and research suggests that between 50% and 92% of children with ASD have tried or are actively using one of these approaches (Hanson et al., 2007; Harrington, Rosen, Garnecho, & Patrick, 2006).

One challenge with CAM or other unsupported approaches is the risk of placebo effect. A classic example in the ASD field is research on the effects of secretin on children with ASD: anecdotal reports from families were highlighted in the media to suggest that the intravenous infusion of synthetic human secretin significantly reduced symptoms of ASD. A double-blind, placebo-control RCT was then conducted and concluded no treatment effects of secretin on a variety of clinical outcomes. The percentage of children who showed significant improvements while in the placebo condition was comparable to those in the treatment condition (Williams et al., 2012). Seeing change in the presence of no treatment seems surprising, but other studies have demonstrated a placebo-like response using parent report measures even in the absence of treatment (Jones, Carberry, Hamo, & Lord, 2017). It is possible that parents' hope for change or additional attention leads to changes in how they report about their child in these studies.

A second challenge with CAM or other unsupported approaches is the safety of children. Many families will try a gluten-free diet based on stories of success from other families affected by ASD. Research studies of this diet have been conducted, and, for the most part, have shown no clinically significant effects of these diets (Piwowarczyk, Horvath, Łukasik, Pisula, & Szajewska, 2018). Yet these studies have also shown that there are no clear adverse effects of taking gluten out of the diet. Thus, the risk is minimal (aside from cost, effort, and potential impact on social opportunities involved in maintaining a strict diet, e.g., preventing a child to join a birthday party where other children are eating the cake as the diet precludes eating cake). In contrast, there are treatments that carry more significant risks to the overall health of children. For example, chelation is a treatment that some claim removes toxins from the blood (e.g., mercury) of children with ASD, and that this toxin removal leads to symptom improvement in the children. Minimal quality research has been conducted and the highest quality study conducted demonstrated no significant treatment effects (James, Williams, Silove, & Stevenson, 2015). Further, there are reports of significant health risks associated with chelation, including death (Brown, Willis, Omalu, & Leiker, 2006).

In one secretin study, 69% of families indicated that they were still interested in trying secretin after learning it was not effective (Sandler et al., 1999). The popularity of unsupported treatments is due in part to the fact that the precise etiology of ASD is still unclear, driving the spread of possible theories and corresponding remedies. The complex nature of ASD also creates many areas of need, which may drive caregivers to seek treatments beyond what supported interventions are able to address (Smith & Wick, 2008). Additionally, caregivers may hear more about unsupported treatments than about evidence-based interventions, particularly through anecdotal channels, such as social media. Often, these treatment approaches are paired with words like "cure" or "healing," which understandably draw in families who are desperate for answers. Novel unsupported treatments often receive more media attention, as well, and the sense of being antagonized by the "establishment" may help to fuel emotionally engaging and persuasive elements of these treatments (Smith, 2015). If the treatment offers hope for improvement, families may want to try it. Therefore, physicians must be able to speak knowledgeably about these unconventional treatments, especially if those treatments may pose significant risk of injury or death (Harrington et al., 2006).

Conclusion

In summary, there are great resources available for professionals and/or parents to read and explore that provide information about evidence-based intervention approaches and how to implement them. Paying attention to the methods a program uses to evaluate its effects (e.g., type of study, what outcomes were measured, etc.) can help one distinguish between an approach that is popular but likely not effective and one that may have a real chance to change outcomes for a child. While there is a growing body of research on what works for children with ASD, the field continues to fall behind other mental health conditions in terms of the number of large, high-quality studies of different approaches. The individual differences in children with ASD can contribute to challenges establishing firm evidence that an approach is effective for such a diverse group of individuals. Therefore, attending to both quantity and quality of research on an approach and the outcomes that seem most relevant to a child and family are all critical. Finally, in addition to reading literature and examining evidence, it is critical to listen to families about their preferences and make efforts to align recommendations to those preferences. The high rate with which families seek unsupported treatments highlights the impact of sharing success stories in addition to scientific findings.

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Chapter 3
Understanding and Addressing Social Communication Difficulties in Children with Autism

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Atypical social communication profiles represent one of the two domains that define autism spectrum disorder (ASD). According to the DSM-5 (American Psychiatric Association, 2013; see Chap. 1), the social communication domain involves differences in three areas: (a) social–emotional reciprocity within interpersonal interactions, (b) the use and interpretation of nonverbal communication, and (c) the development and maintenance of relationships with others. This chapter will focus on the developmental trajectory of social communication milestones, and the intervention strategies used to support social communication development in children with ASD.

While all communications are inherently social, *social communication* is a term that refers to instances when communicative repertoires are deployed for the primary purpose of sharing with, and relating to, others. This is distinguished from communication for more instrumental or utilitarian purposes, such as requesting desired items or regulating others' behavior. Social–communication is separated out in nosology of ASD because this form of communication is more impaired in children with ASD as compared to other forms (Shumway & Wetherby, 2009; Wetherby, 2006), and is more difficult to influence via intervention (Yoder et al., 2015). Further, the social dimension of communication in particular is implicated in other aspects of social functioning more broadly (Bottema-Beutel, Kim, & Crowley, 2019). For example, response to joint attention in early childhood is correlated with adult social skills (Gillespie-Lynch et al., 2012). It should however be acknowledged that the line between social and instrumental communication is not always clear cut. Further,

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this distinction becomes less conceptually sound beyond the preschool period when interactions become more complex, and assigning single motives to communicative acts is not always feasible. Still, this distinction is useful for understanding early development in ASD and the features of communication that are most affected.

Characterizing the Social–Communication Domain in ASD

Social communication—and social functioning more broadly—is highly heterogeneous in ASD. In the late 1970s, Lorna Wing described three distinct social profiles that were noted in a survey of children with ASD (Wing & Gould, 1979). She termed these *active-odd, aloof,* and *passive*. Active-odd children often made social overtures, but did so in a way that was atypical and did not always achieve engagement from an interaction partner (e.g., approaching another child multiple times and talking to them about cars, even after they did not express interest). Aloof children tended to avoid social interaction and seemed to have developed a preference for aloneness. Finally, passive children did not seek out interactions with others, but neither did they avoid interactions when they were approached. Since this early characterization, researchers have attempted to more precisely describe features of social communication in ASD with the goal of capturing ASD-distinctive patterns, subgroups within the ASD population, and specific intervention targets.

Social–communication comprises a complex interplay of developmental achievements. There is no universal agreement about the nature and mechanisms of social–communication, and different approaches have been used to investigate this area, with some research focusing on discrete “skills” within the social communication domain, and others using a more holistic, interactional approach (e.g., Hobson, 2007; Sterponi, de Kirby, & Shankey, 2015). Evidence suggests that both conceptualizations may be useful for characterizing social communication in ASD. For example, Bishop and colleagues (2016) used factor analysis to identify two subdomains of social communication; they termed these *basic social communication* and *interaction quality*. Basic social communication refers to more discrete, within-child behavior repertoires, including the use of eye contact, display of emotion using facial expressions, and sharing enjoyment with others. Interaction quality refers to *dyadic* characteristics of interaction, including reciprocity, conversation quality, and the development of rapport within interaction.

However, an overfocus on discrete, piecemeal behaviors can be misleading (although this approach has certainly dominated the ASD literature in the recent past). It is important to remember that, even if identifying isolated behavior is helpful for diagnosing ASD, actual human social interaction does not involve the simple expression and reception of discrete social behaviors. Rather, social interaction is multimodal, contextually situated, and sequential, and an appreciation of these aspects is critical for understanding both the nature of social communication differences in ASD and how best to support children in relation to these differences.

While many professionals who are familiar with the concept of social communication understand multimodality (i.e., the communicative relevance of bodily and gestural actions in addition to spoken language), and the contextual nature of social meanings (i.e., that words will have different meanings in different contexts), they may be less familiar with the sequential nature of interaction. That is, communicative acts project and constrain the subsequent communicative acts of an interaction partner, and are projected and constrained by communicative acts that have come before (Schegloff, 2007). Because of this reality, it is rarely useful to consider communicative behavior as a strictly "within-child" phenomenon that is a direct manifestation of cognitive capacities (Sterponi, de Kirby, & Shankey, 2015). Instead, communicative acts should be considered interactional achievements where all social partners are at least partially implicated in their production (Schegloff, 1982; Sterponi & Fasulo, 2010). For example, echolalia, which is the repetition of the speech of others, was long considered to be nonsocial and emblematic of disengagement with others (Kanner, 1943). However, Sterponi and Shankey (2014), building on Prizant and Duchan's (1981) work, offer a reappraisal of echolalia that illustrates how close analysis of the interactive contexts in which echolalia is produced show that these utterances are often sensitive to the social context, are projected as relevant responses by the child's interaction partners (i.e., interaction partners design their overtures so that an echolalic response the child is known to produce is a suitable response), and responsive to prior utterances. Therefore, echolalia should be considered a communicative resource. Prior to this reconceptualization, echolalia was considered a target for remediation.

A variety of instruments are used to characterize social communication in young children with ASD. Three of the most common are the *Vineland Adaptive Communication Scales* (VABS-II; socialization and communication domains), the *Communication and Symbolic Behavior Scales,* and the *Early Social Communication Scales* (Mundy et al., 2003). During early development, it is important to use instruments that differentiate communication from language, and that differentiate social communication from communication more generally (as do the three instruments just mentioned). See Anagnostou et al., 2015 for an overview of social communication measurement systems that are relevant to the study of ASD.

Social Communication Development in Typical Development and ASD

Prelinguistic Development in TD Children

Social–communication development begins shortly after birth, when infants show a propensity to orient to the social overture of others. Within the first days, infants show preferential looking to faces as compared to other aspects of their environment, and a preference for their mothers' voice as compared to other voices (DeCasper & Fifer, 1980; Frank, Vul, & Johnson, 2009). Eventually, infants begin to respond to adult bids for interaction and develop the ability to temporally coordinate their actions with their caregivers, such as by smiling or cooing in response to caregiver's smiles, vocalizations, and infant directed speech (Abney, Warlaumont, Oller, Wallot, & Kello, 2016). This form of dyadic engagement with a caregiver is termed *primary intersubjectivity* (Trevarthen, 1979), or what Bakeman and Adamson (1984) refer to as *person* engagement. According to Trevarthen, this involves adapting intentional actions to incorporate the intentional actions of interaction partners. As noted by Tomasello (2019), engagement in these "protoconversations" provides a foundation for more advanced cooperative activities, including actual (verbal) conversations and joint activities (e.g., building a lego tower with a peer).

At around 6 months, infants are able to respond to bids for *joint attention* as they begin to shift their attention between a caregiver and an object or event, following a caregiver's directive (Scaife & Bruner, 1975). At around 9 months, infants can direct their caregiver's attention toward interesting objects and events using prelinguistic gestures, vocalizations, and eye gaze (Leekam & Moore, 2001). These joint attention processes mark a progression from *dyadic* to *triadic* interactions that incorporate aspects of the environment into interactional repertoires (Mundy, 2016). Trevarthen (1987) refers to this set of developmental achievements as *secondary intersubjectivity*. Bakeman and Adamson (1984) describe a similar phenomenon, which they term *joint engagement*. They use this term to refer to prolonged interactions between caregivers and children that involve reciprocity within play activities, and shifting attention back and forth to one another at relevant moments within the interaction. The amount of time children spend in this type of engagement with their caregivers increases in the second half of the first year, and into the second year (Bakeman & Adamson, 1984; Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998). These joint attention and engagement activities set the stage for the onset and continuing development of language, which will be discussed below.

Prelinguistic Development in Children with ASD

Because children are usually not reliably diagnosed with ASD until after their second birthday, it has been challenging for researchers to study the developmental trajectory of early social communication in this population. However, there are at least two strategies for gaining insight into the prediagnostic period in ASD (see Yirmiya & Charman, 2010 for a comprehensive review of this work). The first is to examine home video recordings produced prior to the child's second year. This line of research has shown that a variety of social communication behaviors are reduced in frequency or absent in infants later diagnosed with ASD, joint attention, using and responding to gestures, intentional communication, expressions of emotion, and social orienting to others. These findings have been replicated across several studies using this method. It should however be noted that there are some drawbacks to using home video recordings as a data source, such as a lack of standardization of the measurement context (Yirmiya & Charman, 2010).

The second strategy to studying the early period of ASD development leverages the heritable nature of ASD. That is, 20% of infants who have an older sibling diagnosed with ASD will go on to be diagnosed themselves (Ozonoff et al., 2011). Given the relatively high probability of subsequent diagnosis for infant siblings, researchers can collect data on large groups of these infants and then retain data on participants that do go on to develop ASD for longitudinal analyses (Zwaigenbaum et al., 2007). Given the prospective nature of this method, more sophisticated and standardized data collection techniques have been used as compared to home videos, including eye-tracking technology. Several studies using this technology have found that, prior to the first birthday, infants later diagnosed with ASD attend less to social scenes than do children who are not eventually diagnosed with ASD (Chawarska, Macari, & Shic, 2013; Falck-Ytter, et al., 2018). An early eye-tracking study has also suggested that infant siblings who go on to be diagnosed with ASD show a decline in gaze to their caregiver's eyes from the period between 3 and 6 months, while typically developing infants increase their gaze to caregivers' eyes over the same time period (Jones & Klin, 2013). Additional research has documented that at 10 months, infants later diagnosed with ASD are less likely to initiate joint attention episodes with a social partner when observing an interesting novel event (Nyström et al., 2019). This could mean that early differences in engagement with social stimuli are foundational to the developmental trajectory of ASD. Importantly, children with ASD continue to show differences in gaze patterns throughout early childhood and into adulthood. This includes differences in looking patterns in response to gestures and speech, and atypical gaze shifts to features of the environment and to people when viewing a social scene (Davis & Carter, 2014; Klin, Jones, Schultz, & Volkmar, 2003; see Hamner & Vivanti, 2019, for a review on eye-tracking studies in ASD).

Another early emerging difference in children with ASD is a decreased propensity for imitation as compared to typically developing children (see Vivanti & Hamilton, 2014 for a review). This difference is particularly noteworthy, as imitating others is a resource by which young children engage in reciprocal interactions with caregivers. Indeed, propensity for imitation in children with ASD is highly correlated with overall social functioning (Bottema-Beutel, Kim, & Crowley, 2019), as well as treatment outcomes (Vivanti et al., 2013; Smith, Klorman, & Mruzek, 2015). Children with ASD also show differences in pretend play by the second year and seem to engage in less pretense than their typically developing peers (Barbaro & Dissanayake, 2013). Hobson and colleagues found preliminary evidence that, later in childhood, pretend play is correlated with communication and social interaction (Hobson, Hobson, Malik, Bargiota, & Caló 2013).

These early social communication milestones have received much attention in early developmental research because they appear to differentiate children with ASD from typically developing and intellectually disabled children and/or because they predict later developmental achievements in children with ASD. Interestingly, there is some evidence that early joint engagement processes are even more tightly linked to later developmental milestones, such as language and social functioning, in children with ASD as compared to children who are typically developing (Bottema-Beutel, 2016; Bottema-Beutel, Woynaroski et al., 2019). This could be because children with ASD spend less time jointly engaged with caregivers, which may make each episode more crucial for development (Adamson et al., 2008). It should be noted however, that not all children who receive an ASD diagnosis in early or later childhood show these early social communication differences.

Language and Conversational Development in Typically Developing Children

Starting in the second year, typically developing children incorporate spoken language into their communicative repertoires. This begins with *holophrases*, or one word utterances that are imbued with the meaning of fully formed sentences, and can be used for a variety of interactional and pragmatic purposes. Later in the second year, children begin to combine words together, and eventually develop phrase and sentential speech. During this time, children are also increasingly able to integrate gaze, expression, and emerging vocabulary, and engage in increasingly complex interactions. By the end of the preschool period, children have acquired large vocabularies, and are able to combine words using complex syntactic structures which can be used flexibly across discourse contexts (Tager-Flusberg et al., 2009).

Pragmatics refers to aspects of language as it is actually used (rather than its structural properties), and foregrounds the social context in which language is produced as constitutive of meaning. Pragmatic development is the process by which children learn to formulate their own talk, and understand others' talk, according to the social context. For example, when children incorporate "slang" terms when interacting with peers, but not with their teachers, this would reflect their pragmatic development. This domain of development continues long after the onset of speech (and even into adulthood). Most typically developing children are able to adapt their talk to a variety of contexts by school entry. This includes adaptation in *suprasegmental* features, which are feature beyond simple components of words and syllables, such as speech register, intonation, volume, and tone. Children also learn the mechanics of conversation, such as turn-taking (including speaker allocation and speaker transition), presupposition (i.e., designing turns at talk so that they take into account what a conversation partner already knows), and implicature (i.e., the inferential aspects of talk that are drawn upon when principles of conversation are violated, as occurs with the use of irony). Many pragmatic regularities of talk are culturally specific, and children learn these regularities by participating in interactions with more linguistically competent others (Schieffelin & Ochs, 1986).

Language and Conversational Development in Children with ASD

Well into early childhood, children with ASD continue to display fewer initiations for and responses to joint attention, and spend less time jointly engaged with caregivers than their peers without ASD. Each of these constructs bear concurrent and longitudinal correlations with language development (Adamson et al., 2008; Toth et al., 2006; Yoder, Watson, & Lambert, 2015). The effects of these delays on speech are evident by the second year. Indeed, language delays are an early-emerging concern of caregivers who already have a child diagnosed with ASD (Talbott, Nelson, & Tager-Flusberg, 2015).

The development of spoken language is highly heterogeneous in children with ASD. Some children show no evidence of delay in speech onset while others show delays but eventually develop average or above average lexicons and language skill. Recent estimates suggest that around 25–30% of children diagnosed with ASD do not go on to develop spoken language that can be used flexibly and consistently (Tager-Flusberg, Paul, & Lord, 2005; Tager-Flusberg, 2016; Tager-Flusberg & Kasari, 2013). Some research suggests that once children with ASD do develop spoken language abilities, they use talk for more constrained purposes than children without ASD (Ziatas, Durkin, & Pratt, 2003). After speech onset, children with ASD continue to show atypicalities in nonverbal aspects of communication, including gaze, use of gestures, and facial expressions (for a summary of this research, see Davis & Carter, 2014).

All children with ASD, regardless of language development, show differences in their pragmatic use of language as compared to language–age peers. These differences may become more apparent once children enter preschool, given the increasing complexity of social contexts in early childhood as compared to infancy. Within conversation, children with ASD may show difficulty with presupposition, and appear not to take their conversation partner's prior knowledge into account when formulating their own talk. For example, a child with ASD might begin a narrative without providing sufficient detail to understand the context of the narrative or the specific people involved. Other pragmatic differences include pronominal reversal (e.g., substituting "you" for "I"), overly formal phrasing, topic perseveration, and atypicalities in prosody as well as interpreting prosody in others' speech (summarized in Eigsti, de Marchena, Schuh, & Kelley, 2011, and in Whyte & Nelson, 2015).

Taking an interactional approach, qualitative research in older children and youth suggests that, within conversation, individuals with ASD have difficulty with at least three aspects of talk; interactional coordination, aligning interactional priorities with their conversation partners, and enacting meaning across conversational turns in a way that is consistent with their interlocutors (reviewed in Bottema-Beutel, 2017). Interactional coordination refers to the overall "course of action" that is implemented through conversation, which requires collaboration between interaction partners (e.g., debating, storytelling, affiliating). Similarly, in order for talk to proceed without significant breakdown, interaction partners must maintain at least partially aligned interactional priorities. If, for example, one partner has prioritized listing fine-grained details of a past event during a narrative retelling, and the other partner prioritizes discerning the "moral" or "point" of the story, this may reflect misaligned interactional priorities. Finally, meaning in conversation is not localized to the utterance level; instead, meaning accrues incrementally cross multiple conversational turns. If individuals with ASD are unable to track meaning across an entire stretch of talk, interaction partners may not orient to the overall meaning of the talk in similar ways.

Other research on interactions has suggested that children with ASD may have relatively more difficulty with features of talk that rely on sociocultural meanings, such as interpreting *indexicality* in talk (Ochs et al., 2004). Indexicality refers to meanings beyond semantic properties of words that are unique to social contexts (e.g., deictic expressions such as “Here I am!”, where the referent “I” depends on the speaker). Less difficult (although still impaired as compared to children without ASD) is providing *type-fitted* responses to an interaction partner’s talk, such as responding to a question with an answer (Capps, Kehres, & Sigman, 1998).

Peer Interactions and Friendships

Most research on peer interactions and relationships in children with ASD has been conducted on children who are of late elementary school age. This research suggests that children with ASD are often isolated from their peers in school contexts, and have fewer reciprocated friendships. They also report spending less time with their friends, and rate their friendships lower in quality than typically developing children (Chamberlain, Kasari, & Rotheram-Fuller, 2007; Kasari, Locke, Gulsrud, & Rotheram-Fuller, 2011; Solomon et al., 2011; also see Petrina et al., 2014 for a review). Importantly, research shows that often children with ASD do desire friendships, and many report having at least one friend (Petrina et al., 2014). Social isolation and fewer friendships may be due at least in part to typically developing peers’ perception of children with ASD, rather than conceptual misunderstanding about the nature of friendships (Bottema-Beutel et al., 2019).

Heterogeneity in Social Communication Development in Children with ASD

It is important to note that the developmental trajectories evidenced in children with ASD are far from uniform. As mentioned in Chap. 1, some children show regression in development after appearing to develop along a typical trajectory, and others do not appear to manifest the characteristics of ASD (that are noted by caregivers or professionals) until after the second year (Ozonoff et al., 2018; Yirmiya & Charman, 2010). Ozonoff et al. (2018) studied this complex phenomenon in a prospective, longitudinal study of infant siblings of children with ASD, who had a higher probability of being diagnosed with ASD. Fourteen of the children in this sample were not diagnosed with ASD at age 3 despite multiple screenings, but were eventually diagnosed with ASD in later childhood. The reasons for “missed diagnosis” seemed to vary within children, with some seeming to manifest clearer characteristics of ASD over time, and others seeming to “evolve into impairment” (Ozonoff et al., 2018, p. 856) as social demands increased in later childhood. Fountain, Winter, and Bearman (2012) documented distinct developmental trajectories of social communication with the ASD population. Some children appeared to start out with greater social and communication impairments, but then “bloom” to display relatively less impairment later in childhood. Other children displayed the opposite profile and showed increasing levels of social communication impairment over time, while still other children maintained similar levels of impairment throughout childhood.

Bilingualism and Social Communication Development

Researchers are only beginning to explore issues related to children with ASD who are raised in environments where multiple languages are spoken. However, current research suggests that children with ASD, even those who are significantly delayed in language development, are able to acquire receptive and expressive vocabulary in multiple languages (Dai, Burke, Naigles, Eigsti, & Fein, 2018). In fact, children with ASD may experience some cognitive advantages to being bilingual (Gonzalez-Barrero & Nadig, 2017). This is important to note, because parents are often advised to avoid using their heritage language with their child with ASD, if it differs from the child's language of instruction (Hudry et al., 2018). Qualitative studies of family language practices have documented the difficulties families face when given such advice, as it often means decreasing interactions with their children with ASD (Yu, 2016). This appears to be especially important when caregivers are more fluent in their heritage language as compared to their child's language of instruction.

Addressing Social Communication in ASD

Researchers have begun to identify promising avenues for supporting social communication in young children with ASD, which may be one reason why more children diagnosed with ASD now go on to develop complex language abilities than early estimates suggested (Tager-Flusberg & Kasari, 2013). One of the most promising avenues for early interventions that support social communication outcomes is the facilitation of joint engagement routines (sometimes also called "joint activity routines" or "joint action routines" Ratner & Bruner, 1978). The following paragraphs describe this concept in detail.

Supporting Joint Engagement Routines

Research on typical and atypical development has highlighted the importance of *joint engagement routines* between caregivers and children, or between interventionists and children, for social communication development (Adamson & Bakeman, 1982; Hirsh-Pasek et al., 2015; Rogers, Vivanti & Rocha, 2017). These routines involve repeated interactions between the child and communicative partner involving toys (or other salient aspects of the environment) that are predictable but flexible, and increase in complexity over time. Adults generally follow the child's lead, incorporate play materials that are of especial interest to the child, and cooperate with the child to accomplish a shared goal that provides opportunities to do things together and learn from such experiences (e.g., building a tower with blocks). In this context, child and adult coordinate their actions and share their emotions through gestures, facial expressions, body postures, and reciprocal imitation to communicate, negotiate, and achieve their shared goal (e.g., taking turns in adding blocks to the tower, and smiling to one another to share the suspense when the last block is added to the stack).

Correlational evidence for the utility of joint engagement routines for promoting social communication and language development has been well-documented for both typically developing children and children with ASD (Adamson, Bakeman, Deckner, and Romski 2008; Bakeman & Adamson, 1984; Bottema-Beutel et al., 2014). Further, joint engagement as a dyadic construct appears more highly correlated with later development, such as expressive language, than similar constructs that are measured to reflect discrete behaviors produced by the child (e.g., the number of gestures a child produces to initiate joint attention) (Adamson, Bakeman, Suma, and Robins 2019).

At present, researchers are attempting to maximize the effectiveness of joint engagement routines by identifying the most developmentally important forms of joint engagement, and identifying caregiver/interventionist strategies that increase the likelihood that joint engagement will occur. An especially promising joint engagement format appears to include the following three elements: (a) the child does *not* shift visual attention between the play materials and the adult, (b) it involves reciprocal interactions on toys (e.g., turn taking routines and back-and-forth imitation of actions on objects), and (c) it includes adult's talk about the child's focus of attention (Adamson et al., 2008; Bottema-Beutel et al., 2014; Crandall et al., 2019). This form of joint engagement appears to strike a balance in terms of cognitive demands, in that it does not require the child to shift visual attentional resources between play materials and an adult, but does require reciprocal interaction with the adult via actions on the play materials (Bakeman & Adamson, 1984). The scaffolding that adults provide within this form of engagement may serve as an interactional "template" that allows for reciprocal back-and-forth exchanges (Bottema-Beutel, Lloyd, Watson, and Yoder, 2018). Further, when caregivers talk about the child's focus of attention, children are not required to shift attention to something new in order to connect the talk to the objects or events being referenced. This form of talk appears to be especially facilitative of word learning (McDuffie & Yoder, 2010; Yoder, Watson, & Lambert, 2015). Recent research has also suggested that this kind of engagement may mediate the pathway between children's emerging ability to say words, and their subsequent ability to understand new words (Bottema-Beutel et al., 2018).

Correlational research suggests that adaptive interaction strategies can increase the probability that children will jointly engage with adult interaction partners. This includes providing suggestions about what children can do with the toys they are already playing with (Bottema-Beutel, Lloyd, Watson, & Yoder, 2018). Similarly, children are also more likely to play with toys at their most advanced level when caregivers give suggestions about ways to play with toys (Bottema-Beutel, Malloy, Lloyd, Louick, Watson, & Yoder, 2018). Additionally, engagement in activities that are *emotionally* engaging increase the child's attention and facilitate the appreciation of the partner's social–communicative and emotional facial and bodily cues (e.g., smiling expectantly before blowing bubbles to communicate a feeling of "suspense"; Vivanti & Rogers, 2014). Finally, *mirrored pacing,* which involves an adult imitating children's toy play at moments when children are most likely to attend, also appears to increase the overall duration of joint engagement (Gulsrud, Hellemann, Shire, & Kasari, 2016).

Experimental studies have shown that when trained interventionists facilitate joint engagement routines in children with ASD, participants show increases in both social communication and language, and these increases continue after the intervention has stopped (Kasari, Freeman, & Paparella, 2006; Kasari, Paparella, Freeman, & Jahromi, 2008; see Chap. 6). These findings are important, as they document intervention effects that are developmentally well beyond what is directly taught within the intervention. Social communication can also be improved when caregivers are provided coaching on joint engagement routines, and then implement them within everyday interactions with their children (Green et al., 2010; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Pickles et al., 2016; Rogers, Vismara, Wagner, McCormick, Young, & Ozonoff, 2014). Finally, there is evidence of the effectiveness of these types of interventions when they are implemented in community contexts, such as early childcare centers (e.g., Vivanti et al., 2014, 2019), and efforts to improve the accessibility and community implementation of early intervention for children with ASD, especially for families from minoritized groups or low socioeconomic backgrounds, are increasing (Chang, Shire, Shih, Gelfand & Kasari, 2016; Shire et al., 2017).

Supporting Later Social Communication Development

The early intervention period appears to be the time when children are most receptive to the benefits of social communication interventions. For example, longitudinal research has shown that improvement in verbal functioning between age 2 and 3 predicts children's later language development (Anderson et al., 2014; Pickles et al., 2014). Further, children who start intervention at younger ages appear to have better language outcomes (Smith et al., 2015; Vivanti et al., 2019). Still, even children who do participate in early intervention may need continued support in the social communication domain later in childhood and into adulthood.

While research on supporting more advanced pragmatic aspects of language in the preschool period is at its infancy, preliminary evidence suggests that pragmatic aspects of language may be influenced by lexical acquisition; that is, children with more vocabulary also have greater pragmatic skill (Whyte & Nelson, 2015). Importantly, while some pragmatic regularities can effectively be taught as hard and fast rules (e.g., not cursing in class), other areas of pragmatics are much more complex and not entirely rule-bound. This may make direct instruction ineffective for facilitating pragmatic development. While research in this area is still in the early phases, supporting the extent to which children are able to engage in linguistic interactions with peers and adults may indirectly support both lexical acquisition and downstream pragmatic development. Supported peer engagement increases children's opportunities to learn pragmatic aspects of language, and ensures that the skills they do learn are relevant to the interactions they have with their peers (as opposed to a more idealized form of interaction that is more relevant to formal interactions with adults).

Additionally, there is evidence that in young elementary age children, teaching typically developing children to identify and approach socially isolated children improves the social connectedness of children with ASD (Kasari, Rotheram-Fuller, Locke, & Gulsrud, 2012). Facilitating play experiences between children with ASD and their typically developing peers also leads to greater social involvement with peers (Wolfberg, DeWitt, Young, & Nguyen, 2015). Importantly, this approach appears to be more effective than direct social skill instructions for improving social connectedness.

Supporting Children Who Are Nonverbal

For the 25–30% of children with ASD who do not develop spoken language by the preschool period, alternative and augmentative communication (AAC) systems are a critical tool for maximizing participation in social life, and for continuing to facilitate social communication development. These systems can be low-tech, and consist of objects or laminated icons that are used as communicative symbols. They can also be high-tech, such as an iPad equipped with an app that translates icons displayed on the screen to voice output. Such AAC devices can be programmed with language capabilities that are as complex as formal languages, in terms of flexibility and generativity (i.e., infinite combinations of words can be produced). High-tech devices can be expensive and complex to learn. Therefore, the assistance of a trained speech language pathologist who is experienced in supporting families in accessing this technology is critical to ensuring that it is adequately incorporated into the child's communicative repertoire. Some caregivers may be concerned that adopting an AAC device will further delay the onset of speech. In fact, research has shown that the opposite is true; children with ASD often acquire speech as a result of using an AAC device (Kasari et al., 2014).

A popular low-tech approach is the picture exchange communication system (PECS), which involves the use of picture cards that are combined and displayed on a Velcro board, and then exchanged with a communication partner (see also Chap. 7). This intervention uses reinforcement to aid the child in connecting the icons on the cards with their referents (e.g., a card depicting a cookie can be exchanged for an actual cookie, which will reinforce the concept that the cookie icon symbolizes "cookie"). However, there is currently very little evidence to suggest that this approach improves *social* communication in children with ASD; it appears much more useful for teaching requests (Ganz, Earles-Vollrath, Heath, Parker, Rispoli, & Duran, 2012). In contrast, there is some research to suggest that incorporating speech generating AAC devices into joint engagement interventions has measurable effects on children's social communication outcomes (Kasari et al., 2014).

Interventions that Target Developmentally Distal Outcomes

It should be noted that some of the currently available early interventions appear to be more effective in improving aspects of social communication that are proximal to the intervention (i.e., skills that are directly taught or addressed by the intervention) and context bound (i.e., skills that are only demonstrated within contexts very similar to the intervention context, for example saying "hello" in response to a specific prompt and reward system; Yoder et al., 2013). This is concerning, as the practical or developmental benefits for such outcomes are unclear. However, there are several intervention studies that have shown distal (i.e., outcomes that are developmentally beyond what is directly taught or addressed by the intervention) and generalized effects (i.e., outcomes that appear in contexts that are dissimilar to the intervention context) on social communication. These interventions share some important characteristics; they involve joint engagement routines in natural contexts (which are usually play activities), provide a balance between child-centeredness and adult support, support parent and family involvement, maintain a developmental orientation, and address the child's physiological regulation (Bottema-Beutel, Yoder, Woynoroski, & Sandbank, 2014). These types of interventions will be discussed further in subsequent chapters focusing on intervention.

Future Directions for Research

While social communication intervention research has certainly made strides in the last several decades, more well-designed intervention research is needed that can tease apart the active ingredients of early interventions designed to support social communication, and the processes by which these strategies influence broader development in children with ASD. Additional work also needs to be conducted to better understand peer relatedness in children with ASD, and how peer relationships are intertwined with other aspects of social communication development. Finally, the majority of early intervention research designed to impact social communication has been conducted on participant samples that are of European or Euro-American descent and are monolingual English speakers. Given that social communication interventions often involve influencing family interactions, more research will need to be conducted with culturally diverse families, so that intervention strategies can be adapted accordingly (see for example Guiberson & Ferris, 2019).

Conclusion

Social communication involves communication for sharing with and relating to others, and is a core area of impairment in ASD. Differences in social communication are thought to begin early in children's development, and to impact the development of a variety of developmental achievements including language and peer relationships. For young children with ASD, supporting joint engagement routines within adult–child interactions appears to be a promising means to advance children's social communication. Intervention effects from interventions that focus on joint engagement routines are developmentally distal to the intervention procedures, and appear to influence children's generalized behavior. More research is needed on the development of pragmatic language and the formation of friendships, and interventions to support these milestones.

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Chapter 4
Understanding and Addressing Restricted and Repetitive Behaviors in Children with Autism

Lauren Turner-Brown and MaryKate Frisch

> "In his second year he 'developed a mania for spinning blocks and pans and other round objects.'"
>
> —Kanner, 1943

Introduction

In 1943, Leo Kanner detailed the rigidity and repetitious behaviors of 11 case studies of children who he assumed to have "inborn autistic disturbances of affective contact." One link between Kanner's cases was rigid behaviors and a "strong urge for sameness."Today, an observation of repetitive behaviors in a young child, such as the ones described by Kanner in the quote above, would cause suspicion for the presence of autism spectrum disorder (ASD). Restrictive and repetitive behaviors (RRBs) are key attributes of diagnosis of ASD. The *Diagnostic and Statistical Manual* 5th Edition (DSM-5) divides RRBs into four groups (1) repetitive movements, use of objects, or speech; (2) insistence on sameness, inflexible routines, or ritualized patterns of verbal or nonverbal behaviors; (3) highly restricted interests; and (4) hyper- or hyporeactivity to sensory input or unusual interests (American Psychiatric Association, 2013). RRBs are often further grouped into two categories: low-order behaviors, which include repetitive movements of body and objects and high-order behaviors, which include

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restricted interests, insistence of sameness, and ritualized verbal patterns (Turner, 1999). Much of the literature around young children and RRBs focuses on repetitive sensory motor (RSM) behaviors when discussing low-order behaviors and "insistence on sameness" behaviors when discussing high-order behaviors (Bishop et al., 2013; Richler, Huerta, Bishop, & Lord, 2010). Below, we characterize each of these symptoms and how they may present themselves in young children with ASD.

Characterizing RRB Symptoms

RRBs can occur in typical toddler development; therefore, distinguishing between typicality and atypicality relies on categorizing the type, frequency, and intensity of the behavior (American Psychiatric Association, 2013). Differences begin to emerge in the second year of life between the RRBs of typical infants and infants with ASD (Elison et al., 2014; Wolff et al., 2014), and between infants with other developmental delays and those with ASD (Morgan, Wetherby, & Barber, 2008; Watt et al., 2008). RRB symptoms are complex in part because they may interfere with development and also may serve as areas of strength and interest that can facilitate learning in other areas. Below, we describe each symptom in this domain.

Repetitive Movements, Use of Objects, or Speech

Repetitive body movements are characteristic of typical infant development in the first 2 years of life. Babies flap their arms to balance and when expecting an action. In typical development, these repetitive movements decrease significantly by 2 years of age (Shafer, Newell, Lewis, & Bodfish, 2017). However, in young children with ASD, and in children with global developmental delays, they might continue. In addition to flapping, repetitive body movements may also include spinning or pacing, posturing hands or fingers, or full body movements like rocking. These movements may be adaptive during typical infancy by allowing infants to explore their environment and functionally change their behavior as a result. In contrast, children with ASD may not integrate sensory feedback to adapt their movements to environment. Thus, these behaviors become maladaptive and can interfere with learning and play (Shafer et al., 2017). For example, a child who rocks his body as he is learning to crawl may no longer engage in rocking once he has mastered the skill of crawling. In contrast, consider an infant who already knows how to crawl, and while crawling toward a caregiver who has called his name, pauses and rocks back and forth repetitively. This behavior no longer promotes the development of a skill and interferes with the child responding to his parent.

Repetitive use of objects in young children can present itself as simply playing with a toy repeatedly in the same manner. For example, a child might roll a car back and forth on the floor without ever moving outside of a specific area. Another child might hold a spoon and shake it up and down repetitively. In young children, repetition is a learning strategy, so deciding what makes the repetitive use of an object a symptom rather than a strategy is determined through the observation of patterns over time. While a typically developing toddler may open and close the door on a play house multiple times, she or he will move on to other actions after figuring out how the doors and windows work. In contrast, a child with ASD may continue to open and close the doors to the exclusion of other actions with that toy.

Finally, repetitive speech includes echolalia (repeating words others have said) and idiosyncratic phrases. Echolalia can be immediate or delayed. Immediate echolalia may present itself as repeating the question a person has asked (e.g., Mom says, “do you want some juice?” and the child responds, “you want some juice”). Delayed echolalia often presents as a child reciting a phrase she has heard before, either from a person in her environment or a cartoon or commercial he or she watched. For example, upon entering a tunnel on his ride to preschool in the morning, a child always says, “would you could you in the dark?” echoing his parents’ reading of a Dr. Seuss book *Green Eggs and Ham*. Some children reverse their pronouns as part of this echolalia, asking for a snack by saying, “you want cracker.” Intonation patterns of this speech in young children with ASD stands out as children often echo not only the words, but the exact intonation of the previous speaker each time.

Insistence on Sameness, Inflexible Adherence to Routines, or Ritualistic Behavior

Although insistence on sameness and ritualistic behavior can appear later in life, symptoms may be present in early childhood. For example, a child might insist on eating a particular food (e.g., chips) using a particular plate (e.g., the green one), sitting in a particular chair (e.g., the red one) at each meal. This behavior, by itself, is common in typically developing children between ages 2 and 4 years, when most children become increasingly inflexible as part of normative development (Evans et al., 1997). What distinguishes the behavior in children with ASD is the level of adherence, the degree to which the child becomes upset when the routine is interrupted, and, at times, the idiosyncrasies associated with the routine. To take the same example above, a child with ASD might also only eat one brand of chips and associate a different color plate with a different food s/he eats.

Restricted Interests

Highly restricted interests are often what stand out when meeting an older child or adult with ASD, as they may be able to describe in detail numerous facts about unusual topics such as train schedules or car models. In early childhood, when many children with ASD have not yet developed functional speech, these interests present themselves a bit differently. Rather than talking excessively about a topic, children may play exclusively with one toy (e.g., a toy train) or carry around a particular object (e.g., spoons). At times, these interests can be avenues toward engagement, and highlight strengths of a child with ASD. For example, a child who loves trains may learn to count, distinguish colors, and play creatively through train activities. Parents often see these interests as ways to highlight their child's strengths and interests. For example, a child with a strong interest in dinosaurs may develop this vocabulary for types of dinosaurs ahead of his peers and beyond parents' knowledge. At other times, these interests can interfere with development. For example, a child with restricted interests in trains may become aggressive toward a peer who tries to play with them and may miss other activities in preschool such as singing and art because of exclusive play with trains. Challenging behaviors may result when a child needs to transition away from a preferred toy or when a parent does not bring along the favorite block the child likes to carry.

Hyper- or Hyporeactivity to Sensory Input or Unusual Interests

Atypical sensory reactions and interests are the final symptoms in this category and include both overreaction (hyperreactivity) and underreaction (hyporeactivity). Examples of hyperreactivity include a child covering her ears when she hears loud sounds or refusing to eat foods with certain textures. Examples of hyporeactivity include a child who does not respond when his name is called or does not seem to notice when he is hurt. Along with these types of reactivity, children with ASD might seek sensory input in unusual ways, such as rubbing a fabric in their hands, squeezing objects, mouthing, or chewing beyond the stage when it is developmentally appropriate. While children with a range of developmental disabilities often show hyperreactivity, it is the combination of hyperreactivity with hyporeactivity that is often indicative of a diagnosis of ASD (Ausderau et al., 2014).

In contrast to OCD symptoms, RRBs in ASD frequently do not cause distress, but rather reflect preferred and/or comforting activities. Despite the positive valence, RRBs can lead to distress and even tantrums and aggression when the individual is interrupted or asked to stop the behavior (Klin, Danovitch, Merz, & Volkmar, 2007; Postorino et al., 2017)

Correlates of RRBs

Ability

Some RRB features are associated with ability level. Children who have more significant intellectual disability often display increased RSM such as stereotypies or sensory interests (Bishop, Richler, & Lord, 2006; Lam, Bodfish, & Piven, 2008; Richler et al., 2010). However, this association is less clear in younger children (e.g., under 3 years)—regardless of intellectual ability, many young children with ASD engage in RSM (Bishop et al., 2006). In contrast, insistence on sameness has been shown to be associated with intelligence in the opposite way, with individuals who have higher ability showing higher challenges with insistence on sameness (Bishop et al., 2006; Lam et al., 2008; Richler et al., 2010). In very young children with or at risk for ASD, RRB symptoms are strongly associated, as a whole, with socialization and adaptive behavior abilities (Schertz, Odom, Baggett, & Sideris, 2016; Wolff, Boyd, & Elison, 2016). In addition, there is some evidence that early presence of significantly impairing RRBs is predictive of less optimal outcomes in children with ASD (Troyb et al., 2016).

Age

Before age 2 or 3, it can be challenging to distinguish children with ASD from children with other developmental delays based on the presence of RRBs (Lord, 1995; Stone et al., 1999), especially when observing a child in one setting or asking parents about RRBs. With recorded videos, detailed coding, or specific screening of these behaviors researchers have found that children who develop ASD show more RRBs than their typically developing peers even in the first 2 years of life (Elison et al., 2014; Morgan et al., 2008; Turner-Brown, Baranek, Reznick, Watson, & Crais, 2013; Watt et al., 2008). Thus, the symptoms are present early in life; RSM behaviors seem to decrease over time while insistence on sameness behaviors may increase over time (Richler et al., 2010; Watt et al., 2008).

Sleep

Many children with ASD have some kind of difficulty with sleep, whether it is difficulty falling asleep, staying asleep, or waking (Hollway & Aman, 2011). Decreased sleep is associated with a range of symptoms, including RRBs in children with ASD. In some cases, RRBs may interfere with the process of going to sleep (Richdale & Schreck, 2009). For example, a child may have ritualistic behavior around bedtime that is hard to interrupt. Or, the relationship could go the other way, with decreased sleep leading to increased RRBs (Abel, Schwichtenberg, Brodhead, & Christ, 2018). Some research suggests that decreased sleep is particularly associated with increases in repetitive and stereotyped movements (Hundley, Shui, & Malow, 2016). It is likely that the relationship between RRB and sleep is bidirectional—suggesting that changes in either area may affect the other (Hollway & Aman, 2011).

Gender

In young children with ASD, there do not seem to be differences between males and females and severity of RRB. At older ages findings are mixed, but there is preliminary evidence that RRB symptoms may be worse in males than females (Harrop, Gulsrud, & Kasari, 2015; Knutsen, Crossman, Perrin, Shui, & Kuhlthau, 2019; Van Wijngaarden-Cremers et al., 2014).

Family Well-Being

Many families become involved in their child's ritualistic behavior—imagine the child who screams whenever he arrives at the park to discover he does not have his train to carry around with him. His caregiver must decide whether to return home to retrieve the train (and prevent screaming in public) or to allow and manage the screaming in hope that the child will calm down quickly. These decisions are challenging in the moment as both have immediate negative consequences for the parent (e.g., screaming or added driving). Making decisions to prevent screaming may inadvertently increase the rigidity the child has around having access to that object. It is not surprising, then, that high levels of parent stress have been documented for children with ASD in numerous studies (see Hayes & Watson, 2013, for a review) and that parent stress is frequently associated with challenging and/or RRBs. Parents find RRBs particularly difficult to manage in their daily lives, even more challenging than communication symptoms (Bishop, Richler, Cain, & Lord, 2007; Lecavalier, Leone, & Wiltz, 2006). When RRBs increase, parent stress may increase (Harrop, McBee, & Boyd, 2016). In addition, increased parent stress can negatively impact outcomes of early intervention (Osborne, McHugh, Saunders, & Reed, 2008).

In sum, RRBs are observable early in a child's life, with atypicalities present as early as 12 months. Some of these behaviors decrease across development, such as RSM behaviors, while insistence on sameness behaviors tends to increase over time, particularly during early childhood (Richler et al., 2010). These changes in patterns of the display of RRBs are mirrored by changes in parent stress; as RRBs decrease, so do parenting stress ratings (Harrop, McBee, et al., 2016). Sleep may play a significant role in RRBs.

Why Do Children Engage in RRBs?

Consider a 2-year-old child who is repetitively lining up his crayons in a precise way. When his brother suggests they play with blocks, he does not look over to see what is going on because the crayons are holding his attention. Thus, he misses the opportunity to engage with his brother and play with something different. When it is time to clean up and move to meal time, he becomes upset because he does not have his line of crayons perfect yet. So, he misses the family meal. Finally, because he is so focused on color arrangement of his crayons, he resists when his mother tries to teach him to color with them. These three examples of missed opportunities highlight some of the negative consequences of RRBs on child learning and development. When asked, his parents might describe this behavior differently, however.

They may see this behavior as a strength, as their son knows all the colors in a 128-pack of crayons and can count to 128 at a really early age.

Why do children with ASD engage in RRBs? Do individuals with ASD have lower social motivation and higher motivation to engage with objects? Or, is their entire brain circuitry dysregulated such that reward is processed differently for both social interaction and engagement with objects? Do children with autism have difficulty shifting their attention from one thing to another leading to extended focus on one activity? Researchers have explored these theories, and found some support for many of them along with differences in both the brain size and function that may contribute to development and maintenance of RRBs (Bodfish, Symons, Parker, & Lewis, 2000; Boyd, McDonough, Rupp, Khan, & Bodfish, 2011; Dichter et al., 2012; Klin, Jones, Schultz, Volkmar, & Cohen, 2002; Pierce, Glad, & Schreibman, 1997; Troyb et al., 2016; Turner, 1999).

While there is no one answer to explain the myriad of RRB manifestations, engagement in RRBs can cause a child to miss potential learning opportunities starting early in development. Thus, early intervention has the potential to increase learning opportunities by addressing RRBs and expanding the range of adaptive skills a child develops.

Effects of Early Intervention on RRBs

A majority of early intervention research has focused on promoting early social communication skills rather than on reducing RRBs. Yet there are several focused interventions that specifically target reduction of RRBs, and a range of comprehensive treatment approaches that aim to reduce RRB among a wide range of other treatment targets (e.g., increase communication). We review findings from both below.

Comprehensive Treatment Models

Despite the growing number of comprehensive treatment models (Lee, Odom, & Loftin, 2007) demonstrating positive effects on cognitive, communication, and adaptive skills, there is less evidence of their effects on RRBs. For example, research on Early Intensive Behavioral intervention (EIBI; see Chap. 5), TEACCH (see Chap. 7), Early Start Denver Model (ESDM; see Chap. 6), and Learning Experiences and Alternate Program for Preschoolers and their Parents (LEAP) has shown limited immediate effects on RRBs, despite positive changes in other areas (e.g., Boyd et al., 2014; Dawson et al., 2010; Reichow, Hume, Barton, & Boyd, 2018). There are many possible reasons for these findings. First, high-quality studies of comprehensive treatment models often measure symptom change in a global way. For example, parents might complete a symptom inventory of all types of RRBs, before and after treatment. If the total score increases, it means there are more behaviors and/or the behaviors are more problematic. If the score decreases, it means that there are fewer behaviors and/or the behaviors are less problematic. While this measure tells a lot about overall severity of RRBs, it may be too broad to detect slight changes in specific RRBs that result from intervention.

A second reason why comprehensive treatment models may not have shown positive effects on RRBs in early childhood is the natural progression of these behaviors. Research has shown that RSM often decreases across early childhood. Thus, detecting a treatment effect on top of natural decreases is challenging. In contrast, insistence on sameness or higher-order RRBs may increase during these years, making it even more challenging to show improvement.

Finally, many comprehensive treatment models are designed to focus primarily on social communication and adaptive functioning. Theoretically, as adaptive skills increase (e.g., a child learns to play with more toys or ask for help), RRBs would decrease as a result. If this theory is valid, it might be the case that RRBs would show a decrease long after an intervention is complete rather than immediately after it ends. Some evidence supports this theory, as a 2-year follow up study of ESDM showed more effects of ESDM on RRB 2 years later than immediately after ESDM was implemented (Estes et al., 2015).

In sum, while the evidence of effects of comprehensive treatment models on RRB is limited, research is ongoing. As stated, these models often emphasize building skills rather than reducing symptoms. Where research has shown more positive effects is when examining focused intervention practices whose specific target is reduction of a specific behavior. We review these below.

Focused Intervention Practices

The principles of applied behavior analysis (ABA) and cognitive behavioral therapy (CBT) underlie the focused approaches shown to reduce RRBs. ABA techniques aim to reduce or increase a specific behavior by changing the contingencies under which the behavior occurs. Behaviors occur in an antecedent–behavior–consequence context (ABC; see Chaps. 1 and 5), and efforts to change behavior focus on modifying either the antecedent or the consequence associated with the behavior. Imagine the situation of a child entering a loud preschool classroom. Upon entering, the child covers his ears and rocks his body. His parent then takes his hands off his ears and says, “hands down.” The behavior is covering ears, the antecedent is the loudness in the classroom setting, and the consequence is the physical movement of the child’s hands and verbal direction. ABA techniques to reduce these behaviors focus on changing antecedents or consequences. CBT techniques are similar to ABA, but also consider internal states (e.g., thoughts and feelings) in addition to the ABCs of behavior.

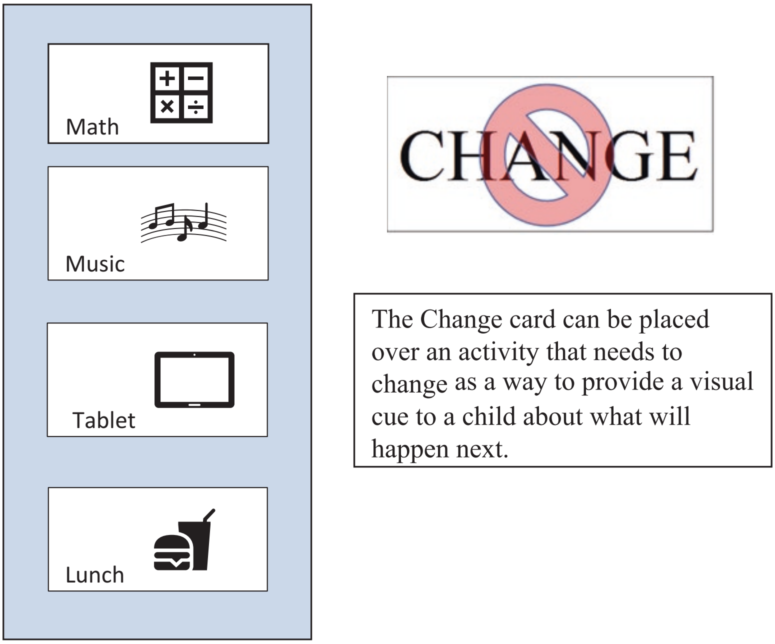
In their review of interventions targeting RRBs, Boyd and colleagues organized successful approaches to reducing RRBs into three categories: consequence-based interventions that interrupt the reinforcement provided by an RRB, antecedent-based interventions that reduce the likelihood of the occurrence of an RRB by altering the environment, and antecedent-based interventions that enrich skills or the environment that may consequently affect the presence of RRBs (Boyd, McDonough, & Bodfish, 2012). For simplicity, we group these as (1) preventing RRBs and (2) changing consequences to RRBs below.

Preventing RRB

Several practices have effectively reduced RRBs by aiming to prevent their occurrence; if we know the contexts in which the behavior occurs, we can change the environment to prevent the behavior and/or teach alternative skills to use instead of an RRB. As illustrated in the following sections, using visual schedules and cues, schedule variation, exercise, and functional communication training are all research-supported approaches for reducing RRBs in this way.

Functional communication training (FCT; Kennedy, Meyer, Knowles, & Shukla, 2000) and similar approaches involve teaching an individual a more appropriate skill, such as a communication or play skill that may serve the same function as an RRB. Consider this scenario. A young child flaps his hands often at school. A functional analysis determined that this behavior occurs most often when a teacher gives a demand, such as “time to clean up,” suggesting that the function of this stereotyped behavior is avoiding a demand. FCT would then teach this child a more appropriate way to get the same result. For example, a therapist might teach a communicative behavior such as signing “break” to request a break from the demand. Teaching more adaptive skills is effective for reducing stereotypies and self-injurious behavior (Kennedy et al., 2000; Lee et al., 2007; Loftin, Odom, & Lantz, 2008; Rispoli, Camargo, Machalicek, Lang, & Sigafoos, 2014; Tiger, Hanley, & Bruzek, 2008).

A second strategy for preventing RRB is using visual schedules and cues. Visual schedules are a component of the TEACCH Approach (Mesibov, Shea, & Schopler, 2006; see Chap. 7) and involve providing visual cues at the developmental level of the child to let the child know what will happen next. Schedules vary in form (e.g., objects, pictures, and written lists) and length (e.g., what is next, two-step, part day, full day). In the context of RRBs, it can be useful to schedule time for when a child can engage in RRB. For example, showing the child that first he must play outside and then he can play on his tablet with picture cues may reduce attempts to bring the iPad to outdoor play (see Lequia, Machalicek, & Rispoli, 2012, for a review, and see Fig. 4.1 for an example of this type of schedule). Using visual cues about upcoming changes in an activity or routine (Horner, Day, & Day, 2006) may also reduce RRBs. This approach may help a child who asks repeated questions about the weather. Placing a time on the schedule when it is appropriate to discuss the weather may reduce weather-talk at other times of day.



The Change card can be placed over an activity that needs to change as a way to provide a visual cue to a child about what will happen next.

Fig. 4.1 Examples of visual schedules

Engaging in physical exercise can also reduce RRB (Bahrami, Movahedi, Marandi, & Abedi, 2012; Kasner, Reid, & MacDonald, 2012; Schmitz Olin et al., 2017). Some research shows an immediate effect, with RRB reduced immediately after a period of exercise. Other studies show more global reductions in RRB after a period of exercise training.

Finally, treatment of sleep problems can lead to reduced RRBs (Malow et al., 2012, 2014; Reed et al., 2009). Approaches including educating parents about sleep hygiene, behavioral interventions to decrease insomnia, and melatonin have all shown promise as ways to improve sleep that also lead to decreases in repetitive and other challenging behavior.

Changing Consequences to RRB

Many studies have explored how to change the consequences associated with RRBs. Harrop and colleagues (2016) studied family reactions to RRB in the home and found that caregivers respond to about half of the RRB their children displayed. These caregivers were more likely to redirect behaviors that involved objects (e.g., visually inspecting objects and shaking objects) than to motor or verbal behaviors (e.g., flapping hands or repetitive sounds). Parents' physical and verbal strategies to stop the child from engagement in the behaviors were rated as the most effective in stopping RRBs (Harrop, Gulsrud, Shih, Hovsepyan, & Kasari, 2016). Examples of approaches that aim to reduce RRB by changing consequences include blocking or response interruption and redirection, differential reinforcement, as well as exposure and response prevention. These are each described below.

Response interruption and redirection involves interrupting an RRB and redirecting the child to a different action (Ahearn, Clark, MacDonald, & In Chung, 2007; Boyd et al., 2011; Koegel, Firestone, Kramme, & Dunlap, 1974; Liu-gitz & Banda, 2010). For example, a father sees his daughter holding a block close to her eye. He then physically interrupts this behavior by placing his hands over her hand and the object, and redirects her to a different behavior, such as placing the block on another to begin making a tower. This approach can both reduce stereotyped behavior and increase more adaptive behavior.

Differential reinforcement entails reinforcement of certain behaviors (e.g., adaptive skills and varying play skills) while not reinforcing other behaviors (e.g., RRB). It can target a range of goals, such as increasing flexible and novel engagement with routines and toys (Azrin, Besalel, Jamner, & Caputo, 1988; Boyd et al., 2011; Miller & Neuringer, 2000). For example, a teacher responds with specific verbal praise whenever seeing a child using a toy in a new way while ignoring repetitive use of the toy.

Finally, exposure and response prevention (ERP; (Huppert & Franklin, 2005) is a CBT approach to reducing symptoms in people with obsessive compulsive disorder (OCD). This approach has been evaluated in children with ASD because of the partial overlap in symptoms between ASD and OCD (e.g., individuals with both conditions can be observed engaging in repetitive behavior such as opening and closing doors; see Klin et al., 2007; Postorino et al., 2017; Scahill & Challa, 2016 for reviews on the similarities and differences between RRBs and OCD symptoms). ERP involves building up skills to handle challenging or fearful situations, and then gradually exposing the child step-by-step to that situation. Thus, the specific RRB characteristics targeted for children with ASD have been rigidity and need for sameness. Consider a child who gets upset when he wants to complete a jigsaw puzzle in a particular order and becomes upset when he is unable to complete it that way. This intervention would entail step-by-step exposure to completing a puzzle in a different way. Results have shown that these approaches reduce rigidity and accompanying anxiety in children with ASD (Boyd, Woodard, & Bodfish, 2013; Eilers & Hayes, 2015; Reaven & Hepburn, 2003), though they have only been tested with older children to date.

Parent Training

RRBs can be difficult for parents to deal with in daily life (Harrop, McBee, et al., 2016). Thus, it is important to ensure parents and caregivers are equipped with a strong understanding of these symptoms as well as approaches that can be useful to daily life. Teaching parents about behavioral inflexibility in ASD, providing parent to parent support, and teaching parents evidence-supported strategies to prevent and respond to RRBs can be helpful (Boyd et al., 2011; Grahame et al., 2015; Lin & Koegel, 2018).

Incorporating Child RRBs in Learning Activities

A common strategy across a range of intervention approaches entails using one RRB characteristic, circumscribed interests, as a way to engage and reward children with ASD. For example, a 4-year-old child in a preschool class loves to play with blocks and cars but refuses to participate in art activities. One strategy to increase his participation in art might be to include cars in the art activity by dipping wheels in paint and rolling the cars on paper to make a pattern. By using this child's special interest in cars, the teacher increases his engagement in art and provides more opportunities for peer interaction as the child is able to participate in a group activity. Research supports this strategy (Boyd, Conroy, Mancil, Nakao, & Alter, 2007; Gunn & Delafield-Butt, 2016). This approach also reflects the notion that the talents that may develop from these interests (e.g., a strong vocabulary of dinosaur names or states and capitals) are valuable, positive, and a true strength for the individual with ASD.

Pharmacotherapies

Despite considerable research on the efficacy of a range of medications on RRBs, only buspirone currently shows promise to reduce these symptoms in children with ASD. Buspirone is a serotonin agonist generally used to treat anxiety in children and has been associated with improvement in RRBs (Chugani et al., 2016). Other medications have not led to reduction in RRB symptoms, including serotonin receptor inhibitors (Accordino, Kidd, Politte, Henry, & Mcdougle, 2016; Carrasco, Volkmar, & Bloch, 2012).

Conclusion

RRBs are present early in life and can cause significant impairment in development and lead to increase in parent stress and other mental health challenges in children with ASD. Several focused intervention practices including prevention of RRB and changing consequences to RRB are effective for reducing RRB, and supporting parents may have lasting positive effects on the child and family. In addition, some RRBs, such as circumscribed interests provide a way to reach and engage with a child who may be challenging to engage in typical ways. These interests may also develop into strengths to be promoted throughout life.

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Chapter 5
Applied Behavior Analytic Approaches to Early Intervention for Children with Autism

Giacomo Vivanti and Melanie Pellecchia

Many early intervention programs for children with ASD are based on the principles of applied behavior analysis (ABA). This chapter will cover the basic principles of ABA, as well as the strategies and procedures used in the ABA-based early intervention program for ASD called "early intensive behavioral intervention (EIBI)," while an in-depth discussion about naturalistic applications of ABA for ASD early intervention will be the focus of the next chapter.

As mentioned in Chap. 1, applied behavior analysis is a scientific discipline (rather than a specific treatment or a curriculum) which investigates the variables that influence an individual's behavior, with a focus on the improvement of behaviors considered to be important for the individual's functioning and well-being (Baer et al., 1968). Within the field of ABA the term "behavior" applies to any observable and measureable act performed by an individual, in contrast to the traditional use of the term to refer to how a person behaves. Talking, running, eating, laughing, screaming, and hitting are all forms of behavior within this frame, because one can observe and measure the occurrence of each of them. The goal of applied behavior analysis is to carefully measure the occurrence of socially significant behavior and modify the behavior using systematic "environmental contingencies," i.e., modifying the circumstances or stimuli that create or encourage the behavior.

The following vignette exemplifies a common situation in which a socially important behavior, a child's verbal response, is influenced by two key variables; what happens before the child's behavior and what happens after. During a play routine, a caregiver says "ready, set …" while looking expectantly at her child with

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her hands positioned to tickle the child's abdomen. The child responds to the caregiver saying "go!" The caregiver smiles and starts tickling the child. The child laughs, and says again "go!" to get more tickles. In this situation, there are three important elements that maintain the child's behavior, an *antecedent* (the caregiver saying "ready, set"), a *behavior* (the child saying "go"), and a *consequence* (the parent tickles the child). This is often referred to as the A–B–Cs of behavior. Within an ABA framework, the *antecedent* (A) is an event that occurs before a *behavior* (B), and the *consequence* (C) is an event that follows the behavior. The example illustrates a phenomenon known as operant conditioning, a learning process that reliably predicts the behavior of any living organism based on the universal law that behaviors followed by reinforcement will have a higher probability of occurring in the future, and behaviors followed by punishment have a lower probability of occurring in the future (Skinner, 1965). Operant conditioning is used in ASD early intervention as the framework for understanding and, if needed, modifying, the antecedent–behavior–consequence (ABC) contingencies underlying the child's behavior. This allows us to answer the question "why does the child engage in a particular behavior?"—a question that, in the ABA field would be framed as "which variables *reinforce* or *maintain* the behavior?" Answering this question allows one to design interventions to increase or decrease the occurrence of specific behaviors, such as using the word "help" to replace the undesirable behavior of biting one's own hand. The goal, therefore, is to shape a child's behavioral repertoire to equip her or him with functional skills and reduce behaviors that can be harmful to self or others (e.g., aggression and self-harm).

The concepts of reinforcement and punishment are often used differently outside of the field of ABA. In lay terms, reinforcement is often used interchangeably with the term "reward," and is used to describe a *desired* or *preferred* consequence for a behavior. Within ABA, the term reinforcement implies the use of a *consequence* that *increases* the likelihood of a certain behavior occurring again in the future. Similarly, the term punishment is often used to describe an *undesired* consequence for a behavior. Within ABA the term punishment only applies to *consequences* that *decrease* the future likelihood of a behavior. For example, if a child is sent to his room for arguing with his sister, but he continues to argue with his sister in the future, the consequence of being sent to his room is not a punishment because it did not decrease the future rates of arguing, although most would say that the boy was being "punished."

The application of ABA in the field of ASD early interventions has generated sophisticated approaches and technologies to measure and modify the behavior of young children with ASD in order to promote the acquisition of important skills (e.g., requesting) and decrease challenging behaviors (e.g., self-harm). Empirical work supporting these techniques originated in the 1960s, when behavioral principles were first used to successfully teach novel behaviors or discourage unwanted behaviors of individuals with disabilities, challenging the notion that severe challenging behavior could not be modified (Wolf, Risley, & Mees, 1964). Furthermore, research pioneered by Carr and Durand in the 1980s indicated that many challenging behaviors observed in children with ASD served a communicative function, providing the foundation for successfully teaching socially appropriate communication to replace challenging behavior (Carr & Durand, 1985).

The various applications of ABA share seven key principles, outlined in Box 5.1.

Importantly, there are many acronyms and terms that are frequently used (and sometimes misused, or used imprecisely) in this complex field. Box 5.2 illustrates the meaning of some of the most frequently used ABA concepts.

Box 5.1:

In 1968, Baer and colleagues articulated seven dimensions that guide practices in applied behavior analytic interventions. These dimensions continue to frame the provision of ABA and include: (1) *Applied*: the applied aspect of ABA emphasizes that interventions should have a practical value and be applied to behaviors that have a socially significant impact for the quality of life of the individual; (2) *Behavioral*: interventions use clear, unambiguous operational definitions of the target behavior (e.g., "refusing to complete assigned work" as opposed to "being disobedient"); (3) *Analytic*: rooted in data-based decision-making, with data systematically collected, reviewed, and analyzed to support decisions on whether interventions should continue, be modified, faded, changed, or stopped; (4) *Technological*: procedures need to be clearly operationalized so that they can be implemented across settings by anyone and results can be replicated; (5) *Conceptually systematic*: interventions are consistent with principles of behavior validated by empirical research; (6) *Effective*: the implementation of procedures needs to be monitored and analyzed to determine if they are having the expected impact on the target behavior; and (7) *Generality*: behavior change should last over time, appear in novel settings, and with many different people.

Box 5.2: Frequently Used Acronyms in the ABA Literature

ABA—Applied behavior analysis; a discipline focused on the factors that influence socially significant behavior, whereby Applied refers to the social importance of targeted behaviors, Behavior refers to the focus on observable phenomena, and Analysis refers to evidence of an interaction between an independent variable (an intervention) and a dependent variable (the behavior of concern).

BACB—Behavior Analyst Certification Board; the certifying body that defines the training and testing necessary to certify professionals working in the field of behavior analysis.

BCBA—A board-certified behavior analyst; this individual holds a master's degree, has completed 1500 h of supervised field work, passed a competency exam, and is required to obtain continuing education.

BCaBA—A board-certified associate behavior analyst; this individual holds a Bachelor's degree, has completed 1000 h of supervised field work under a BCBA, passed a competency exam, and receives ongoing supervision from a BCBA.

RBT—A registered behavior technician; this individual implements behavioral interventions and has completed BACB-approved training, passed a competency exam, and receives ongoing supervision from a BCBA.

DTT—Discrete trial training; a structured teaching arrangement in which isolated opportunities to practice a skill are provided by an instructor; this term is sometimes used erroneously as a synonym for ABA**.**

EIBI—Early intensive behavioral intervention; a comprehensive intervention for young children with ASD that utilizes principles of ABA and is implemented for an intensive number of hours each week (e.g., 10–35 h/week).

FCT—Functional communication training; a communication intervention designed to teach appropriate communication for individuals with limited communication skills. FCT involves identifying the function (or purpose) of an individual's maladaptive communication behavior (e.g., banging the head against wall to request attention), and teaching alternative appropriate behaviors that serve the same function (e.g., saying the word "help," or touching the adult's shoulder to gain attention).

FBA—Functional Behavior Assessment; a systematic method of assessment to gather information about the purpose (function) of a challenging behavior.

BIP—Behavior intervention plan; an intervention plan based on the results of a functional behavior assessment to decrease undesired behavior and increase appropriate behavior.

Treatment Techniques in Applied Behavior Analytic Approaches to ASD Early Intervention

ABA techniques are often used in the context of focused interventions targeting a circumscribed set of behaviors (e.g., parent training to teach how to request for help) as well as in comprehensive packages designed to address multiple areas of need, such as the approach referred to as early intensive behavioral intervention (EIBI). EIBI is a comprehensive treatment approach for children with ASD, which is based on the principles of applied behavior analysis, initiated at a young age (<5 years) and delivered intensively (10–35 h/week) in an individualized 1:1 child–adult instructional format. EIBI includes specific goals derived from assessment results, the use of manualized instructional procedures and fidelity systems to guide implementation, and the use of data collection systems to facilitate continuous progress monitoring.

There are several approaches to instruction commonly used within EIBI, ranging from highly structured didactic approaches to naturalistic play-based strategies. The structured component within EIBI is known as discrete trial training (DTT; Krug et al., 1979; Lovaas, 1981; Smith, 2001). During a "discrete trial," the child receives individual instruction in a learning environment designed to minimize distraction (e.g., a table where only materials relevant to the task at hand are available), and target skills are broken down in "discrete" components that are taught in isolation. Learning trials include a specific antecedent (e.g., the verbal instruction "show me dog") designed to elicit a specific behavior (the child pointing to the picture of a dog). These are repeated multiple times in a row. Correct responses are systematically reinforced (e.g., the child is given his favorite toy or a candy) and praised, and the trial is repeated until a predefined criterion is met (e.g., 80–100% of correct responses).

DTT procedures were informed by research conducted by Lovaas and colleagues suggesting that children with ASD have attentional, cognitive, and sensory difficulties that hinder processing of multiple cues at the same time. Therefore, the use of instructional cues that are concise and unambiguous and the provision of multiple repetition of the same antecedent–behavior–consequence sequences serve to increase attention to specific instructional cues and promote skill acquisition (Lovaas et al., 1979; Lovaas & Smith, 1989; Mayville & Mulick, 2011). Another rationale informing DTT procedures is the notion that unlike typical children, those with ASD might not find social praise alone (e.g., the adult saying "good job!") to be intrinsically reinforcing—therefore, extrinsic rewards, such as edible treats or access to toys, are often used to motivate children with ASD (Lovaas, 1981). These, however, are delivered in conjunction with social praise, so that the child can learn over time to "pair" (associate) social praise with the positive experience related to the nonsocial reinforcers.

Importantly, DTT is not synonymous with ABA, and most EIBI programs include a combination of DTT and unstructured or naturalistic approaches to instruction (e.g., Howard et al., 2005). Naturalistic behavioral instruction typically consists of sessions that occur in the child's natural environment (instead of a setting carefully crafted to be free of distraction like in DTT). This approach to instruction is usually play-based and uses items that are motivating to the child to guide the teaching interaction. These sessions are initiated and paced by the child, take place in a variety of locations, and employ a variety of teaching materials. The child chooses the instructional object or activity, and the reinforcer is related to the response (e.g., providing access to a car for correctly identifying a car). This type of instruction involves following the child's lead and capturing and contriving teachable moments related to the context. Environmental arrangement is a critical aspect of this approach, such as, for example, placing a preferred toy in sight but out of the child's reach as a method to create an opportunity for the child to request for the toy.

Within EIBI, skills are often taught within the DTT format first, and then generalized to other settings using naturalistic behavioral approaches. These naturalistic approaches were adopted within EIBI in response to critiques that skills taught within a DTT format do not readily generalize to other settings or teaching interactions. An in-depth discussion of naturalistic interventions will be provided in Chap. 6.

In addition to the broad treatment strategies described above, scientific research in the field has generated numerous other techniques that have been incorporated into EIBI. These include:

Prompts and Prompt Fading

A prompt is a cue meant to facilitate the occurrence of a certain response. Prompts can take many forms, such as verbal, physical, gestural, or visual. Examples include showing a child a picture of a toilet as a prompt for him to request to go to the bathroom (visual prompt), or placing a child's hand on the faucet to prompt him to turn on the water (physical). Prompts are systematically faded, or removed, as an individual demonstrates independence with the response, e.g., pointing to the faucet instead of placing the child's hand on the faucet as the child demonstrates success with turning on the water (Walker, 2008).

Chaining

Chaining is a procedure for teaching a complex set of behaviors in which the steps in a behavior chain are taught individually over time until all the steps are completed. For example, when teaching a child to wash his hands—first teaching the child to turn on the water, and then once the child independently turns on the water, adding the step of pumping the soap dispenser, and then adding rubbing hands together, etc., until all the steps in the handwashing routine are taught (Bancroft et al., 2011).

Task Analysis

Task analysis is the process of breaking a complex skill down into smaller units that can be taught individually. For example, in a school setting, teaching a child the arrival routine can be facilitated by identifying the smaller units which make up the routine (go to cubby, take off coat, hang up coat, open backpack, take out homework, put away homework, hang up backpack). Chaining is often used to teach the steps identified through the task analysis (Libby et al., 2008).

Differential Reinforcement

Differential reinforcement is a procedure for providing reinforcement for behaviors that meet a specific criterion, while withholding reinforcement for all other behaviors that do not meet this criterion (for example, providing reinforcement when a child says "ball," but withholding reinforcement when a child say "buh."; Karsten & Carr, 2009).

Shaping

Shaping is a procedure whereby differential reinforcement is used to systematically and gradually reinforce successive approximations to the targeted response, such as, for example, providing reinforcement when a child says "cookie," and then only providing reinforcement when the child says "want cookie," and then only providing reinforcement when the child says "I want cookie." (Ricciardi et al., 2006).

Noncontingent Reinforcement (NCR)

Noncontingent Reinforcement (NCR) is a procedure designed to reduce challenging behaviors. When using NCR, reinforcement is provided on a specified time interval, instead of in the presence of a specific behavior. For example, a child who engages in aggressive behavior in order to obtain attention would receive attention every 5 min, rather than only receiving attention in the presence of a particular behavior. The reasoning underlying the use of NCR is that providing the child with attention on a regular set interval would decrease his motivation to engage in challenging behavior in order to obtain attention (Smith et al., 2019).

Functional Communication Training

Functional Communication Training (FCT) is an intervention in which an appropriate communicative behavior (e.g., verbally requesting, pointing, using a picture) is taught as a replacement for challenging behaviors used by the child to achieve the same purpose. For example, FCT can be used to teach a child to point to a symbol card that represents taking a break when she/he wants to take a break, instead of swiping books off of the table when she/he wants to take a break (Durand & Carr, 1992).

Extinction

Extinction involves the discontinuation of reinforcement for a previously reinforced behavior (i.e., a behavior that once received reinforcement but no longer does). The goal of extinction is to decrease the occurrence of undesired behavior. For example, a child who previously received a treat when he cried no longer receives a treat in the presence of crying. In this example, the crying behavior is under extinction (Jin et al., 2013).

High P Procedure/Behavioral Momentum

In this procedure, a series of easy tasks are presented in quick succession followed by a more difficult/target task. The theory underlying the High P (high probability) procedure is that an individual is likely to respond to a difficult task when it is immediately preceded by tasks that they can complete easily (Mace et al., 1988).

Evidence Supporting Applied Behavior Analytic Approaches to ASD Early Interventions

Applied behavior analysis emphasizes the use of objective and clearly defined descriptions of treatment targets and intervention techniques, which allows for replication of procedures by others. The emphasis on technological precision in this field has generated a wealth of empirical research, including pioneering evidence on the successful use of ABA approaches for ASD early intervention. This evidence includes numerous single-subject design studies supporting the evidence of specific behavioral techniques on improving target behaviors (National Autism Center (2015). Further, several studies based on a group design have tested the efficacy of this approach as a comprehensive package. One prominent example is the Lovaas study (Lovaas, 1987) measuring the outcomes of 19 preschoolers who had received 40 h/week of individualized intervention for 2 years, compared to 19 peers who were delivered the same intervention for 10 h or less/week, and a "community treatment as usual" comparison group. Results indicated that approximately half of the participants in the intensive treatment group had achieved normal intellectual functioning, including mainstream educational placement without assistance, while the two comparison groups showed limited gains. Gains in the intensive treatment group were maintained at a follow-up conducted when participants averaged 13 years of age (McEachin et al., 1993). The study sparked both optimism, as it pointed to the potential for children with ASD to achieve very positive outcomes in response to intervention, and controversies, due to the emphasis on "normalization" of intellectual functioning as the benchmark for positive outcomes, and methodological shortcomings, such as the lack of randomized assignment of participants to intervention conditions.

To address this latter criticism, Smith and colleagues conducted a randomized controlled trial aimed to replicate the Lovaas study, the first study using this design in the field of ASD early intervention (Smith et al., 2000). Results confirmed superior gains for children receiving EIBI compared to peers in the control group, although to a lesser degree compared to the findings reported in the Lovaas study. Additional research, mostly based on single-subject design or nonrandomized group studies, documented substantial improvements in the areas of cognitive functioning, adaptive functioning, language development, problem behavior, and, to a lesser degree, social communication and reciprocity (Green, 1996; Anderson et al., 1987;

Birnbrauer & Leach, 1993; Smith et al., 2000; Weiss, 1999; Howard et al., 2005; Makrygianni et al., 2018; Smith & Iadarola, 2015). All studies have reported marked variability in outcome, with some children demonstrating significant gains across a range of developmental, behavioral, and social outcomes, and other children demonstrating minimal to no progress following treatment—a finding that parallels the evidence for all ASD early interventions (Eldevik et al., 2010; Howlin & Charman, 2011; Smith et al., 2015). As comparative research in the field is virtually nonexistent, it remains to be established whether this approach produces superior benefits compared to other evidence-supported approaches, or is particularly beneficial for children with ASD who have specific characteristics (Vivanti, 2017).

Overall, the use of ABA strategies in early intervention for ASD is recommended by many expert panels and task forces (e.g., National Research Council, 2001), although the strength of evidence for EIBI varies depending on the evaluation parameters that are used (Smith & Iadarola, 2015; see also Vivanti, 2017). For example, a recent review based on the GRADE system, which only considers randomized controlled trials as conclusive evidence, has indicated that the quality of research evidence supporting EIBI is less than optimal (Reichow et al., 2019; see also Green & Garg, 2018). Conversely, reviews that include evidence from different study designs (and in particular single-subject studies, upon which most ABA literature is based) came to the opposite conclusions (e.g., Eldevik et al., 2012; Makrygianni et al., 2018; Smith & Iadarola, 2015). For example, many techniques identified as “evidence-based practices” according to comprehensive reviews of the National Standards Project and the National Professional Development Center on Autism Spectrum Disorder (2014) are based on ABA (Odom et al., 2010; Wong et al., 2015), and EIBI is endorsed by numerous agencies such as the American Academy of Pediatrics, the American Psychological Association, and the Autism Society of America. As mentioned in Chap. 1, there remains controversy about several aspects of EIBI, including the level of inference that can be derived from nonrandomized designs (see Smith et al., 2007; Vivanti et al., 2018), the logistical and financial barriers related to delivering treatment for many hours per week, the evidence supporting the need for such intensity (Pellecchia et al., 2019), and whether aspects of EIBI (DTT in particular) are consistent with processes that appear to facilitate learning in typical development and generalization in nonintervention contexts (e.g., child-driven active experiential learning, and engagement in a continuous flow of back-and-forth social engagement between child and adult during daily routines; Schreibman et al., 2015; see Chap. 9). Procedures designed to address some of these concerns are covered in the next chapter. Additionally, as mentioned in Chap. 1, the neurodiversity movement has frequently challenged ABA approaches based on their focus on “normalization,” which is seen as prioritizing “conformity” at the expenses of diversity (Gruson-Wood, 2016). While the influence of the neurodiversity approach on intervention is in its infancy, there is increasing effort in the intervention community to include key stakeholders, such as individuals with ASD and their families, in the decision-making related to what should be defined as desirable goals and outcomes for intervention, and how interventions should be designed and implemented (Pellicano & Stears, 2011; Vivanti & Volkmar, 2019).

Despite these criticisms, the use of basic ABA principles, such as reinforcing children for desired behavior, remains a paramount component of most, if not all, validated approaches to ASD early intervention. Additionally, research has consistently shown the efficacy of these procedures for teaching critical and potentially life-saving skills such as using appropriate means to communicate instead of self-injurious behavior. As an illustration of the far-reaching relevance of this body of literature, the Individuals with Disabilities Education Act (IDEA, 1997/2004) requires that interventions based on functional behavior assessment are developed to target challenging behaviors and improve communication in children with disabilities.

Who Can Deliver Applied Behavior Analytic Interventions?

Applied Behavior Analytic interventions should be delivered by professionals or paraprofessionals who have education and supervised training aligned with the task list created by the Behavior Analyst Certification Board (BACB). In the United States, certain states require that BCBAs are supervised by licensed psychologists, but there is state-to-state variation in supervision requirements. Though many professionals holding a BCBA certificate have experience with young children with ASD, the BCBA certification does not necessarily guarantee that a provider has experience with young children with ASD. Therefore, in the context of ASD early intervention, it is advisable to identify practitioners with expertise in ASD and child development.

Additionally, in the United States, different licensure requirements for practicing behavior analysis are adopted in different states, and in some states private insurance companies and Medicaid have the mandate to cover ABA services for individuals with ASD. Unfortunately, the professional certification process (BACB) and state licensing practices are not always aligned. As an example, some states provide a behavioral interventionist license without requiring the applicant complete the education or training required by the BACB (www.bacb.com/licensure-regulation/), and other states require documentation of training and licensure in a related field.

As the number of individuals who are diagnosed with ASD has increased in the past decade, there is shortage of qualified professionals who can provide ABA services and there are individuals that claim to be using ABA when in fact they are not certified or licensed to do so. Therefore, it is important that consumers make informed decisions and examine the qualifications of those offering ABA treatment, and that legislation continues to support training and dissemination efforts to provide effective treatment for those with ASD.

Conclusions

Early intensive behavioral intervention has gained widespread acceptance as an effective treatment for young children with ASD. As described above, EIBI includes many different intervention techniques and approaches to intervention that are based on the principles of ABA. Most often, EIBI is delivered as part of a comprehensive treatment package including an array of different techniques and a combination of structured and naturalistic approaches to instruction. Given the range of different techniques included within EIBI, there is often confusion for parents and researchers alike regarding the best approach to use for any given child with ASD. Unfortunately, the research regarding the type of behavioral approach best suited for individual children, given their individual clinical profile, is lacking. When recommending EIBI treatment packages clinicians should consider each child's developmental profile, and align the treatment goals and treatment approach with developmentally appropriate practice. Further, consideration of each child's family context, and therapeutic services provided in addition to the child's EIBI (e.g., speech and/or occupational therapy) should be considered to ensure alignment with child and family needs and across therapeutic modalities.

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Chapter 6
Naturalistic Developmental Behavioral Interventions for Children with Autism

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"Naturalistic developmental behavioral interventions" (NDBIs) is an umbrella term used to describe early intervention approaches that blend behavioral and developmental strategies and use a naturalistic format to address the learning needs of children with autism spectrum disorder (ASD). While the term was coined by Schreibman and colleagues in 2015, NDBI approaches have a long tradition in the ASD field, originating from the attempt to address some of the perceived limitations of behavioral approaches originally designed for older children, and to incorporate knowledge from developmental psychology to maximize developmental outcomes such as language, play, and socialization (Koegel, O'Dell, & Koegel, 1987; McGee, Krantz, Mason, & McClannahan, 1983; Rogers & Lewis, 1989; Schreibman et al., 2015). In the first section of this chapter, we will describe features that are common across NDBI approaches as well as differences and areas of overlap between NDBIs and the standard ABA approaches described in Chap. 5. Subsequently, we will review the principles, strategies, and empirical support for the different ASD early intervention models that fall under the NDBI umbrella.

Key Features of Naturalistic Developmental Interventions

Similar to the comprehensive approaches based on standard applied behavioral analytic techniques, such as EIBI (see Chap. 5), interventions based on the NDBI framework emphasize the importance of (a) starting treatment early in life; (b) delivering treatment in an intensive manner, with many learning opportunities provided throughout the child's day; (c) drawing on evidence-supported practices and

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manualized procedures; (d) tailoring treatment objectives on the individual child's profile of strength and needs; (e) monitoring treatment progress through systematic evaluations of child's behavior change; (f) monitoring fidelity of treatment implementation (i.e., the degree to which the intervention is delivered as intended) through the use of fidelity tools that measure adherence to operationally defined intervention procedures; and (g) involving caregivers in decision making. Additionally, like the approaches described in Chap. 5, NDBIs use operant conditioning techniques to promote the acquisition of novel behaviors, including the use of the "antecedent–behavior–consequence" (ABC) contingency structure to systematically cue and reward the child's behavior. However, NDBIs diverge from EIBI in the format of instruction delivery and teaching content, which are informed by the naturalistic and developmental principles listed below.

Naturalistic Principles

The "naturalistic" component of the NDBIs reflects the nonartificial nature of (a) the physical and social context in which instruction takes place, (b) the instructional cues given to the child, and (c) the consequence (reinforcement) delivered by the adult to encourage (reinforce) the child's behavior. With regard to the first aspect, instruction in NDBI is commonly delivered in a physical environment that looks similar to the environment where young children without ASD learn. Rather than engineering the physical space to prioritize attention to an adult-defined task (e.g., by eliminating all distractions, making only objects relevant to the task at hand available, or using "self-explanatory" materials and tasks), NDBI programs use toys, materials, and activities that are similar to the ones a typical child is likely to encounter in their environment. The rationale for this approach is to facilitate learning in response to everyday routines and stimuli rather than a highly structured "therapy room" situation, so that the child has frequent opportunities to generalize acquired skills in everyday contexts, has experience interacting within complex, dynamic environments that mirror nontherapeutic interactions, and has learning experiences during activities and routines that are shared with others (e.g., meals, bath time, playground activities, play routines at home or in daycares).

Importantly, while NDBIs aim to reduce the discrepancy between the setting in which instruction takes place and the context of typical daily experiences, materials and activities are still organized in a way that maximizes child learning and participation to the activity. This is frequently achieved by managing the quantity and nature of "competing stimuli" that are present in the activity, arranging the space to facilitate face-to-face interaction and attention to the adult contingent responses to the child's behavior, and strategically drawing attention to materials to facilitate increasingly complex interactions. This might include giving the child access to only half of the blocks or puzzle pieces in a container to facilitate turn-taking, using objects that require assistance, playfully obstructing access to preferred materials or placing them out of reach to facilitate requesting, expectant waiting (e.g., before placing the last block on a tall block tower) to facilitate emotion sharing (e.g., the suspense before the tower falls), drawing attention to specific actions/materials, and pacing activities to facilitate sustained interest. Therefore, the naturalistic focus coexists with a high degree of adult control on the stimuli provided to the child. Additionally, the degree of structure might be increased or decreased based on child needs and progress (e.g., Vivanti, Duncan, Dawson, & Rogers, 2017).

The "naturalistic" component of NDBI also refers to the strategies adults use to facilitate particular kinds of interactions. While standard procedures in EIBI use concise, stripped-down instruction that clearly defines the target behavior (such the adult telling the child "match" or "push"), NDBI programs emphasize the use of "natural" language, that is, the kind of communication that would be used for young children without ASD—such as saying "ready, set, go!" with a highly emotional tone of voice. The rationale for this "naturalistic language" format is to facilitate generalization of child learning in response to stimuli that the child is more likely to be exposed to in ordinary contexts and daily routines. Further, recent research suggests that use of "telegraphic speech" in caregivers' does not facilitate child language development (Sandbank & Yoder, 2016).

Additionally, the use of a highly animated tone of voice and body language when delivering instructional cues is based on developmental research showing that typically developing children learn best in response to affectively rich interactions (Kuhl, 2007), and that children with ASD show an attenuated, but not absent, response to social affect (Rogers, Vivanti, & Rocha, 2017). Therefore, the use of naturally sounding language associated with an affectively rich display of gestures, emotional facial and vocal expressions, and animated body language serves the purpose of enhancing the child's engagement with the therapist or parent and the activity and facilitating learning in response to stimuli and situations that are similar to those experienced by other children.

Finally, the naturalistic component of NDBIs refers to how the child behavior is reinforced (i.e., rewarded) with delivery of "natural" consequences being preferred to unrelated rewards. For example, in order to reinforce the child's use of the word "up," the adult will lift the child up, rather than rewarding the child with food or an unrelated object for correct use of the word "up". An additional rationale for the provision of intrinsic reinforcement rather than external reward is that the back-and-forth flow of the interaction is not disrupted by introducing materials unrelated to the ongoing interaction (e.g., a tablet during a peek-a-boo routine used to target eye contact).

In summary, the naturalistic component of NDBIs involves targeting skills in the context of "ordinary" and culturally relevant shared experiences and routines, with multiple instructional cues and materials, to facilitate learning and acquisition of responses within the daily contexts where the targeted behaviors are meant to be used (Vivanti, 2019). This approach is analogous to teaching a child how to swim directly in the water rather than first practicing the motions outside of the water.

Developmental Principles

The “developmental” piece of NDBIs is reflected in the selection of intervention targets (what is being taught) as well as the strategies used to target treatment objectives. Intervention targets are informed by research on the developmental sequences and prerequisites for the acquisition of specific skills. For example, research has shown that joint attention, imitation, and functional play are key precursors to language and social cognition in typical and atypical development (Charman, 2003; Poon, Watson, Baranek, & Poe, 2012; Tomasello, 2019; Vivanti & Hamilton, 2014) as acquisition of these skills enables the child to participate in social exchanges that further contribute to his or her learning (e.g., learning the meaning of new words by following the adults’ pointing gesture during a visit at the zoo, or learning to play with a drum by imitating a peer during a “music and movement” routine in daycare). As research has shown that learning in children with ASD appears to follow developmental sequences that, at least in some domains, are similar to those observed in typical development (Mundy, 2016; Tager-Flusberg et al., 1990), NDBIs emphasize targeting “pivotal” (i.e., foundational) skills that create the social infrastructure upon which language, social skills, and cognition are developed (Kasari, Gulsrud, Paparella, Hellemann, & Berry, 2015; Koegel, Koegel, Harrower, & Carter, 1999).

This approach requires consideration of the developmental sequences along which complex skills unfold in human development, that is, teaching what “comes first” developmentally in order to create a foundation for more advanced skills. As we will discuss in the section on research supporting different NDBIs, empirical research confirmed that targeting precursors to language and social development facilitates “collateral” acquisition of more advanced behaviors even when those are not directly targeted by therapy (Kasari, Paparella, Freeman, & Jahromi, 2008; Whalen, Schreibman, & Ingersoll, 2006).

Developmental principles also emphasize targeting behaviors that are in the so-called “zone of proximal development” (Vygotsky, 1930–1934/1978), that is, the skill level that is just beyond the child’s current repertoire (see also Chap. 9). This requires the consideration of the child’s chronological and developmental age in the selection of developmentally appropriate targets (i.e., behaviors that the child is ready to learn based on its current developmental stage). For example, a developmentally appropriate goal for a nonverbal child who is reaching toward an object with an open hand for requesting is to teach a pointing gesture, rather than the three-word sentence “I want ___.” This process is facilitated by connecting new behaviors to the child’s current developmental level (e.g., facilitating the pointing gesture in the same context in which the child is reaching), which requires the assessment of children’s present behavioral repertoire and selection of developmentally informed “next-step” targets. For very young children this is typically accomplished within simple routines such as tickling games, peek-a-boo, clapping games, song routines, or bubbles or balloon games, during which contingencies between antecedent stimuli (e.g., the adult saying “pop!” during a bubbles game), the child’s behavior (the child touching the bubble), and a rewarding experience (the bubble pops and the adult smiles at the child) are highly predictable, emotionally engaging, and salient. Behavioral strategies such as shaping (reinforcing approximations to the target behavior), prompting (inserting a verbal, visual, or physical cue between the instruction and the target behavior), and fading (gradually removing the prompts used to support the spontaneous occurrence of the target behavior and avoid "prompt dependency") are also frequently used to facilitate the transition from the current behavioral repertoire to the "next level." This, in turn, provides the foundation for participation in more sophisticated "symbol-infused" routines in which the cause-and-effect focus gradually is replaced by symbolic activities (e.g., drawing, symbolic play), and verbal language (whether spoken or augmented and alternative means) becomes the primary communication modality (Adamson, Bakeman, & Deckner, 2004).

One key notion informing NDBIs is that the construction of behavioral expertise through early intervention has the potential to shape brain development as the organization and specialization of the brain are particularly open to change during preschool years. Therefore, the provision of early intervention during early sensitive stages of brain plasticity might allow for a deeper impact of these social learning experiences on the developing brain (although importantly, learning experiences change brain structure and function throughout the lifespan, and individuals with ASD can learn new skills at any stage of their lives).

Furthermore, learning in typical development is facilitated by affective engagement and emotional connectedness between the learner and the adult delivering instruction. For example, children are more likely to learn novel words or actions from someone who is playfully engaged with them compared to a situation where the exact same words and actions come from a nonengaging adult (Kuhl, 2007; Nielsen, 2006). Therefore, NDBIs consider affective engagement and social–emotional connectedness between child and adult not just as a desirable attribute that precede the act of learning (i.e., building rapport before starting a teaching trial) but rather as an active component of effective learning.

Additionally, NDBIs are informed by research documenting that during early development, typical children are more likely to learn in response to self-initiated goals and self-driven interests (Legare, 2014; Saylor & Ganea, 2018). For example, young children are more likely to learn names for objects that they are interested in compared to those of objects they are not interested in (Begus, Gliga, & Southgate, 2014). Additionally, they are more likely to learn cause–effect associations in response to a self-generated action, for example, activating a cause–effect toy, compared to observing another person activating the toy (Kushnir, Wellman, & Gelman, 2009). Consequently, NDBIs attempt to promote active experiential learning by facilitating and reinforcing child initiative and spontaneity, and building learning opportunities on activities that stem from the child's own goals, sought-out materials, and preferred routines.

Importantly, the indication of "following the child's lead" in NDBIs does not mean that the adult's role is to encourage *any* behavior spontaneously produced by the child. Maladaptive behaviors are systematically analyzed and reduced following the behavioral strategies discussed in the previous chapter, and behaviors that are not conducive to social learning (e.g., engagement in solitary activities with electronic toys) are also discouraged. Rather, learning episodes in NDBIs take place during routines that incorporate both child goals and adult scaffolding of novel behaviors, shared control of materials, turn-taking, and a balance between child and adult contributions to the interaction. For example, if a child spontaneously starts drawing dots on a piece of paper using a red marker, the adult will join and imitate the child's behavior using a different marker to attract his attention, and subsequently will model novel behaviors (e.g., drawing lines instead of circles) to expand the child behavioral repertoire while still considering the child's interest in markers.

The focus on the child's intrinsic motivation is particularly important in the context of teaching social communication and language. NDBIs are informed by developmental research on the social–pragmatic function of language, that is, the notion that language in typical development is a collaborative activity that serves social-affiliative motives such as the desire to share interest about something (Tomasello, 2010). In typical development, the information that is shared during early child–adult interactions is the mutual pleasure for being part of the interaction, which is conveyed through nonverbal means such as mutual gaze and emotional facial expressions. In the second year of life, children start sharing information about external objects/events that attract their interest (e.g., a balloon flying) using gestures, such as pointing, which are frequently followed by the caregiver's contingent labeling of the object, for example, "a balloon!" (Mundy, 2016). These early emerging preverbal conversations characterized by mutual social-affective engagement and a shared frame of reference are considered to be the infrastructure upon which verbal language emerges (Bloom, 2002; Kuhl, 2014). Based on this body of literature, NDBI approaches target language within a "conversational" back-and-forth flow of verbal and nonverbal exchanges that may center around and build on common themes, whereby child and adult communicate, negotiate, and achieve shared goals while manifesting shared enjoyment in the interaction. Therefore, instead of breaking down complex behaviors such as a conversation into smaller units to be targeted one at the time through discrete trials (e.g., saying the word "three"), NDIBIs start from creating a nonverbal conversation structure upon which a verbal repertoire is built (e.g., adult and child push buttons on a pop-up toy as the adult initially says "one … two … three!, and subsequently only "one … two …"). This is based on the notion that language is facilitated (rather than hindered) by engaging the child in a "communicatively rich" situation that involves multiple modalities and interactive goals (including manifestations of affect as well as verbal and nonverbal cues).

In summary, NDBIs are informed by developmental research showing that children learn best when engaged in affectively rich "conversational" routines that build on the child's goals and whereby the child experiences the natural contingencies of their self-initiated behavior (e.g., the caregiver labeling objects they are looking at) in the context of activities and situations that are similar to those experienced in typical daily and play routines. Within this general framework, several different approaches have been developed that take into account developmental research on typical learning processes while adopting specific strategies to address the symptoms of ASD. In the remainder of the chapter, we will focus on the different NDBI approaches to ASD early intervention, focusing on both intervention procedures and scientific support for each model.

Early Start Denver Model (ESDM)

ESDM (Rogers & Dawson, 2010b) is a comprehensive intervention for young children with autism ages 12–48 months that includes a manualized set of treatment procedures and a curriculum that addresses multiple developmental areas with a focus on the core deficits seen in toddlers and preschoolers with ASD (social orientation, affect sharing and attunement, imitation, joint attention, verbal and nonverbal communication, as well as functional and symbolic play). The ESDM originates from the Denver Model, an autism intervention model developed by Rogers and colleagues in the 1980s (Rogers, Lewis, & Reis, 1987) and later expanded into the "Early Start Denver Model" (ESDM; Rogers & Dawson, 2010b), which included additional treatment procedures and a developmentally informed curriculum checklist (ESDM Curriculum Checklist; Rogers & Dawson, 2010a). ESDM is designed for implementation across multiple settings and delivery formats, including therapist-delivered, parent-mediated, and teacher-delivered group-based programs in daycare or preschool settings (Rogers & Dawson, 2010b; Rogers, Dawson, & Vismara, 2012; Vivanti et al., 2017).

Theoretical Basis

The theoretical foundations of the ESDM include the cascade model of ASD proposed by Rogers and Pennington (1991) according to which early symptoms of ASD hinder the development of the processes that facilitate bodily and emotional engagement during early interactions, such as imitation, reciprocal vocalization, and sharing of affect. Reduced social engagement, in turn, disrupts the development of neural specialization and behavioral expertise in the social communication domain. Additional theoretical principles are based on the social motivation framework of ASD proposed by Dawson et al. (2004; Dawson & Bernier, 2007), suggesting that symptoms of ASD might be linked to a deficiency in experiencing social engagement as intrinsically rewarding. Additionally, the ESDM is informed by the naturalistic application of applied behavior analysis developed by Koegel and colleagues in their pioneering work on pivotal response training (PRT; Koegel, O'Dell, & Koegel, 1987), which focuses on addressing child motivation, spontaneity, social initiation, and response generalization.

Practice and Implementation

In the ESDM, measurable learning objectives are developed from a comprehensive assessment of the child's profile of strengths and needs using the ESDM curriculum checklist (Rogers & Dawson, 2010a), which evaluates each child's behavioral repertoire across multiple developmental domains. The child's progress is systematically recorded, mastery of all objectives is assessed every 12 weeks using the same checklist, and new learning objectives are generated based on the assessment results. Teaching episodes in the ESDM are embedded within joint activity routines (see Chap. 3), which include a set-up phase, in which the child chooses the activity; a theme in which the child and the adult participate equally in the activity chosen by the child, creating a predictable and enjoyable routine; variations that expand the theme; and a closing phase, marking the ending of the current activity followed by a transition to the next one. This joint activity structure is designed to address both the social impairments (through the joint engagement component) and the flexibility difficulties (through the systematic introduction of variations on the theme) that define ASD, while also providing opportunities to target multiple objectives capitalizing on the child's spontaneous interest for specific activities/materials. During joint activity routines, a variety of evidence-based instructional techniques are deployed to target learning goals, including the use of "antecedent–behavior–consequence (ABC)" sequences, shaping, fading, prompting, and chaining, active management of affect, arousal, and motivation, and the use of warm, playful shared interactions as a context for learning. Decision trees are used to readjust the program when progress is slower than expected in one or more areas, including increasing structure and reinforcers' strength and introducing augmentative communication tools. A fidelity tool is used to monitor treatment adherence.

Empirical Support

Research supporting the ESDM includes several randomized controlled trials, single-subject design studies, and quasi-experimental studies indicating positive treatment effects in the area of language/communication, with more mixed results in the area of cognitive and adaptive functioning. Intervention outcomes are more favorable in response to intensive, therapist-implemented delivery than short-term parent-mediated formats. The most relevant studies that tested the ESDM are described in Table 6.1.

Table 6.1 Selected research studies on the ESDM

Study	Design	Treatment characteristics	Sample	Main results
Dawson et al. (2010)	Randomized controlled trial	1:1 therapist-implemented; 20 h/week for 2 years	Enrollment: $N = 48$ ESDM group: $n = 24$ ($M_{age} = 23.9$ months, $SD = 4.0$) Community group (treatment as usual): $n = 24$ ($M_{age} = 23.1$ months, $SD = 3.9$) Two-year follow-up: $N = 45$ ESDM group: $n = 24$ ($M_{age} = 52.4$ months, $SD = 3.4$) Community group: $n = 21$ ($M_{age} = 52.1$ months, $SD = 4.3$)	Compared to the community group, children in the ESDM group showed more improvements in cognitive ability and adaptive behavior
Rogers, Estes, et al. (2012)	Randomized controlled trial	Parent-implemented; 1 h/week for 12 weeks	Enrollment: $N = 98$ ESDM treatment group: $n = 49$ ($M_{age} = 21.02$ months, $SD = 3.51$) Community group (treatment as usual): $n = 49$ ($M_{age} = 20.94$ months, $SD = 3.42$) Posttreatment (after 12 weeks): $N = 98$ ESDM treatment group: $n = 49$ ($M_{age} = 24.77$ months, $SD = 3.15$) Community group: $n = 49$ ($M_{age} = 24.49$ months, $SD = 3.43$)	No significant group differences in child outcomes Parents in both groups improved interaction skills. Significantly stronger parent–therapist working alliance were reported in the ESDM group
Vivanti et al. (2014)	Quasi-experimental controlled trial	Group–ESDM implemented with staff–child ratio of 1:3; 15–25 h/week for 12 months	Enrollment: $N = 57$ ESDM treatment group: $n = 27$ ($M_{age} = 40.30$ months, $SD = 9.55$) Community group ("generic" treatment program for autism): $n = 30$ ($M_{age} = 41.97$ months, $SD = 6.71$	Children in both groups improved cognitive ability, adaptive behavior, and social skills (ADOS social affect) Improvements in overall cognitive and receptive language skills were significantly higher in children receiving the ESDM

(continued)

Table 6.1 (continued)

Study	Design	Treatment characteristics	Sample	Main results
Estes et al. (2015)	School-age follow up of the Dawson et al. (2010) RCT	Same as the Dawson et al. (2010) study	Children who participated in the Dawson et al. (2010) study were assessed 2 years after the intervention ended. $N = 39$, on average 6 years of age, $M_{age} = 72.9$ months, $SD = 2.6$	Two years after the Dawson et al. 2010 trial ended, children in the ESDM group maintained skills previously acquired in overall cognitive ability, adaptive behavior, symptom severity, and challenging behavior. Changes in core autism symptoms (ADOS) and adaptive functioning occurring from the end of intervention to the follow-up evaluation were superior in the ESDM group
Vismara et al. (2018)	Randomized controlled trial	Telehealth parent-implemented; parents were randomized to the ESDM group or a treatment as usual group; parents received 1.5 h telehealth training/week for 12 weeks. Follow-up 12 weeks after the intervention ended	Enrollment: $N = 32$ ESDM treatment group: $n = 17$ ($M_{age} = 31.9$ months, $SD = 10.4$) Community group (treatment as usual): $n = 15$ ($M_{age} = 27.2$ months, $SD = 7.9$) Posttreatment: $N = 24$ ESDM treatment group: $n = 14$ Community group: $n = 10$ Follow-up: $N = 24$ ESDM treatment group: $n = 14$ Community group: $n = 10$	Parents in the ESDM group achieved fidelity of implementation and showed higher satisfaction with and confidence to use the program and website resources than community parents after the treatment and at the follow-up. Children in both groups improved their social communication skills across time regardless of parent treatment fidelity
Colombi et al. (2018)	Quasi-experimental controlled trial	1:1 therapist-implemented; 6 h/week over 6 months	Pretreatment: $N = 92$ ESDM treatment group: $n = 22$, between the age of 18 and 48 months ($M_{age} = 31.1$ months, $SD = 8.0$) Community group (treatment as usual): $n = 70$ ($M_{age} = 35.2$ months, $SD = 7.6$)	Both groups improved in cognitive ability, adaptive behavior, and social skills after 3 months and 6 months. Children in the ESDM group made greater gains in cognitive and social skills after 3 and 6 months and larger improvements in adaptive behavior after 3 months of treatment

Zhou et al. (2018)	Quasi-experimental controlled trial	Parent-implemented; Parents received 1.5 h coaching/week for 26 weeks (weekly treatment hours unknown)	Enrollment: $N = 43$ ESDM treatment group: $n = 23$ ($M_{\text{age}} = 26.65$ months, $SD = 3.37$) Community group (treatment as usual): $n = 20$ ($M_{\text{age}} = 26.43$ months, $SD = 4.52$) Posttreatment: $N = 43$ ESDM treatment group: $n = 23$ ($M_{\text{age}} = 34.93$ months, $SD = 3.00$) Community group: $n = 20$ ($M_{\text{age}} = 34.15$ months, $SD = 4.67$)	The ESDM group demonstrated greater improvements in social affect, social communication, and symbolic play as compared with the community group
Vivanti et al. (2019)	Randomized controlled trial	Children randomized to receive group–ESDM either in specialized or inclusive settings, with staff–child ratio of 1:3-4; >15 h/week for 10–11 months	Enrollment: $N = 44$ Group–ESDM in inclusive setting: $n = 22$ ($M_{\text{age}} = 24.73$ months, $SD = 4.72$) Group–ESDM in specialized setting: $n = 22$ ($M_{\text{age}} = 26.36$ months, $SD = 4.64$)	Children showed improvements in spontaneous vocalization, social interaction, and imitation and across distal measures of verbal cognition, adaptive behavior, and autism symptoms regardless of intervention setting Parents of children in both intervention settings reported decreased stress
Rogers et al. (2019)	Multisite randomized controlled trial	1:1 therapist-implemented; 15 h/week for 24 months. Parents received 4 h of parent coaching/month for 24 months.	Enrollment: $N = 118$ ESDM treatment group: $n = 55$ ($M_{\text{age}} = 20.58$ months, $SD = 3.37$) Community group (treatment as usual): $n = 63$ ($M_{\text{age}} = 20.70$ months, $SD = 3.21$) Posttreatment: $N = 81$ ESDM treatment group: $n = 45$ ($M_{\text{age}} = 48.53$ months, $SD = 3.05$) Community group: $n = 36$ ($M_{\text{age}} = 48.75$ months, $SD = 3.77$)	Better language outcomes for the ESDM group, no group differences in cognitive or adaptive functioning

Pivotal Response Treatment (PRT)

PRT (Koegel & Koegel, 2006) is a behavioral treatment approach for children with ASD as young as 24 months of age, developed by Robert L. Koegel and Lynn Kern Koegel in the 1980s (Koegel et al. 1987). PRT is focused on the child's motivation to learn and interact with others in their natural environment as well as the "pivotal" skills of self-initiations, responding to multiple cues, self-management, and empathy (Koegel, Ashbaugh, & Koegel, 2016). The concept of "pivotal" skills refers to abilities which, when successfully acquired, can facilitate widespread learning across multiple developmental areas. By targeting those foundational skills, PRT is designed to facilitate collateral improvements in other areas of development (e.g., communication, language, play, and social behaviors) and to decrease episodes of distress or disengagement. PRT techniques can be embedded in daily activities and implemented in a variety of settings, including home (Hardan et al., 2015; Schreibman, Kaneko, & Koegel, 1991; Vernon et al., 2019), and school (Suhrheinrich, 2011; Suhrheinrich, Stahmer, & Schreibman, 2007).

Theoretical Basis

PRT is informed by the notion that ASD symptoms cause social–communicative attempts of children with ASD not to be reinforced during social interactions. As a consequence children with ASD fail to experience response–reinforcer contingencies, resulting in developing "learned helplessness" in the social domain (Koegel et al., 2016). Such learned helplessness decreases the likelihood that the child will initiate and respond to social stimuli, thus interfering with the acquisition of new skills. In order to address these deficits, PRT is designed to increase an individual's motivation to engage with others in social interactions by strengthening the response-reinforcement contingency. Motivational strategies are designed to improve the child's overall responsiveness, engagement, and affect, drawing from ABA principles and techniques (e.g., reinforcement, antecedent control, prompting, fading, shaping, and chaining) embedded within child-led activities and naturally occurring learning opportunities.

Practice and Implementation

PRT targets motivation, self-initiations of social interactions, responding to multiple cues, self-management skills, and empathy within naturalistic interactions. Strategies designed to increase the child's motivation include taking into account the child's preferences, allowing children to choose materials and activities, reinforcing attempts, varying tasks frequently, and interspersing maintenance and acquisition tasks (i.e., tasks that the child already masters and tasks that present new challenges). Improvement in pivotal skills is expected to create a motivational and learning foundation for widespread and generalized gains in developmentally downstream domains, including language, play, and cognitive and adaptive skills. Parent training is an integral component of the program.

Empirical Support

While most of the studies evaluating PRT have used single-subject designs (Koegel, et al., 1987), several group studies, including randomized controlled trials and quasi-experimental studies, have been recently published with results indicating improvements in targeted skills in many treated children. Evidence of collateral improvements in nontargeted areas is more mixed (Verschuur et al., 2014). Relevant group-based studies that tested PRT are described in Table 6.2—see also Verschuur et al., 2014, for a comprehensive literature review.

Table 6.2 Selected early intervention research studies on PRT

Study	Design	Treatment characteristics	Sample	Main results
Schreibman et al. (1991)	Randomized group design	Parent-implemented (19 parents of children with autism were randomly assigned into PRT group or discrete trial training group) Duration and intensity unknown	Enrollment: $N = 19$, ranging from 2.8 to 12 years old ($M_{age} = 7.2$ years)	Parents in the PRT treatment group showed more positive affect compared to those receiving traditional discrete trial training
Hardan et al. (2015)	Randomized controlled trial	Parent-implemented (parents were randomized to PRT or psychoeducation groups); daily for 12 weeks	Enrollment: $N = 48$ PRT treatment group: $n = 25$ ($M_{age} = 4.1$ years, $SD = 1.2$) Parents psychoeducation group: $n = 23$ ($M_{age} = 4.1$ years, $SD = 1.3$)	Children in the PRT group showed significantly greater improvements in frequency of utterances, in comparison with children in the psychoeducation group
Vernon et al. (2019)	Randomized controlled trial	1:1 therapist-implemented; 8 h for 26 months; parents received training 2 h/week	Enrollment: $N = 23$ Enhanced-PRT group (pivotal response intervention for social motivation): $n = 12$ ($M_{age} = 35.75$ months, $SD = 9.31$) Wait-list group (treatment as usual): $n = 11$ ($M_{age} = 34.45$ months, $SD = 10.08$)	In the PRT treatment group, more improvements in symptom severity, cognitive skills, language skills, adaptive skills. In the wait-list group, no significant gains were reported on any measures

JASPER (Joint Attention, Symbolic Play, Engagement, and Regulation)

JASPER is a manualized treatment approach for young children with developmental disabilities, including ASD (Kasari, Freeman, & Paparella, 2006; Kasari et al., 2015; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010). JASPER focuses on increasing joint attention, imitation, and play as these behaviors provide a foundation for the development of other skills that are impaired in ASD, including social communication. This is achieved through a range of naturalistic developmental behavioral strategies (e.g., modeling, imitating, increasing the child's joint engagement with caregivers or interventionists, and planning activities based on the interests of the child) integrated into developmentally appropriate play activities. JASPER can be implemented by parents (Harrop, Gulsrud, Shih, Hovsepyan, & Kasari, 2017; Kasari et al., 2015), teachers (Chang, Shire, Shih, Gelfand, & Kasari, 2016; Lawton & Kasari, 2012; Shire et al., 2017), or clinicians/therapists (Shire et al., 2019).

Theoretical Basis

JASPER targets core skill deficits observed in young children with ASD, including joint attention, symbolic play, engagement, and regulation (Kasari et al., 2006; Kasari et al., 2015; Kasari et al., 2010). Strategies to improve joint attention skills (e.g., sharing attention with others through pointing, showing, and coordinating visual attention between people and objects) are designed to facilitate the development of social engagement and later spoken language (Kasari et al., 2006; Kasari et al., 2010; Wong, 2013). Similarly, JASPER is designed to target symbolic play in order to facilitate collateral improvements in social and communication functioning, given the link between symbolic play and the development of language and social functioning in typical and atypical development (Kasari et al., 2006; Kasari et al., 2005; Kasari et al., 2014). Additionally, as joint engagement is associated with cognitive, social, and communication development (Goods, Ishijima, Chang, & Kasari, 2013; Shire et al., 2019; Wong, 2013), JASPER targets joint engagement to promote social communication and learning opportunities. Supporting emotion and behavior regulation is also emphasized within JASPER as these developmental domains are critical to the advancement of social communication and play (Shire et al., 2019).

Practice and Implementation

In JASPER, joint attention, symbolic play, engagement, and regulation are targeted using naturalistic developmental behavioral strategies such as following the child's lead and interest, modeling and prompting for joint attention, imitating the child's actions on toys to obtain her or his attention, facilitating and expanding play, narrating the child's play behaviors, and giving corrective feedback during developmentally appropriate play activities (Kasari et al., 2006; Kasari et al., 2014; Kasari et al., 2008). In addition, environmental manipulations (e.g., strategically arranging environmental antecedents and consequences) are used to facilitate the child's spontaneous social and communicative bids (Kasari et al., 2006; Kasari et al., 2014; Kasari et al., 2008).

Empirical Support

As detailed in Table 6.3, several studies based on randomized designs support the effectiveness of JASPER in improving joint engagement, joint attention, language, and play skills for young children with ASD.

Early Social Interaction (ESI)

ESI (Wetherby & Woods, 2006) is a comprehensive early intervention model that focuses on a collaborative coaching approach to empower parents to teach important skills to their child in natural environments (Wetherby et al., 2014; Wetherby & Woods, 2006).

Theoretical Basis

ESI has a family-centered capacity-building focus (Wetherby et al., 2018), which emphasizes equipping families with strategies to address their child's developmental needs. Additionally, the model is based on empirical research and clinical investigations of communicative functions in ASD (Wetherby, 1986; Wetherby & Prutting, 1984) and addresses the relationship among communication, social–emotional development, and emotion regulation (Prizant & Wetherby, 1990). Within ESI, parents are actively engaged throughout the assessment and intervention process, facilitating collaborative decision making on treatment planning and active reflection on the use of intervention strategies. Parents are encouraged to incorporate teaching strategies to target developmentally appropriate treatment goals at home or in the community during daily routines important to the family. The purpose of teaching in naturalistic environments is to increase the child's participation in everyday activities and the involvement of the child's family in the community. The naturalistic focus of ESI is also designed to promote the generalization of skills and reduce the amount of professional time needed for service provision (Wetherby et al., 2014; Wetherby & Woods, 2006).

Table 6.3 Selected research studies on the efficacy of the JASPER

Study	Design	Treatment characteristics	Sample	Main results
Lawton and Kasari (2012)	Randomized controlled trial	Teacher-implemented; daily for half-day for 6 weeks	JASPER group: $n = 9$ ($M_{\text{age}} = 46.0$ months, $SD = 5.00$) Comparison group (treatment as usual): $n = 7$ ($M_{\text{age}} = 43.01$ months, $SD = 6.00$)	Children receiving JASPER demonstrated increased joint attention and joint engagement than the comparison group
Goods et al. (2013)	Randomized controlled trial	1:1 therapist-implemented; 30 min twice/week for 12 weeks	Enrollment: $N = 15$ JASPER group: $n = 7$ ($M_{\text{age}} = 48.73$ months, $SD = 11.68$) Comparison group (treatment as usual): $n = 8$ ($M_{\text{age}} = 54.68$ months, $SD = 10.25$) Posttreatment: $N = 11$ JASPER group: $n = 5$ ($M_{\text{age}} = 58.84$ months, $SD = 10.98$) Comparison group: $n = 6$ ($M_{\text{age}} = 60.55$ months, $SD = 9.36$)	Children in the JASPER group demonstrated more diversity of spontaneous play and use of requesting gestures as compared to children in the comparison group
Kasari et al. (2014)	Randomized controlled trial	Parent/caregiver-implemented; 2 h/week for 3 months with 3-month follow-up	Baseline: $N = 112$ JASPER group: Caregiver-mediated module (CMM) $n = 60$ ($M_{\text{age}} = 41.9$ months, $SD = 10.0$) Comparison group: Caregiver education module (CEM) $n = 52$ ($M_{\text{age}} = 42.8$ months, $SD = 10.21$)	Children in the JASPER group demonstrated greater improvements in joint engagement and initiations of joint attention compared to the comparison group. Children receiving the JASPER maintained joint engagement over time. Children in both groups retained initiations of joint attention over time. Children in the JASPER treatment group also improved symbolic play skills but not functional play skills

Kasari et al. (2015)	Randomized controlled trials	Parent-implemented; 1 h/week for 10 weeks	Enrollment: $N = 86$ JASPER group: $n = 43$ ($M_{age} = 30.7$ months, $SD = 3.5$) Psychoeducation group: $n = 43$ ($M_{age} = 32.3$ months, $SD = 2.7$)	Children in the JASPER group showed a significant increase in joint engagement compared to the psychoeducation group. The improvement maintained at the 6-month follow-up
Chang et al. (2016)	Randomized trial (at the school level)	Teacher-implemented; staff-child ratio = 1:2; daily for 3 months with 1-month follow-up. Six classrooms with one teacher and one assistant in each of them	Enrollment: $N = 66$ JASPER group: $n = 38$ ($M_{age} = 48.87$ months, $SD = 6.30$) Comparison group (treatment as usual): $n = 28$ ($M_{age} = 51.64$ months, $SD = 6.46$) Posttreatment: $N = 63$ JASPER treatment group: $n = 35$ Comparison group: $n = 28$ Follow-up: $N = 62$ JASPER group: $n = 34$ Comparison group: $n = 28$	Children in the JASPER treatment group made significant improvements in initiations of joint engagement, joint attention gestures and language, and play skills, as well as cognitive ability over children in the comparison group
Gulsrud, Hellemann, Shire, and Kasari (2016)	Randomized controlled trial	Same as the Kasari et al. (2015) study	Same as the Kasari et al. (2015) study	Children in the JASPER treatment group demonstrated greater increase in joint engagement than those in the psychoeducation group
Shire, Gulsrud, and Kasari (2016)	Randomized controlled trial	Same as the Kasari et al. (2015) study	Same as the Kasari et al. (2015) study with one child being excluded due to missing data at entry	Children in JASPER treatment group significantly increased responsive behavior compared to the psychoeducation intervention
Harrop et al. (2017)	Randomized controlled trial	Same as the Kasari et al. (2015) study	Same as the Kasari et al. (2015) study	No group differences were found in restricted and repetitive behaviors after treatment
Shire et al. (2017)	Randomized trial (at the classroom level)	Teaching assistant-implemented; about 2 h/day for 10 weeks with 1-month follow-up; a session had 8–10 children with each child paired with a teaching assistant	Enrollment: $N = 115$ JASPER group: $n = 56$ ($M_{age} = 31.71$ months, $SD = 2.94$) Comparison group (treatment as usual): $n = 59$ ($M_{age} = 31.54$ months, $SD = 3.17$)	Children receiving JASPER demonstrated larger improvements in joint engagement, joint attention, and play skills compared to comparison group. The developmental gains were maintained at the one-month follow-up

Practice and Implementation

Parents collaborate with professionals to create an individualized treatment plan for their child and are coached to use intervention strategies in daily activities throughout the day (Wetherby et al., 2014). ESI uses a manualized curriculum-based assessment based on the SCERTS (Social Communication, Emotional Regulation, and Transactional Supports) intervention to identify developmentally appropriate goals and monitor progress (Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006; Wetherby et al., 2018). SCERTS focuses on three dimensions that are foundational to the development of children with ASD, including (1) social communication, with treatment goals including expanding the use of gestures, sounds, and words, initiating spontaneous verbal and nonverbal communication, understanding the meaning of words, initiating and responding to joint attention, increasing functional object use and pretend play, and extending reciprocity in interaction; (2) emotional regulation, with relevant intervention targets including expressing emotion, expanding self-regulatory strategies to calm self when dysregulated, using communication to help regulate emotion when frustrated or help is needed, and using regulatory strategies to stay engaged in activities and handle new and changing situations; and (3) transactional supports, that is, the specific teaching strategies and learning supports for parents (Wetherby et al., 2018).

After treatment goals are identified, the coach and the parent work collaboratively to (a) identify what works for the parent–child dyad using observation, direct teaching, and modeling, (b) practice imbedding intervention with the guide of the therapist and direct feedback, (c) continue practicing with parent-led sessions and reflection on the engagement of the parent and child, and (d) increase parent independence (Wetherby et al., 2014; Wetherby et al., 2018). The coach ensures that the objects, equipment, and materials are appropriate for the routine and observational data are collected periodically for progress monitoring.

Empirical Support

As displayed on Table 6.4, empirical support for ESI includes a quasi-experimental study and a randomized controlled trial that compared different dosages and formats of the same intervention. Results support the effectiveness of this approach in promoting gains in communication, daily living, and social skills for very young children with ASD.

Table 6.4 Research studies on the early social interaction (ESI)

Study	Design	Treatment characteristics	Sample	Main results
Wetherby and Woods (2006)	Quasi experimental study	Parent-implemented (therapist-assisted with two home visits/week); daily for 12 months (weekly treatment hours unknown)	Enrollment: Pre-ESI group: $n = 17$ ($M_{age} = 18.19$ months, $SD = 3.85$) Posttreatment: $N = 35$ Post-ESI group: $n = 17$ ($M_{age} = 30.72$ months, $SD = 3.66$) Comparison group (no treatment) $n = 18$ ($M_{age} = 31.61$ months, $SD = 3.45$)	From baseline to posttreatment, children in the ESI treatment group significantly improved social communication skills. Compared to the control group at posttreatment, children in the ESI treatment demonstrated better performance in social signals, rate of communicating, communicative functions, and understanding
Wetherby et al. (2014)	Randomized controlled trial	Parents randomized to individual-ESI or group-ESI coaching. Both groups are encouraged to incorporate intervention strategies into daily routine activities for at least 25 h/week for 9 months	Enrollment: $N = 82$ Individual–ESI coaching group: $n = 42$ ($M_{age} = 19.64$ months, $SD = 1.93$) Group–ESI coaching group: $n = 40$ ($M_{age} = 19.58$ months, $SD = 1.42$)	Children receiving individual–ESI showed improvement in social communication at a faster rate than those in group-ESI. Parents of children in individual–ESI reported significantly better communication, daily living, and social skills as compared to group–ESI. Children in individual–ESI improved receptive language skills significantly. In comparison, those in group–ESI showed no change

Project ImPACT (Improving Parents as Communication Teachers)

Project ImPACT is a parent training curriculum designed to target social communication skills for young children with autism up to 6 years of age (Ingersoll & Dvortcsak, 2010). The program utilizes a naturalistic approach that includes behavioral and developmental strategies integrated into play activities and daily routines. Parents use these strategies in partnership with an interventionist to promote social engagement, language, social imitation, and play.

Theoretical Basis

Project ImPACT draws from research on the effectiveness of parent training in enhancing child developmental outcomes, promoting generalization and maintenance of targeted skills, and reducing parental stress and depression (Ingersoll & Dvortcsak, 2010). Against this background, Project ImPACT provides parents with a systematic guide to teach their child social communication skills using developmental strategies and ABA-based techniques (e.g., prompting, shaping, and reinforcement).

Practice and Implementation

Project ImPACT teaches parents interactive teaching techniques and direct teaching techniques, which form a three-layer pyramid (Ingersoll & Dvortcsak, 2010). The four interactive teaching techniques at the base of the pyramid (i.e., *follow your child's lead*, *imitate your child*, *animation*, and *modeling and expanding language*) are the foundation for the treatment, serving to improve the child's motivation and engagement as well as adult responsiveness. Once the parent has become proficient at these, the interactive teaching techniques at the middle layer (i.e., *playful obstruction*, *balanced turns*, and *communicative temptations*) are subsequently introduced to facilitate spontaneous communication. Lastly, the top layer of the pyramid includes the direct teaching techniques, which involve the use of prompting and reinforcement for teaching the child more advanced social communication goals.

Empirical Support

As shown in Table 6.5, empirical support for Project ImPACT includes one quasi-experimental study and two randomized studies suggesting improvements in social communication for treated children.

Table 6.5 Research studies on the efficacy of project ImPACT

Study	Design	Treatment characteristics	Sample	Main results
Ingersoll and Berger (2015)	Randomized controlled trial	Parent-implemented; parents randomized to self-directed vs. therapist-assisted	Enrollment: $N = 27$ Self-directed group: $n = 13$ ($M_{age} = 46.08$ months, $SD = 13.18$) Therapist-assisted group $n = 14$ ($M_{age} = 41.57$ months, $SD = 12.24$)	Compared to the self-directed group, parents in the therapist-assisted group were more likely to engage with ImPACT online (a telehealth-based parent-mediated intervention). The program completion rate was significantly higher in the therapist-assisted group than the self-directed group
Stadnick, Stahmer, and Brookman-Frazee (2015)	Nonrandomized group design	Parent-implemented; parents received training 1 h/week for 12 weeks	Enrollment: $N = 30$ Project ImPACT group: $n = 16$ ($M_{age} = 46.75$ months, $SD = 25.88$) Community group (treatment as usual): $n = 14$ ($M_{age} = 64.07$ months, $SD = 22.32$)	Children in the project ImPACT group made significant improvements in communication skills
Ingersoll, Wainer, Berger, Pickard, and Bonter (2016)	Randomized controlled trial	Same as the Ingersoll and Berger (2015) study: Parent-implemented; parents were expected to use online training resources without or with the assistance of a therapist (self-directed vs. therapist-assisted)	Same sample as the Ingersoll and Berger (2015) study: Enrollment: $N = 27$ Self-directed group: $n = 13$ ($M_{age} = 46.08$ months, $SD = 13.18$) Therapist-assisted group $n = 14$ ($M_{age} = 41.57$ months, $SD = 12.24$)	Children in both groups increased scores on language measures; those in the therapist-assisted group made greater gains. Children in the therapist-assisted group showed improvements in social skills. Compared to the self-directed group, parents in the therapist-assisted group demonstrated greater improvements in implementation fidelity and positive perceptions of their child

Incidental Teaching (IT)

Incidental teaching (IT) is an intervention approach which targets the acquisition of spoken language during naturally occurring adult–child interactions. The most distinctive feature of IT is that all interactions during the intervention must be initiated by the child. The concept of IT was originally created by Betty Hart and Todd Risley in the 1970s (Hart & Risley, 1978) and further developed by Gail McGee in the 1990s (McGee, 2005; McGee, Morrier, & Daly, 1999). IT can be implemented by parents, teachers, or therapists.

Theoretical Basis

Incidental teaching emphasizes the importance of family involvement and child social engagement in facilitating language learning and inclusion of children with ASD. Treatment techniques in incidental teaching are based on the notion that children with ASD have difficulty initiating social communication. Therefore, teaching strategies are designed to be embedded in fun play activities that capitalize on the child's interests, motivations, and attentional focus. ABA principles are incorporated within such play activities in natural environments.

Practice and Implementation

IT is used to teach children with ASD communication skills such as responding to social interactions, labeling items, and requesting objects (Neely, Rispoli, Gerow, & Hong, 2016). Building on the child's self-initiations, the interventionist observes the child's preferred objects/activities and captures "teachable moments" (i.e., learning opportunities) to teach the targeted behaviors (McGee et al., 1999). Within the IT framework, materials are typically placed out of reach but within sight in order to create opportunities for the child to request. In a typical teaching episode, once the child shows interest in the materials, the interventionist places his/her hand on the child's hand and looks expectantly to wait for an appropriate response (e.g., verbalization or gesture). In the absence of an appropriate response, the interventionist asks "What do you want?" and provides further prompts as needed (e.g., asking specific questions such as "What color car do you want?" making gestures, and modeling the desired response) to encourage the child's response (McGee et al., 1999). Natural consequences (e.g., access to desired materials, assistance, or adult attention) are systematically provided to reinforce the child's communicative efforts.

Empirical Support

Several single-subject studies (e.g., McGee & Daly, 2007) suggest that children with ASD can improve their language skills through incidental teaching techniques. However, no group-based studies on the effectiveness of this approach are available.

Enhanced Milieu Teaching (EMT)

EMT (Hemmeter & Kaiser, 1994) is an early language intervention approach designed for young children with language impairments, including children with ASD (Kaiser, Hancock, & Nietfeld, 2000). Building on child interests and initiation, the interventionist catches "teachable moments" to model and prompt specific language skills during everyday interactions in a natural and functional context (Kaiser et al., 2000; Olive et al., 2007). EMT can be delivered by parents in the home environment (Hemmeter & Kaiser, 1994; Kaiser et al., 2000), by teachers in the child's classroom (Drasgow, 2007; Olive et al., 2007), or by therapists in home or clinic settings (Hampton, Kaiser, & Roberts, 2017; Hancock & Kaiser, 2002).

Theoretical Basis

The EMT model incorporates three components, which include (a) environmental arrangement, (b) responsive interaction, and (c) milieu teaching (Hancock & Kaiser, 2002; Kaiser et al., 2000). Environmental arrangements are utilized to increase the level of engagement and facilitate learning. Adult responsiveness to the child's communicative attempts is emphasized as parent–child interactions provide natural opportunities for language learning (Hampton et al., 2017; Hemmeter & Kaiser, 1994; Roberts & Kaiser, 2012). EMT also draws strategies from a program called milieu teaching (Hart & Rogers-Warren, 1978), a set of procedures designed to embed language learning opportunities within the child's natural environment by capitalizing on a child's interest in and motivation to gain access to specific materials.

Practice and Implementation

EMT aims to improve social communication skills using responsive interaction strategies and behavioral teaching procedures during naturalistic interactions (Hancock & Kaiser, 2002; Kaiser & Roberts, 2013; Olive et al., 2007). Techniques include following the child's lead, taking turns, imitating the child's play behaviors and vocalizations, and expanding on the child's utterances to increase child communication, modeling language, prompting the child's communication targets, reinforcing communication by providing access to requested objects, and using time delay (see Chap. 5) to elicit language (Hart & Rogers-Warren, 1978; Kaiser et al., 2000). In addition, manipulation of the environment (e.g., putting materials out of reach to promote requesting) is used (Hancock & Kaiser, 2002; Kaiser et al., 2000). These language teaching procedures are embedded throughout play-based therapy sessions.

Empirical Support

As detailed in Table 6.6, there is some initial support for the efficacy of EMT in improving some dimensions of language in young children with communication difficulties as well as in school age children with ASD (Hampton et al., 2017), while evidence of treatment effects on language for young children with ASD is limited.

Reciprocal Imitation Training (RIT)

Reciprocal imitation training (RIT; Ingersoll, 2008) is a treatment approach focused on teaching imitation to young children with ASD. RIT incorporates teaching strategies targeting the flexible and social use of imitation during natural play activities and daily routines. Parents (Ingersoll & Gergans, 2007), therapists (Ingersoll, 2010, 2012), and the child's siblings (Walton & Ingersoll, 2012) can be trained as treatment providers to implement RIT.

Theoretical Basis

RIT is rooted on the notion that imitation in early childhood development is critical to the development of cognitive and social communication (e.g., language, play, and joint attention), serving both a learning function (acquisition of new knowledge) and a social-affiliative function (Vivanti & Hamilton, 2014). As children with ASD exhibit significant deficits in imitation skills that interfere with their learning and social functioning (including imitation of body movements, object use, vocalizations, and facial expressions), RIT focuses on teaching imitation to young children with ASD to support cognitive and social development.

Practice and Implementation

RIT (Ingersoll, 2008) targets the social use of imitation (e.g., object and gesture imitation) in young children with autism during play interactions. ABA-based techniques including modeling, prompting, and contingent reinforcement are

Table 6.6 Research studies on enhanced milieu teaching (EMT)

Study	Design	Treatment characteristics	Sample	Main results
Kaiser and Roberts (2013)	Randomized group design	"Therapist-only" EMT group: two therapists, 24 30-min sessions in clinic and one therapist, 12 20-min sessions at home; 6-month and 12-month follow-ups. "Parent and therapist" EMT group: Therapist- and parent-implemented, 24 30-min sessions in clinic and parent-implemented, 12 20-min sessions at home; 6-month and 12-month follow-ups	Children with developmental delay, autism spectrum disorders, or Down syndrome Enrollment: $N = 77$ "Therapist-only" EMT group: $n = 38$ ($M_{age} = 41.32$ months, $SD = 7.30$) "Parent and therapist" EMT group: $n = 39$ ($M_{age} = 40.05$ months, $SD = 8.76$)	No group differences were found in language skills
Roberts and Kaiser (2015)	Randomized controlled trial	Caregiver-implemented; four training workshops, 24 treatment sessions across 3 months (two sessions/week: One 20-min session in the clinic and daily at home for an average of 17 h/week)	Toddlers with *language delays*, excluding children with intellectual disability, hearing loss, a major medical condition, or autism spectrum disorder Enrollment: $N = 97$ EMT group: $n = 45$ ($M_{age} = 30.3$ months, $SD = 5.0$) Comparison group (treatment as usual): $n = 52$ ($M_{age} = 30.6$ months, $SD = 5.1$)	The use of all language facilitation strategies significantly improved in caregivers in the EMT group. Children in the EMT group demonstrated significantly better receptive language skills compared to the comparison group. No group differences in expressive language skills
Curtis, Kaiser, Estabrook, and Roberts (2017)	Randomized controlled trial follow-up	Same as the Roberts and Kaiser (2015) study	Same sample from the Roberts and Kaiser (2015) study	After the intervention ended for 12 months, parents of children in the EMT treatment group reported lower rates of externalizing and internalizing behaviors for the children
Hampton et al. (2017)	Randomized controlled trial follow-up	Same as the Roberts and Kaiser (2015) study	Same sample from the Roberts and Kaiser (2015) study	No group differences in expressive or receptive language skills at either the 6- or 12-month follow-ups

incorporated for teaching imitation within naturalistic social interactions. In order to increase the child's use of eye contact, joint attention, and reciprocity in preparation for imitation, the child's play partner (e.g., caregiver) is expected to contingently imitate the child's actions on toys with a duplicate set of toys, the child's gestures and body movements, and vocalizations (Ingersoll, 2008, 2010, 2012). The play partner is also trained to use developmentally appropriate language to describe the child's play behaviors or to create sound effects in response to the play activities. In teaching imitation, the therapist models an action, paired with a verbal marker to describe the action. Gesture imitation is taught by the play partner demonstrating a meaningful gesture (e.g., affective, object, attributes, and conventional action gestures) as related to the child's play (Ingersoll, 2010). Modeled actions/gestures vary across toys/materials in order to avoid rigid associations between actions and specific toys. Both social reinforcement (e.g., praise) and tangible reinforcement (e.g., access to materials) are used in the intervention.

Empirical Support

As displayed in Table 6.7, there is initial support for the efficacy of RIT in improving elicited and spontaneous imitation (Ingersoll, 2010) as well as joint attention initiations and social–emotional functioning (Ingersoll, 2012).

Table 6.7 Research studies on the efficacy of the reciprocal imitation training (RIT)

Study	Design	Treatment characteristics	Sample	Main results
Ingersoll (2010)	Randomized controlled trial	1–1 therapist-implemented; 3 h/week for 10 weeks	Enrollment: $N = 21$ RIT treatment group: $n = 11$ ($M_{age} = 41.36$ months, $SD = 4.30$) Community group (treatment as usual): $n = 10$ ($M_{age} = 37.20$ months, $SD = 7.36$)	Children in the RIT treatment group made more improvements in elicited and spontaneous imitation
Ingersoll (2012)	Randomized controlled trial	1–1 therapist-implemented; 3 h/week for 10 weeks	Enrollment: $N = 27$ RIT treatment group: $n = 14$ ($M_{age} = 39.3$ months, $SD = 7.3$) Community group (treatment as usual): $n = 13$ ($M_{age} = 36.5$ months, $SD = 8.0$)	Children in the RIT treatment group made more improvements in joint attention initiations at the end of the treatment and at a 2- to 3-month follow-up, compared to the community group. Children in the RIT treatment group also improved social–emotional functioning significantly more than the community group did at the follow-up

Early Achievements (EA)

Early achievements (Landa, Holman, O'Neill, & Stuart, 2011; Landa & Kalb, 2012) is an intervention approach designed to address the learning challenges of young children with ASD or other social and communication disorders. A comprehensive developmental curriculum called Assessment, Evaluation, and Programming System for Infants and Children (AEPS; Bricker, 2002) is utilized for treatment planning, and strategies informed by developmental and behavioral research are delivered in naturalistic settings.

Theoretical Basis

The EA intervention is grounded in research suggesting that child's school readiness can be facilitated through intervention strategies that promote the development of communication, symbolic, linguistic, concept and event representation, reciprocal social engagement with peers, and perspective taking (Landa, 2016).

Practice and Implementation

The EA intervention involves naturalistic developmental behavioral intervention strategies whereby the interventionist creates opportunities for the child's spontaneous communication by following the child's attentional lead and expanding on their play and use of language. Frequent "orchestrated opportunities" are deliberately created for social engagement using various strategies such as modeling, labeling, and imitating the children's actions. The interventionist further encourages the child to imitate peers and adults, to respond to joint attention, and to share their positive affect with others.

Empirical Support

As detailed in Table 6.8, the EA intervention was evaluated in a randomized controlled trial (Landa et al., 2011), which reported treatment effects on socially engaged imitation with gains generalized into different contexts and maintained at the 6-month follow-up. Gains for initiation of joint attention and shared positive affect were similar in the treatment and control groups.

Table 6.8 Research on the efficacy of early achievements (EA)

Study	Design	Treatment characteristics	Sample	Main results
Landa et al. (2011)	Randomized controlled trial	Teacher/therapist-implemented (adult to child ratio = 3:5); 2.5 h/day for 4 days/week for 6 months	Treatment group: $n = 24$ ($M_{age} = 28.6$ months, $SD = 2.6$) Comparison group (regular treatment): $n = 24$ ($M_{age} = 28.9$ months, $SD = 2.8$)	Children in the treatment group showed increased socially engaged imitation after the intervention. Generalization in unfamiliar contexts and maintenance of the skill at the follow-up were also reported. Children in both groups demonstrated similar improvements in initiation of joint attention and shared positive affect

Adapted Response Teaching

Adapted response teaching (ART; Baranek et al., 2015) is a relationship-based intervention aimed at increasing parent responsiveness and, consequently, child developmental outcomes in 1-year-old infants who have an older sibling with ASD, due to their increased likelihood of being later diagnosed with ASD or experiencing developmental delays. It is adapted from the Responsive Teaching Curriculum (Mahoney & MacDonald, 2007), which teaches parents the utilization of highly responsive interactions with their children within daily routines to promote cognition, communication, and social–emotional functioning. ART is primarily designed to be implemented by parents in home environments (Baranek et al., 2015; Watson et al., 2017).

Theoretical Basis

ART is based on two primary theoretical foundations (Watson et al., 2017). First, by targeting pivotal behaviors (e.g., intentional communication, joint attention, and social play), the intervention aims to promote downstream benefits across cognition, language, communication, socialization, and adaptive behavior (Baranek et al., 2015; Watson et al., 2017). In addition, increasing parent responsiveness is critical to the development of communication, language, emotional regulation, sensory regulation, and attention regulation (Watson et al., 2017). Thus, ART was designed to increase the caregivers' responsiveness and sensitivity to their child in order to promote child's development in these areas.

Practice and Implementation

ART is designed to target intervention objectives falling into two broad categories, including the social–communication domain (i.e., social play, joint activity, joint attention, vocalization, intentionality, and conversation) and sensory regulatory domain (i.e., self-regulation, attention and arousal, exploration, engagement, adaptability and coping, and cooperation; Baranek et al., 2015). These "pivotal" domains are known to provide a foundation for later social and cognitive development (Baranek et al., 2015). Parents are trained to use responsive teaching strategies reflecting five dimensions (i.e., reciprocity, contingency, control, affect, and match) during daily routine activities (Baranek et al., 2015; Watson et al., 2017). Responsive strategies used to teach social communication include imitating the child's actions and vocalizations, repeating activity the child enjoys, being animated, communicating at the child's level and without asking questions, and expanding on the child's play (Watson et al., 2017). In order to teach sensory regulatory skills, parents are encouraged to match the child's pace, follow the child's lead, mirror the child's play behavior and use parallel play to join an activity, treating the child's emotions as meaningful and legitimate, and giving frequent opportunities to make choices. A family action plan is created in order to assist parents in implementing and reflecting on the responsive teaching strategies used in daily interactions with their child (Baranek et al., 2015; Watson et al., 2017).

Empirical Support

In the context of ASD early intervention, ART has been tested by randomized trials that included infants presenting early signs of ASD identified through early screening. Evidence for intervention effectiveness, as shown in Table 6.9, is mixed.

Table 6.9 Research studies on the efficacy of adapted responsive teaching (ART)

Study	Design	Treatment characteristics	Sample	Main results
Baranek et al. (2015)	Randomized controlled trial	Parent-implemented; parents received an average of 27.6 training sessions at home with an average of 5.8 additional contacts with a therapist across a 6- to 8-month period; treatment delivered between parent training sessions (weekly treatment hours unknown)	Infants at risk of autism spectrum disorder Enrollment: $N = 16$ ART treatment group: $n = 11$ ($M_{\text{age}} = 15.22$ months, $SD = 1.2$) Comparison group (treatment as usual): $n = 5$ ($M_{\text{age}} = 15.6$ months, $SD = 1.3$)	Infants in the ART group showed improved social adaptive behavior, including communication and socialization, compared to the treatment-as-usual group. Parents of the infants in the ART group were less directive
Watson et al. (2017)	Randomized controlled trial	Parent-implemented; parents received 24.9 training sessions at home with an average of 2.4 additional contacts with a therapist across a 6- to 8-month period; treatment was delivered between parent training sessions (weekly treatment hours unknown)	Infants at risk of autism spectrum disorder Enrollment: $N = 87$ ART treatment group: $n = 45$ ($M_{\text{age}} = 13.8$ months, $SD = 0.71$) Comparison (treatment as usual): $n = 42$ ($M_{\text{age}} = 13.7$ months, $SD = 0.79$)	No main effects of ART on child social–communication, sensory-regulatory, adaptive, and autism symptomology. Parents in the ART group demonstrated greater parental responsiveness compared to the treatment-as-usual group

Conclusions

In this chapter, we have examined a variety of early intervention approaches that adhere to the Naturalistic Developmental Behavioral Intervention (NDBI) framework. These interventions are informed by the notion that developmental sequences and processes of early learning supporting typical development are also observed in ASD, although autism symptoms and associated features affect developmental rate and learning patterns in specific domains. Consequently, NDBIs attempt to embed behavioral strategies within the back-and-forth flow of social interaction that characterize early child–adult exchanges (Mundy, 2016; Rogers et al., 2017). Within this framework, the various interventions described here are based on different theoretical orientations and hypothesized mechanisms of change, although they present with remarkable similarities in their practical implementation (to the point that questions have been raised on the need for such numerous "brand names" in the field; Vivanti et al., 2018).

Nevertheless, important differences among the models discussed here include whether they address specific "pivotal" areas such as imitation or social communication (e.g., PRT, JASPER, RIT) or are designed to be comprehensive in scope with treatment targets covering nonsocial domains such as cognitive, motor, and adaptive functioning (e.g., ESDM, ESI). Additionally, the strength of evidence differs across approaches, ranging from support from large randomized trials (e.g., JASPER, ESDM) to preliminary evidence based on nonrandomized designs (e.g., incidental teaching). Additionally, some NDBI interventions have been implemented and evaluated across different age groups (e.g., PRT) while others have been designed to address the needs for very young children (e.g., ESI, ART). While evidence for effectiveness is generally favorable, benefits are more frequently reported in areas that are directly targeted by the intervention, and variability across outcome measures and participants are substantial.

It is also important to acknowledge that our list of NDBI models might not be exhaustive, and intervention programs might exist that do not explicitly use the term NDBI but are broadly consistent with the NDBI principles nonetheless (e.g., Schertz, Odom, Baggett, & Sideris, 2013). Additionally, other ASD early interventions have been implemented and evaluated that involve a developmental focus but do not fit within the NDBI category as they do not include behaviorally based procedures. Notable examples include the Developmental, Individual Difference, Relationship-Based (DIR) Model, which focuses relationship and interactions, emotional development, and individual differences in sensory modulation, processing, and motor planning (Greenspan & Weider, 1998), and the Preschool Autism Communication Trial (PACT), which uses parent coaching to increase parental sensitivity and responsiveness to the child's communication and facilitate adaptation of the parents' communication style to the level of their child's understanding (Green et al., 2010). This latter approach is supported by very well-designed research suggesting treatment-related changes in parental responsivity as well as reduced autism symptom severity for treated children (Pickles et al., 2016).

Finally, while NDBIs are partly designed to address some perceived limitations of standard ABA approaches such as EIBI, both approaches appear to be beneficial to children with ASD. The paucity of direct comparison studies, together with the variability in outcomes across models, and the increasing incorporation of naturalistic strategies in ABA-based approaches make it difficult to provide strong conclusions regarding the superiority of one approach versus the other. Understanding for whom, and for what skills, more naturalistic versus more structured approaches are helpful is a critical clinical and research challenge, which will be discussed in the following chapters.

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Chapter 7
The TEACCH Approach and Other Visually Based Approaches for Children with Autism

Lauren Turner-Brown and Kara Hume

Introduction

The TEACCH approach as well as other visually based approaches to early intervention for children with ASD considers that the child with ASD has strengths and weaknesses, and that using areas of strength, such as understanding visual information, may help when teaching skills in an area of weakness. For example, Picture Exchange Communication System (PECS; Bondy & Frost, 1998) teaches children to exchange a picture that represents a word with an adult to communicate when that child is not able to verbally express what he or she wants. Below, we review the TEACCH approach for young children as well as other visual approaches used in ASD early intervention.

The TEACCH Approach

The TEACCH Autism Program started studying autism and developing approaches for teaching individuals with ASD in the late 1960s. Structured TEACCHing was the broad approach developed based on research of Dr. Eric Schopler to accomplish two primary goals: (1) to teach a child as many independent skills and routines as possible and (2) to modify the environment to make it more meaningful for a child. Principles that contribute to this approach include understanding the "culture" of

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autism, or the way the individual with ASD sees and interprets his or her world, understanding individual needs of the child, using visual strategies to support learning, and using special interests or talents to promote engagement (Mesibov, Shea, & Schopler, 2005). When this approach was first developed, children with ASD were diagnosed at older ages; thus more recent work has addressed how to apply these principles and Structured TEACCHing strategies to younger children (Ozonoff & Cathcart, 1998; Turner-Brown, Hume, Boyd, & Kainz, 2019; Welterlin, 2009), and, most recently in a manualized parent coaching manual called Family Implemented TEACCH for Toddlers (FITT; Hume, Turner-Brown, & Boyd, 2013). A description of how Structured TEACCHing for young children with ASD and their families follows along with examples of structure that can be used to support the development of receptive and expressive communication, play, and social skills.

Structured TEACCHing Goals for Young Children

To understand Structured TEACCHing with young children, we first review the goals of the approach followed by the specific strategies employed. A primary *goal* of Structured TEACCHing has always been teaching children and older learners with ASD as many independent skills as possible. Independence has proven to be a key skill for optimal outcomes in adulthood. However, for children as young as 12–18 months, independence is not typically a skill area named by caregivers and professionals as a priority. While many young children wish to assert their independence during this period and caregivers can support this desire when possible, toddlerhood is mostly a time to emphasize and build learning and relationships. Thus, the primary goal for Structured TEACCHing when used with young children is to support engagement (Turner-Brown et al., 2019), defined as *being actively and productively involved in activity.*

Structured TEACCHing with young children supports engagement with: (1) people, especially caregivers and family members, to support the development of communication and social interaction skills; (2) toys/objects, to support the development of play skills, which creates opportunities for social interaction and supports many types of learning; and (3) toys/objects and people together, to support the development of "*coordinated or joint attention*," which is the child's ability to share attention between the caregiver and some other object or event in the immediate location.

A second goal of Structured TEACCHing with young children involves modifying the environment to make it understandable and meaningful for the individual with ASD. This goal is identical to goals for older learners. Modifying the environment often entails adding visual cues and supports to help answer six questions that often lead young children with ASD to be confused or frustrated:

1. Where am I supposed to be?
2. What am I supposed to do?

3. How should I do it?
4. How long will I do this or how many should I do?
5. How will I know that I am making progress and when I am finished?
6. What will happen next?

The use of visuals is particularly important with young children, both with and without ASD, because young children are not developmentally ready to process abstract or complicated verbal ideas. Important ideas such as time (e.g., how long activities will last, what it means if we are "leaving in 5 min"), sequencing (such as what activities come "before" and "after"), and sharing (such as offering or giving a toy to others) are abstract. When teaching these concepts to young children with ASD, concrete and visual cues such as an object or picture represent the abstract idea.

Structured TEACCHing Components

Using Structured TEACCHing with young children with ASD and their families requires incorporating common principles of early intervention. First, partnering with caregivers is a key when providing intervention to young children. This is central to the TEACCH philosophy (see Drs. Schopler and Reichler's (1971) then groundbreaking notion of "parents as co-therapists.") Next, it is important to provide services and offer supports in natural environments. These include families' homes, early care and education programs, and other community settings where young children spend the most time. Last, it is essential that skills are taught through participating in everyday activities and routines. Teaching caregivers how to use Structured TEACCHing strategies across daily routines, such as bath time, play time, and meal time, allows the child to have opportunities for intervention every day, throughout the day, without requiring daily visits from an interventionist, specialized equipment, or travel to a medical or clinical setting. The four components or types of structure used with young children and their families are discussed below.

Physical Organization of the Environment

The first component of Structured TEACCHing is physical organization of the environment. An organized environment with carefully arranged intervention spaces may support children who become distracted easily or have difficulty in processing information. Organizing the physical environment also supports active engagement.

There are two primary strategies for physically organizing the home environment to maximize engagement. The first is to use physical and visual boundaries to better define space and expectations for young children. Clarifying spaces in the home helps young children better understand what activities will occur in each different area in the home (e.g., this is where we eat, this is where you play, this is where you get dressed). These boundaries are not meant to contain a child rather to serve as a concrete reminder of where to be and what the expectations are in each space. The FITT manualized approach coaches parents to establish two areas for different types of play with young children—an area for *table-based play* (e.g., puzzles, ring stackers, shape sorters, paints, or markers) and an area for *floor-based play* (such as balls, trucks and cars, bubbles). The table-based play area serves as a location to introduce new play activities or teach new skills. A designated location for teaching new skills helps in creating positive routines around learning, which helps young children accept new activities and materials. Other spaces are created based on what routines or skill areas caregivers would most like to target. For example, if caregivers identify sitting at the table during dinner as a priority skill to target, then creating a physically organized space at the table would be recommended. Similarly, if caregivers would like support during bath time, bedtime, book time, or potty time, those spaces would be organized to help clarify expectations.

The second step is to determine where the spaces should be established and what physical and visual boundaries may be needed to help the child better understand the space. This process involves parent–therapist brainstorming to determine what is necessary. Consider Ryan, a 2-year-old with ASD who always stops when he walks past the entertainment center to stare at his reflection. Parents might consider a physical boundary in his play area that prevents him from walking past this reflective glass during play time. Or, consider Jane, whose older siblings often watch TV in the afternoons in a family room. Jane's parents might choose to set up an area in a different room to play with her because distractions are fewer. See below for examples of physically organized spaces (Fig. 7.1).

Physical and visual boundaries can be used in other areas of the home to clarify spaces and expectations. For example, if a family would like the child to sit at the table during meal time rather than run out of the room, caregivers may choose to

Table based play area.
A parent or therapist sits against the wall. The child sits in his chair and sees the activities he will do to his left. He completes the activities at the table, then places them in a finished basket to the right.

Floor based play area.
A blanket and toys provide visual cues to the child to let her know where she will play with her caregiver.

Book area.
Books are at eye level and accessible with a carpet area for reading

Fig. 7.1 Physical organization of the home tuck the child's seat closest to the wall rather than out in the middle of the kitchen. The wall may serve as physical boundary reminding the child of the expectation to stay at the table.

A second strategy of physical organization is to minimize distractions. Limiting distractions encourages the child to increase attention to the other person and play materials rather than attending to other sights and sounds in the environment. This could involve limiting the number of toys visible or available to young children when playing together. For example, while a father and his son are building with blocks, covering, or putting away other play materials, such as balls or trucks, may increase the child's attention to the blocks. Minimizing distractions may also include turning off screens (such as computers, tablets, smart phones, televisions) for periods of the day in the home, using visual boundaries such as shelves, or placing covers over items that are not currently in use.

Schedules

The second major component of Structured TEACCHing is the use of a schedule. Providing visual information for children about where to go and when to go there is an important strategy for supporting the child's understanding of communication and expectations. Visual information can attract and hold a child's attention, provide a concrete form of representation of important ideas, and support strengths in visual processing. Schedules also support children with limited receptive language skills.

There are several considerations for using schedules with young children with ASD. First, young children are not likely able to understand a schedule that uses abstract representations such as line drawings, words, or even photographs. The most appropriate schedule form for young children is the use of objects—either functional objects that will be used in the scheduled activity, such as a sippy cup to use at meal time, or representational objects that represent where the child is going, such as a set of toy keys that represents transitioning to the car.

Next, young children are not ready to process long sequences of schedule information; instead, they best understand one piece of information at a time. This information is communicated through a transition object—a concrete way to show the child where he is going next. Each activity or location is represented by a specific object. For example, if a child has difficulty transitioning to the changing table during diaper changes, caregivers may select a diaper as a transition object. When it is time to transition for a diaper change the caregiver will give the diaper to the child and say, "Time for diaper change" and help the child get to the correct location. In time, with the consistent use of transition objects, young children will learn what the transition object means, and transition difficulties will decrease as understanding improves.

Sample Transition Objects

- *Favorite bath toy or washcloth*: Bath
- *Diaper*: Diaper change/Bathroom
- *Puzzle piece*: Table-based play
- *Toothbrush*: Brushing teeth
- *Favorite toy*: Floor-based play
- *Book*: Reading time/book area
- *Placemat*: Mealtime
- *Pillow/stuffed animal*: Bedtime
- *Special toy or CD*: Going for a ride in the car
- *DVD case*: TV time
- *Sand shovel*: Going out to the playground
- *Soap container*: Washing hands

For some young children, a very short sequence of two objects or photos, called a "*first/then schedule*" may be used to help them understand when a favorite activity is going to return. For example, if a child has difficulty transitioning away from a favorite DVD to come play on the floor with a caregiver, two objects may be presented. First, the transition object used for floor-play is presented and next to it is the DVD cover, indicating that first the child will play, and then he can return to the DVD (Fig. 7.2).

Fig. 7.2 First-then object schedule. This schedule shows the child what is coming first and next. First, he will eat lunch, then he will play balloons with his mom

Activity Systems

The third component of Structured TEACCHing is an activity system. An activity system helps children better understand what to do once they arrive at a designated space or location, such as the table-based play space or the bathroom. The activity system shows the child what activities will be completed, how long the activities will take, how he will know that the activities are finished, and what will happen next. These systems are sometimes termed "*work systems*" (Hume, Plavnick, & Odom, 2012), but "*activity systems*" were coined when the approach was used with young children to reduce the connotation that children were "working" and emphasize the wide range of activities that could benefit from this organizational system.

Activity systems are used during table-based play routine by placing the activities that the caregiver and child will do together on the child's left and a "*finished*" basket on the child's right (a left-to-right activity system, see image 1 above). The finished basket is a designated location where children put their activities when they are finished with them. Caregivers and interventionists teach the system to the child by emphasizing that activities are taken from the child's left, completed together at the table, then put in the finished basket on the right. This allows the child to see how many activities will be completed and what the activities are. Also, they can see that activities are finished when they are in the finished basket. Children also learn that a transition object after the structured activities will direct them to the "what's next" activity, typically playing on the floor or moving to a caregiver-selected routine like snack or outside play.

Activity systems are also used during other routines in the home, to support engagement in daily routines such as dressing, tooth brushing, and taking a bath. For example, a 3-year-old boy, Louis, with ASD cries every day when his mother tries to get him dressed. An activity system would clarify for Louis what he is supposed to do, how long it will last, how he knows he is finished, and what activity is coming next. Specifically, laying the clothes out in a left-to-right fashion allows Louis to see how many steps are required, and as each piece of clothing is put on, he can see that progress is being made. A transition object such as a favorite book at the end of the line of clothes helps Ryan know what preferred activity is coming next (Fig. 7.3).

Visually Structuring Activities and Cues

Finally, the last component of Structured TEACCHing is visually structuring activities and cues**.** With older children, this component often entails making "tasks" that promote independence. For young children, the focus is on using visual structure to support learning across developmental domains (e.g., early learning, imitation, play, etc.). Activities typically have a clear beginning and end, include a sensory component like preferred sounds or textures, are highly motiving, and build on the child's strengths.

Fig. 7.3 Daily routine activity system. Organizing each item of clothing provides visual cues to a child about how much she needs to do, and what she will do when she finishes getting dressed

These activities incorporate elements of visual instructions, visual organization, and visual clarity. See images below for examples of these elements of visual structure.

Visual instructions such as a series of photos may be used to teach a multistep play activity. For example, when teaching a child with ASD a play routine with a baby doll, interventionists or caregivers may take a series of photos of activities to do with a doll (such as put baby in tub, wash baby, dry baby). Single photos may also be used to provide support for young children as they are learning functional and symbolic play routines (e.g., a farm animal completes an action, such as the pig jumps, the horse sleeps).

Visually organizing the activities can include stabilizing them on a tray, providing containers for extra parts and pieces, and reducing the number of parts and pieces.

Visual clarity of toys and activities means providing cues or highlighting within a play activity to emphasize its most important parts and pieces.

In addition to these principles, activities often *incorporate the child's interests*, a key Structured TEACCHing principle. Adapting play materials to incorporate individual interests can be an important first step to help young children with ASD to engage with new materials or play in new ways. For example, if a child does not typically engage with Duplos®/Legos® but is interested in characters from Sesame Street®, adding pictures of favorite characters to the blocks can increase his interest and motivation to learn to play with them (Fig. 7.4).

Blending Structured TEACCHing with Other Approaches

To summarize, therapists and parents use structure to develop table, floor, and daily living routines that promote active engagement in the child with ASD. Visual approaches support the child's understanding of these routines and his ability to transition between activities. Next, therapists and parents develop goals that target areas of development most affected by ASD. Imitation skills are an example of skills taught in Family Implemented TEACCH for Toddlers (Hume et al., 2013;

This introductory activity is visually clear, simple, and incorporates the child's interests in trains.

This activity highlights where shapes go to simplify goal for an early learner.

This photo sequence guides a child in steps to give baby doll a bath

This basketball activity promotes imitation skills as each play partner bounces the balls and drops them into the hoop.

Fig. 7.4 Visually structured activities

Turner-Brown et al., 2019). Therapists and parents begin by conducting informal assessments to determine what interests the child, where she might show emerging skills. Treatment goals can develop from this assessment and may be targeted using highly structured activities if necessary but will also incorporate naturalistic activities and strategies, such as Reciprocal Imitation Training (Ingersoll, 2010) to ensure skills generalize beyond a structured activity.

TEACCH Summary

Providing support for young children with ASD and their families is crucial because children are receiving diagnoses at younger ages, and effective early intervention is proven to improve developmental outcomes. Structured TEACCHing principles and the four elements of structure, adapted to be developmentally appropriate for young children, can serve as important tools for teaching a number of skill areas, including coordinated attention, expressive communication, and play skills. By specifically partnering with parents in natural environments and applying Structured TEACCHing strategies to daily routines, this intervention model ensures that the goal of engagement is supported throughout the child's day.

Other Visual and Augmentative Approaches

Visual and/or augmentative approaches can be quite helpful in teaching communication to young children with ASD. Rather than focus only on speech, these approaches emphasize the importance of directing communication in a variety of forms to others and utilize visual cues or electronically generated sounds to support the child. Three examples of these approaches are PECS, speech-generating devices, and video modeling.

Picture Exchange Communication System

PECS (Bondy & Frost, 1998) is one approach that has proven effective in teaching children a range of communication skills (see Wong et al., 2015, for a review). This approach is designed for children with limited functional communication skills to initiation as well as back and forth communication. PECS is one example of an alternative and augmentative communication system. The approach entails teaching a child to give a partner a picture of an item in exchange for the actual item. For example, if a child wants to play with a toy train, he would give the communicative partner a picture of a train, and the partner would then give the child the actual train. PECS uses behavioral strategies to build the exchange skill and expand upon the vocabulary and length of communication. Research has shown improvements in communication and social skills in young children who learn this approach (Carr & Felce, 2007; Dogoe, Banda, & Lock, 2010; Jurgens, Anderson, & Moore, 2009) as well as to older learners (see Wong et al., 2015, for a review).

Speech-Generating Devices

Speech-generating devices include a range of devices that speak electronically when a child pressed a button. At a simple form, there may be one button to push to request “more,” and the device speaks “more.” In a more complex form, the child could press three picture buttons or icons that represent more, bubbles, and please, and the device would speak that phrase. Studies have shown that the use of speech generated devices promotes spontaneous language in minimally verbal children with ASD when paired with a naturalistic developmental behavioral approach (Almirall et al., 2016; Kasari et al., 2014). Use of these devices can also promote peer interactions in preschool aged children (Thiemann-Bourque, Feldmiller, Hoffman, & Johner, 2018).

Video Modeling

Another visual approach that can lead to gains in communication, social, play, and daily living skills is video modeling. In this approach, individuals are presented with videos that demonstrate skills or behaviors being taught. For example, a child might watch a video of children taking turns appropriately to learn how to take turns with his peers. Or, a parent might watch a video of how he plays with his son and get feedback or tips about ways to engage his child in more complex ways (e.g., video self-modeling). In an early intervention context, video modeling can improve play skills (e.g., Dueñas, Plavnick, & Bak, 2019; Hine & Wolery, 2006). In these studies, young children watch videos of children playing and then show increases in varied play with peers in their school setting. With older children and even adults, video modeling can lead to changes in a range of skills and behavior, including conversations, self-help, and parenting (see Wong et al., 2015, and Hong et al., 2016, for a review).

Summary

In summary, the TEACCH approach as well as other augmentative communication approaches can support young children with ASD by supporting areas of relative weakness, such as understanding language or using speech. It is promising that these approaches can be used with other approaches to support children and families.

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Chapter 8
Choosing the "Right" Program for Each Child in Autism Early Intervention

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In the previous chapters, we have described a plethora of early intervention approaches and techniques that have at least some evidence suggesting benefits for children with ASD. Being able to choose among different interventions is, in principle, desirable, given the heterogeneity of learning strengths and needs in children with ASD. Nevertheless, families and professionals are faced with many challenges when navigating treatment options, including (a) selecting the "right" intervention for the particular child, as different children with ASD have different needs, and might respond differently to different interventions and (b) selecting the right intervention provider in the community, given that the same intervention can be implemented differently by different providers.

Selecting the Right Intervention

Even when guidance is given to discern between evidence-supported and unsupported interventions, the issue of which intervention should be chosen for an individual child remains a dilemma for families and professionals alike. Will this particular child benefit more from receiving EIBI, JASPER, or ESDM? These interventions, like the other evidence-supported approaches described in the previous chapters, have been shown to "work" at the group level (i.e., when comparing the average progress of a group of children receiving the intervention versus a comparison group), but outcomes vary from child to child. For example, research has suggested that improvements following EIBI are very rapid for approximately 20–30% of children, very slow for 10–20% of children, and in between the two extremes for

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most children (Eldevik et al., 2010; Smith et al., 2015). Similar variability is documented following NDBI approaches (Tiede & Walton, 2019) and delivery of "non-branded" early intervention services in the community (Noyes-Grosser et al., 2018).

This does not mean necessarily that some children are just "fast learners" and others "slow learners"—rather, intervention outcomes are shaped by the interplay between child and intervention characteristics. Although all evidence-supported interventions include procedures to individualize the treatment program to the learning profile of each child, they differ across a number of key treatment strategies (e.g., emphasis on verbal versus visually conveyed instructions, child-lead vs. adult-directed models) and objectives (e.g., focus on cognitive vs. social skills). As children with ASD vary in their learning strengths, needs, and preferences, and different intervention approaches vary in their teaching procedures, outcomes will be optimal when the right fit is identified between the child's learning profile and treatment teaching techniques. For example, it is plausible that a child who seems to learn best in response to visually presented information (e.g., pictures) and has difficulties with changes in routine might benefit an intervention that uses picture-based schedules showing the sequence of activities that will occur during her or his day.

Family priorities, beliefs, and needs are also an important consideration when selecting interventions. Different approaches use instructional techniques (e.g., play-based vs. structured adult-directed teaching) that may fit differently with a family's educational style and cultural values about educating children. Similarly, different parent coaching formats might be more or less compatible with the caregivers' learning style and availability (e.g., small groups sessions vs. 1:1 supervision in which the parent is asked to implement educational strategies and receives live feedback).

Nevertheless, establishing the best fit between child/family features and the teaching procedures involved in different approaches is not easy, given the complexity of child and family learning styles, preferences and needs, the limited knowledge on "what works for whom" in ASD early intervention, and the variability in intervention options across contexts. Currently, research suggests that the specific intervention approach that children with ASD receive in the community depends mostly on the geographical proximity to a specific provider and the theoretical orientation of that provider rather than consideration of child or family characteristics (Green, 2007; Hebert, 2014).

However, research efforts in this area are increasing, providing insight on the factors that can be considered when selecting among different intervention options (Stahmer, Schreibman, & Cunningham, 2011; Vivanti et al., 2014). For example, there is initial evidence that pivotal response training (PRT) might be particularly beneficial for children who engage more with toys, approach people more often, and show positive affect more frequently (Fossum et al., 2018; Koegel et al., 1999; Sherer & Schreibman, 2005; Schreibman, Stahmer, Barlett, & Dufek, 2009). This profile was found to predict response to PRT but not DTT (Schreibman, Stahmer, Barlett, & Dufek, 2009). Vivanti et al. (2013) also found that engagement with toys, together with imitation and response to joint attention (but not social attention), predicted positive response to the Early Start Denver Model. Conversely, Yoder and

Stone (2006) reported that children who engaged more with objects responded better to an intervention based on PECS (see Chap. 7) compared to a naturalistic intervention, while children who were less interested in objects had better outcomes in response to a naturalistic intervention compared to the PECS intervention. Additional research found that children showing low interest in objects benefitted most from the "Hanen More Than Words" intervention, a parent-mediated naturalistic approach focused on language (Carter et al., 2011). Finally, larger gains in response to DTT and EIBI have been documented in children who are more socially engaged and responsive to social reinforcers such as praise (Klintwall & Eikeseth, 2012; Klintwall et al., 2015; Smith et al., 2015).

These findings provide an initial indication of interventions that can be particularly beneficial for children with specific profiles as well as skills that should be targeted in order for children to benefit optimally from specific approaches. However, the evidence base is too preliminary to make conclusive recommendations on the intervention a particular child should receive in order to achieve optimal outcomes. Methodological complexities include variability in the outcome measures used to characterize children's learning profiles and define intervention response and, for most studies, lack of comparison groups that allow for a determination of whether children who are not optimally responsive to one intervention will benefit more from an alternative intervention. For example, low scores in IQ, language, and adaptive and social functioning predict poorer response across different early interventions. However, as poor performance on standardized tests can reflect a variety of factors, including difficulties in test-taking skills (e.g., understanding verbal instructions, compliance, attention to relevant features of the task), it is important to identify the specific barriers and strengths that make children more or less amenable to benefit from different interventions. For example, rather than concluding that a child will be a "poor responder" to an early intervention model because she or he has a low IQ score, it is helpful to identify and target the constraint responsible for the low performance in the IQ test (e.g., difficulties engaging in tasks mediated by verbal instructions) to ensure the child is "equipped" for learning in response to early intervention models that require this prerequisite. Importantly, however, targeting "readiness" skills should not result in children missing the opportunity to participate in high-quality interventions that provide rich learning opportunities. Rather, therapists should calibrate instruction to the child's current level of ability/understanding while at the same time working toward moving to the next level. For example, for a child who has low performance in IQ testing due to difficulties with understanding verbal instructions, it might be helpful to use augmentative alternative communication strategies (see Chap. 7) to facilitate learning across multiple goals and domains while also targeting toward language understanding.

In the absence of a conclusive evidence-base on "what works for whom," several scholars have suggested clinical guidelines on matching children to interventions based on the theoretical fit between child and family factors and what different interventions are designed to achieve. For example, Siegel (1999) suggested that approaches based on DTT are best suited for children who are not motivated by novelty, social reward, or peer affiliation and have difficulties learning "incidentally" from nonstructured interactions. Additionally, according to the same author, TEACCH would best serve children who need a high degree of predictability, and whose primary difficulty is in comprehending and expressing verbal and nonverbal communication, but learn best in response to visually mediated information. Finally, Siegel suggests that developmental approaches are best suited for children who engage more frequently in self-initiated actions and are more motivated by novelty and social interaction. In other words, approaches that emphasize "following the child's lead" might be best for children who offer many leads to follow, particularly in the social domain, while those relying on a high degree of repetition and structure might be ideal for children with a preference for predictability and struggle with novelty and unstructured situations. Similarly, preference for verbal versus visual instruction and social versus nonsocial reinforcers can inform assignment to more versus less naturalistic approaches.

While most children with ASD will show a constellation of deficits and preferences across these different dimensions rather than a "clean" profile of preference for visual versus verbal instruction, response to social versus nonsocial reinforcers and motivation for predictability versus novelty, consideration of these features can help practitioners decide which approach may be most suited for them. As mentioned earlier, it is important for all children with ASD to receive interventions that are both tailored to their existing strengths and provide opportunities to grow in areas of relative weakness, so that catering to specific learning preferences (e.g., using images to communicate) does not deprive children from the opportunity to gain expertise in multiple modalities and domains.

Additionally, regardless of any a priori reasoning on what approach works best for the child, treatment progress in response to the selected intervention should be consistently monitored and intervention strategies should be changed if data indicate that the teaching program is not facilitating child learning. Slow learning rate in a child receiving evidence-based intervention does not mean that the child cannot learn or that the intervention is ineffective for all children—rather, it means that the selected teaching strategies, despite the theoretical fit for the child, do not meet the child's learning needs and preferences. In this case, it is imperative to take action and introduce new evidence-based approaches that differ from what has been tried already rather than persist indefinitely on the basis of the clinician's philosophical adherence to a specific model.

Selecting the Right Provider

Once a decision is made on which intervention seems to be the best fit for the child's learning needs and strengths, another complex challenge is choosing the right provider for that intervention. While information on the effectiveness of interventions is based on the results of carefully conducted clinical trials, families typically access interventions through services available in their community. The range of services available to young children varies considerably across contexts (see Chap. 10 for more information on this topic), and many of the intervention approaches described in the previous chapters are not widespread across communities.

Additionally, community implementation of interventions is highly variable and can substantially deviate from the manualized procedures and fidelity criteria used in clinical trials (Stahmer et al., 2005). This, in turn, comes with the risk of diminished effectiveness (Nahmias et al., 2019). Further, community providers often pick and choose intervention strategies from a variety of approaches, including both evidence-based and unsupported interventions, rather than adhering to one specific intervention package (Drahota, Aarons, & Stahmer, 2012). Although flexibility and drawing from various sources of knowledge might appear preferable than adhesion to a single approach, unsystematic deviations from a protocol and mixing strategies (including unsupported ones) come with the risk of “diluting” intervention effectiveness (Vivanti, 2017).

Therefore, when choosing among different interventions in the community, one should consider not only the scientific evidence for the “brand name” intervention offered by the provider (e.g., EIBI, ESDM, or JASPER) but also the degree to which such intervention is delivered as intended. As implementing intervention models with high fidelity requires understanding of the evidence base, extensive training, and appropriate resources, important criteria to guide choice of the intervention provider are whether (a) all the intervention practices offered by the provider are supported by scientific evidence (see Chap. 2 for details on criteria used to established whether intervention are evidence-supported); (b) staff delivering the intervention has received formal training/certification in the intervention they offer; (c) intervention fidelity (i.e., the degree to which intervention is delivered as intended, or at least maintains the aspects of the intervention thought to be most important) is systematically monitored; (d) resources are available to accomplish the intervention goals (e.g., availability of typically developing children for an ABA program targeting social skills or whether a parent coaching intervention is offered after work hours, thus allowing working caregivers to participate in the program).

Additionally, when providers offer an eclectic model that combines different practices, it is important that a clearly defined plan exists on the specific goals targeted by the different practices (Kasari & Smith, 2013). For example, an evidence-based parent coaching program focused on management of disruptive behavior might be combined with therapist-delivered implementation of an alternative augmentative communication system to target functional communication. In this case, the combination of these different interventions, if implemented at fidelity by trained clinicians, might result in a complementary effect (as the two approaches address different areas of need) or even a synergistic one (improvements in child communication increase the success of the behavioral management intervention). However, the combination of strategies can be problematic when inconsistent procedures are used to target the same goal—for example, if disruptive behaviors are at times addressed through planned ignoring and other times through removing a token from the child's token board (see Chaps. 5, 6, and 8 for details on these strategies). In these cases, strategies might work against one another, and exposure to inconsistent responses and teaching methods can be detrimental to child learning.

Conclusions

In summary, identifying intervention programs that are optimally tailored to the specific child and family needs does not rely on an exact science but requires the appreciation of the child's learning needs (including barriers originating from co-occurring difficulties that are not part of the core deficits of ASD, such as deficits in motor skill, difficulties with eating or sleeping behaviors) and resources that might help children respond to the teaching style and goals offered by the intervention. This, in turn, requires a fine-grained knowledge of what the child needs to learn (which will inform treatment objectives), how the child learns best (which will inform treatment strategies), what the family's goals and resources are, and fine-grained understanding of what interventions are designed to achieve and how and what they require on the child and family's part. Additionally, regardless of the theoretical reasoning for recommending a specific approach, professionals need to maintain an open-minded and data-driven attitude and change intervention strategies when data show limited intervention progress. Finally, it is important to appreciate that the same intervention approach can be implemented differently by different providers. Therefore, factors such as the intervention provider's level of training, fidelity of implementation, and consistency of intervention procedures should be considered when choosing among treatment options. Finally, there are several intervention strategies and goals that cut across models and are critically important for the success of the intervention being delivered regardless of the specific approach. These are discussed in detail in the following chapter.

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Chapter 9
Beyond Monolithic Packages: Important Strategies Across Early Interventions for Children with Autism

Kristen Bottema-Beutel and Shannon Crowley

Promoting Active Child Engagement

As described in Chaps. 3 and 6, children's development can be supported by engagement with caregivers and other social partners. In these interactions, caregivers scaffold increasingly complex forms of social interaction often in the context of play activities (Bakeman & Adamson, 1984; Bruner, 1982). Developmental theory has long suggested that the mechanism by which caregiver–child play and other forms of social engagement has beneficial impacts on development involves children's active role in shaping and sometimes leading the interactions and activities in which they are engaged (Piaget & Inhelder, 1971). This principle also applies to development in children with ASD. As such, active child engagement is the premise of many early interventions, especially those targeting social communication development (e.g., Kasari et al., 2015).

To ensure that children with ASD are actively engaged within intervention contexts, interactions with interventionists or caregivers should be characterized by shared control, mutual regulation, and creativity. This can mean that adults do things such as follow the child's lead during toy play activities (imitate the child's actions on toys, or take on a play persona parallel to the child's selected persona), verbally expand on the child's spontaneous interactional overtures (following a child point by saying, "yes, I see the duck!"), and engage in creative word play using onomatopoeic sounds to draw the child into the interaction (playfully animating the duck and saying "quack quack quack!" in a back and forth exchange). Intervention research has also shown that "responsive" practices such as mirrored pacing (imitating the children's actions shortly after the child has produced them) and communicative

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synchrony (communicating about what the child is doing) are linked to children's gains in language (Green & Garg, 2018). Further, the intervention context itself should incorporate preferred materials and child interests into activities (Gulsrud et al., 2016; Schreibman et al., 2015). Capitalizing on the child's interests will maximize children's motivation to communicate with caregivers about materials in the environment, enact complex play schemes during play, and actively participate during daily activities.

Importantly, although interventionists and caregivers may have explicit goals in mind when scaffolding engagement with children with ASD, the specific details of how the interaction is to proceed should not be entirely defined in advance or expected to strictly conform to a "correct" standard. Interactions that are overly constraining in terms of children's expected modes of participation can lead to passive participation, suppress active engagement, or can even be met with resistance which will ultimately undermine children's display of interactional competence (Sterponi & Fasulo, 2010).

Caregiver Coaching

Many early interventions that were originally developed in clinics with trained professionals acting as interventionists have now been adapted so that they can be implemented by caregivers in the child's home; these are referred to as parent-mediated interventions. Nevill, Lecavalier, and Stratis (2016) recently conducted a meta-analysis of these interventions and showed positive albeit modest effects on overall symptoms associated with ASD, socialization, communication, and cognition. A benefit of caregivers acting as interventionists is that, at least theoretically, intervention strategies can be used much more frequently and fused into family routines (more on this in the next section). In order for caregivers to effectively carry out intervention procedures, they must be adequately coached by professionals who have expertise in intervention techniques. This type of training is usually referred to as caregiver coaching and is now an emerging area within early intervention research. Much of the caregiver coaching research has focused on NDBI or developmental interventions (see Chap. 6) that focus on caregiver–child interactive routines as the primary intervention context (e.g., Green et al., 2010; Kasari et al., 2015). As such, one of the primary areas of focus for caregiver coaching is maximizing caregiver responsivity to children's interactional overtures.

Caregiver coaching can be delivered in a variety of modalities, such as in-person or via video conferencing or other online technologies (see Sutherland, Trembath, & Roberts, 2018), and in a variety of instructional formats, including 1:1 or small group sessions. Most coaching models involve some amount of instruction on intervention strategies, multiple opportunities for the caregiver to practice using the strategies with the child, and feedback on the quality of caregiver's implementation of each strategy. The "dose" of caregiver training can also vary considerably with sessions lasting 30 min to 3 h and occurring weekly to monthly over several months.

Many parent-mediated intervention programs emphasize that similar to young children who are the ultimate receivers of the intervention caregivers must have an active role in the coaching process to effectively learn to implement intervention strategies (Wetherby et al., 2018). This means that caregivers are involved in setting appropriate child goals, specifying how general intervention procedures will be adapted to the individual child, characterizing their own responsivity to children's overtures, and identifying children's responses to the intervention procedures (Nevill et al., 2016). In a randomized controlled trial, Shire, Gulsrud, and Kasari (2016) demonstrated that an intervention actively engaging parents in ways to be more responsive interaction partners produced superior outcomes to a didactic teaching approach that focused on similar content (see also Rogers et al., 2019).

Incorporate Interaction Strategies into Everyday Routines

As caregivers learn interaction strategies that accommodate their child's cognitive, communicative, and sensory profiles, these strategies can be incorporated into everyday routines and activities that already, or could potentially, involve the child (Landa & Sharpless, 2018; Rogers et al., 2019). For example, caregivers might expand on children's initiations during meal and snack times, imitate children's actions on toys during play routines at home, or incorporate visual supports into bathing, dressing, or clean-up routines.

There are several advantages to leveraging the child's everyday environment to support children's development as compared to exclusively relying on intervention sessions in clinical or other decontextualized settings. First, when caregivers are able to adapt everyday routines to be more accommodating to their children with ASD, it improves the child's ability to access and participate in routines that have cultural and familial significance. Second, as mentioned in Chap. 6, clinical environments can be overly stripped down (i.e., exclude any stimuli thought to be superfluous to learning) and can utilize stimuli that do not change in quality from session to session. This can make it difficult for children to generalize what they have learned in clinical settings to settings that are more relevant to the child's life, such as the home (Schreibman et al., 2015). Third, everyday routines by definition occur with high frequency and are repeated across days and weeks, giving children many more learning opportunities than can be provided in clinic visits. At least theoretically, more learning opportunities will translate to greater developmental gains.

While initial research into interventions that include a strong home component has shown some promise (e.g., Green et al., 2010; Kasari et al., 2015), there is a caveat to recruiting caregivers as interventionists. Doing so can lead to situations where caregivers are made to feel that *all* interactions with the child should serve a therapeutic role, requiring caregivers to exclusively function as therapists (with children always positioned in the role of pupil). To avoid this outcome, special effort should be made by intervention providers so that the strategies caregivers are encouraged to use are culturally relevant, acceptable to the family, and easily integrated into the caregivers' natural interaction styles and daily routines (Vivanti, 2019).

Thoughtful Environmental Arrangements

Interventionists and caregivers can arrange the physical intervention and home environment in a thoughtful way that accommodates the cognitive and sensory profiles of the child. The TEACCH approach, described in detail in Chap. 7, is based on a set of instructional strategies and systematic arrangements of the environment that account for the individualized needs and preferences of children with ASD (Mesibov & Shea, 2010). Although this approach is typically used in classroom settings, the visual support strategies and environmental arrangements can be adapted for early intervention contexts. In particular, these supports can foster meaningful interactions between the child and adult, help children more independently engage in important tasks, and have better access to their environment (Welterlin, Turner-Brown, Harris, Mesibov, & Delmolino, 2012).

Arrangements to Support Sensory Differences

Some individuals with ASD are reported to have differences in their perception of and response to sensory information. Interventionists and caregivers should be mindful about the child's' sensory processing patterns and adapt the physical organization of the setting to accommodate their individual sensory profiles (Ganz, 2007). Children who display a hyporesponsiveness to sensory stimuli are less likely to process sensory information from the environment and could benefit from more intensive stimulation in intervention settings and within the home. Using brightly colored materials, playing music, or promoting physical activity can help children become actively engage with others (Dunn, 2007).

On the other hand, children who are hyperresponsive to sensory stimuli can be more easily distractible and sensitive to sensory information from the environment. Interventionists can cover windows or have the children sit with their backs to doors and windows to accommodate visual sensitivity (Mesibov & Shea, 2010). In addition, caregivers could plan for more quiet time throughout the day if children can become overstimulated by noise and physical activity.

Supporting Transitions

The restricted and repetitive behaviors or interests that are characteristic of ASD can include an insistence on sameness or inflexible adherence to routines (American Psychiatric Association, 2013; Chap. 4). These features can make it difficult for children to transition between activities OR cope with unexpected changes in their schedule. However, the implementation of multimodal supports such as text, visual cues, and oral language can be used to convey expectations and serve as reminders regarding the child's schedule of activities (Sterling-Turner & Jordan, 2007). For example, a timer can be used for the child to visualize how much time is left in a particular play activity, and visual schedules comprised of picture cards arranged in a sequence can be implemented to help children anticipate future activities (D'Elia et al., 2014).

Balancing Between Structure and Novelty

Young children with ASD often show a preference for sameness in their environment, activity schedules, and interactional routines with others (APA, 2013). Intervention programs may seek to accommodate this preference by maintaining a uniform physical arrangement of the intervention space, providing similar materials such as the same set of toys from session to session, engaging in consistently ordered intervention activities, and encouraging interventionists to use similar interaction styles tailored to individual children's preferences. Providing such structure can be critical for ensuring that children are comfortable with intervention routines (especially for children who may become dysregulated with unexpected schedule changes or sensory stimulation). However, maintaining too much structure can result in overdependence on sameness that can prevent the child from learning new skills, generalizing the skills they have learned to contexts outside the intervention, or developing an ability to be flexible.

To mitigate this concern, intervention programs should promote a balance between providing structural adaptations that maintain the child's emotional regulation while also introducing novelty that will encourage growth and development. This can be both at a "macro" level, such as changing the sequence of intervention activities or providing new sets of toys in addition to more familiar toys or the "micro" level such as expanding on the child's existing play and language routines to introduce new elements (Chang et al., 2016).

Developmental Sequencing of Intervention Goals

Interventions that are able to influence children's growth beyond what is directly taught in the intervention tend to focus on goals that are developmentally sequenced (Yoder et al., 2013). Appropriate goals are initially selected to reflect the child's cognitive, social, and communication profile (see Chaps. 3 and 6), which should be established using assessment procedures that have been validated for developmental domain. Vygotsky's concept of the "Zone of Proximal Development" (ZPD; Vygotsky, 1930–1934/1978) is helpful for determining appropriate starting points for intervention (see Chaps. 1 and 6). The ZPD is defined as competencies just beyond what the child can do independently but can achieve with support (often provided by the interventionist, or some other more competent social partner). Once these goals are achieved, new goals are then set that reflect progression through a cascading developmental trajectory where subsequent milestones build on previously achieved milestones. Descriptions of developmental trajectories are usually based on research conducted on typical child populations but can also include deviations from typical paths that commonly occur in ASD populations (Rogers, 2006).

While this approach is promising for facilitating children's long-term growth, there are two potential barriers to implementing developmental strategies within interventions for children with ASD. First, developmental pathways are better described in some domains as compared to others. For example, much is known about the development of social communication in both child development, more generally, and in children with ASD, in particular (see Chap. 3 for a description of this trajectory). On the other hand, there is less consensus on the developmental origins or pathways of processes with the RRB domain (see Chap. 4) in children with ASD (Poljac, Hoofs, Princen, & Poljac, 2017; Rogers & Ozonoff, 2005). This means that for some domains of development, there is an insufficient understanding of how developmental milestones build on one another to appropriately sequence intervention goals using this framework.

Second, there is some evidence that children with ASD do not always follow (or need to follow) a typically developing sequence for some domains, and there is significant variation within the ASD population in terms of developmental trajectories (Lord, Bishop, & Anderson, 2015). While there is evidence that interventions can be implemented that support children with ASD in achieving social communicative milestones that follow a typical child trajectory (Wetherby et al., 2018), there is also some evidence that "environmental demands" can guide intervention targets in many cases with less emphasis on developmental pathways (Bottema-Beutel et al., 2014). That is, interventionists can consider the types of new skills or competencies that will aid the child in better accessing their environment, regardless of a known developmental progression of these skills. This is especially the case when developmental sequences are not well defined.

Data Collection to Guide Goal Selection and Inform Decision Making

All early intervention programs for children with ASD should involve some means of collecting and analyzing data on child progress to ensure that the intervention is working as intended. Specific data collection procedures will vary depending on the nature of the intervention and the targeted developmental domain or child behavior. Some intervention traditions, such as EIBI (see Chap. 5), have highly developed methods for operationalizing and measuring target behavior and for making intervention decisions based on collected data. These interventions typically use observational procedures to assess children's current behavioral profiles as well as the environmental variables that influence the child's behavior. Once the intervention has been implemented, these methods are also used to determine if there are decreases or increases in the level, trend, or variability of the occurrence of a specific behavior or set of behaviors to determine whether or not an intervention was successful.

Other traditions, especially those that do not target discrete behaviors, may take a more eclectic approach to data collection. Informal and formal observations, interviews, standardized assessments, and document reviews may be used to determine children's developmental levels across a variety of domains, and developmentally appropriate goals are then selected. Similar procedures may be used to monitor intervention progress although it is important that a specific protocol is established to consistently measure the phenomena of interest before, during, and after intervention implementation to monitor children's development. Similar to behavioral approaches, developmental interventions should attend to the absolute value indicated by measurement procedures (e.g., a child's standardized score on an assessment of social functioning to determine whether the child is at the expected level given their age) as well as growth rates to determine if progress is being made at a sufficient pace.

During and after the implementation of an intervention, formative and summative assessments are also used to determine if intervention procedures should be modified or discarded and replaced by entirely new interventions to better meet children's needs. Decision making should use data collected from a variety of stakeholders in addition to direct observation of the child with attention paid to the feasibility of implementing the intervention as well as its effects on the child. Finally, it is important to measure intervention *fidelity*, that is, the extent to which the intervention was implemented as planned (see Chap. 8). This is usually done by observing the intervention in progress by someone other than the interventionist. If the intervention did not follow prespecified procedures or was not administered in the correct "dosage" or level of intensity, this should be addressed before a determination is made about the adequacy of the planned intervention.

Providing Meaningful, Natural Reinforcement

A critical component of behavioral interventions is the provision of reinforcement. As described in Chap. 5, reinforcement is any stimulus following a child behavior that increases the probability that the child will produce the behavior again in the future (Skinner, 1963). Originally, extrinsic reinforcers that were unrelated to the behavior the child produced, such as treats or stickers, were the primary means of reinforcement (Lovaas, 1987). However, interrupting social routines by providing external rewards unrelated to the activity may result in overdependence on the reinforcement, disruption of the activity flow, and an inability to generalize newly learned skills to contexts that do not involve reinforcement.

Instead, caregivers or interventionists should aim to naturalistically embed reinforcement that the child perceives as internally motivating into social activities (Schreibman et al., 2015). For example, if a caregiver and child are engaged in a play routine and the child spontaneously requests a doll, the adult should help the child retrieve the doll as a means to reinforce the child's request for help. In addition to responding to the child's request, the caregiver should be socially attentive to the child, which will reinforce joint engagement more generally (Rogers, 2013). In contrast to external reinforcement, naturally embedded reinforcement is contextually meaningful. When activities provide opportunities to engage in interactions that are inherently reinforcing, this provides a context for the child to understand the social-interactive functions of their behavior and develop agency in shaping joint engagement routines. However, external reinforcement should be considered when children show limited learning in response to intrinsic reinforcement, and failure to learn a new behavior/refrain from a current behavior pose an immediate danger to the child (e.g., if a child is being encouraged to wear protective clothing or sunscreen during outdoor time on a sunny day). Some interventions (e.g., Rogers & Dawson, 2010) include a decision tree to guide selection of reinforcers based on intervention progress, following a hierarchy from more intrinsic to more external reinforcers.

Task Analysis to Teach Functional Skills

Many EIBI strategies for young children with ASD involve the adult explicitly providing the child with instructions on how to accurately produce a new behavior. To teach more complex skills, it may be necessary to use task analysis, a procedure in which skills are broken down into simpler components or steps. Learning complex skills in smaller components that systematically build on one another, as opposed to learning skills in a single step, can be less overwhelming for the child and can ultimately improve skills acquisition.

When task analysis procedures are developed, a few key ideas should be kept in mind. First, steps can be represented using photographs or other pictorial systems for children who are not yet reading text or able to identify sight words (see Chap. 7). This will provide the child with visual reminders of how to complete each step (Eldevik, Hastings, Jahr, & Hughes, 2012). Second, task analyses are often paired with prompt hierarchies to cue the child to complete each step and reinforcement systems to shape the child's correct execution of task components. Prompt hierarchies often proceed with a "least to most" progression, beginning with gestures (e.g., pointing at the tooth brush holder to remind the child to retrieve the tooth brush) and ending with hand-over-hand assistance (e.g., guiding the child's hand to grasp the tooth brush). This ensures that the child receives just enough but not too much support in completing the task (Gulsrud et al., 2016). Finally, task analyses are most effective for teaching functional skills that can be sensibly broken down into discrete steps, such as bathing, dressing, brushing teeth. For some domains, particularly those involving social engagement, breaking processes down into discrete components changes the meaning of the social experience. For example, teaching the child to rotely memorize a social script can result in interactions that appear ritualized and stilted and bear little resemblance to naturally occurring interactions that are dynamic and fluid (Bottema-Beutel, Park, & Kim, 2018).

Fading Intervention Supports Over Time

Prior to the implementation of an intervention, plans should be made to systematically fade interventionist or caregiver provision of supports where possible. This can include decreasing the amount, intensity, or adult control over several different types of supports, including environmental supports (e.g., allowing the child to organize and initiate the use of visual schedules and sensory accommodations), reinforcement (providing longer intervals between reinforcements, especially extrinsic reinforcement not related to a given activity), and scaffolding provided by caregivers during engagement routines (e.g., allowing the child to retrieve and arrange activity materials, waiting for the child to initiate turn-taking routines).

Gradually fading supports over the course of early intervention is important for several reasons. First, failure to do so can result in overreliance on adult-provided support, which can unnecessarily limit children's independence (Hume, Loftin, & Lantz, 2009). This also means that children may have difficulty transitioning between early intervention and K–12 education, a context where children are expected to be more independent. Finally, fading caregiver scaffolding during joint engagement routines can allow the child greater agency and control of the interaction with less reliance on the caregiver to initiate and maintain interactions. This will prepare the child for eventually engaging with same-age peers, who may be less apt to provide scaffolding during joint engagement.

Conclusion

To date, there are a variety of early intervention strategies that appear to be associated with positive adaptive and/or developmental outcomes for children with ASD. High-quality interventions may use some or all of the strategies described in this chapter, which are then individualized to meet the unique needs of children and families. Intervention strategies should also be selected and adapted according to the social and cultural context as well as the specific environment in which the intervention is to be implemented.

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Chapter 10
Understanding Legislation, Health Insurance, and Disparities in Service Provision in Autism Early Intervention

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Individuals with Disabilities Education Act

In the United States, the provision of educational services to children with disabilities from birth to 21 years of age is mandated by the Individuals with Disabilities Education Act (IDEA, 2004). Under this law, children with disabilities are eligible to receive a free (i.e., publicly funded) and appropriate public education (FAPE), which would result in meaningful benefit to the child. IDEA also specifies a preference that children receive these services in a least restrictive environment (LRE), which for school age children means placement in classrooms alongside their typically developing peers as opposed to segregated settings. Finally, IDEA provides procedural safeguards that outline referral, assessment, education planning, service provision, and progress monitoring processes. Below, we provide an overview of this federal law in relation to both early intervention services prior to school entry (Part C and Extended Part C), and school-based services (Part B).

Early Intervention Services Under IDEA Part C

Under Part C of IDEA, eligible children under the age of 3 may receive early intervention services, which are preferentially delivered in the home setting with the participation of caregivers. The services provided vary by state, and may include combinations of parent- and practitioner-provided interventions, with different states favoring different modes of delivery and types of services (Stahmer &

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Mandell, 2007). There are two categories of eligibility under which children may qualify for early intervention services. The first category applied to children who exhibit developmental delays, and the second applied to children with established conditions putting them at substantial risk of developmental delay. Given that a reliable ASD diagnosis is not usually made until after age 2, many children with ASD become eligible under the developmental delay category prior to an ASD diagnosis. Eligibility under this category involves a determination as to whether or not the child is experiencing delays (with thresholds set by individual states) in at least one of five categories: cognitive, social–emotional, speech and language, adaptive, and physical development (Early Childhood Technical Assistance Center, n.d.). Although most states use federal guidelines at least in part to establish eligibility criteria, there is some variation from state to state that seems to translate to variation in the proportion of young children with ASD who receive early intervention (Barton et al., 2016).

Once children are found eligible for early intervention services, service providers work with families to develop an individualized family service plan (IFSP) that can include services provided to both the child and the caregivers. These often include, but are not limited to, applied behavior analysis, speech therapy, occupational therapy, or other psychosocial treatments. IDEA Part C stipulates that these plans should be tailored to meet the needs of individual children, and should consider parents' input in regards to service selection. However, early intervention providers are not required to implement services desired by the family if they are able to provide other services that would convey the same benefit. There is also a lack of clarity in federal law regarding service intensity (i.e., the number of treatment hours) that must be provided through early intervention, which reflects a lack of research evidence in this regard (Dicker, 2013). The American Academy of Pediatrics recommends at least 25 h/week of intervention services with low child to teacher ratios, which should be delivered year round (Myers & Johnson, 2007). Even given these recommendations, there is no explicit provision that IFSPs must provide this level of intensity for every child.

Transition to School Under IDEA Part B

Some states offer transitional services from age 3 to kindergarten enrollment, known as "Extended Part C." These services are meant to support the transition between early intervention services and entry into the school system. If children are not receiving Extended Part C services or have aged out of these services, they then transition to IDEA Part B services. IDEA Part B is the section of federal law that mandates special education services for children and youth ages 3–21. This law lists 13 specific disability categories under which children may be eligible to receive educational interventions, one of which is autism. Children either transition from an IFSP into an individualized education program (IEP) developed by a team of school professionals, administrators, and the child's caregivers, or are referred for an evaluation once they reach school age to determine eligibility. Because services are generally more comprehensive and family centered under Part C as compared to Part B, there is sometimes conflict during the transition periods as families work with schools to determine which services will continue through the child's school-based program, and which will be revised or discontinued (Dicker, 2013). Similar to Part C services, school-based services can include various types of programming, which can be delivered by classroom teachers or other licensed (and in some cases unlicensed) professionals. Because of the LRE provision of IDEA, many more children with ASD are educated alongside their typically developing peers than have been in the past (Morningstar, Kurth, & Johnson, 2017).

Just as is the case with IDEA Part C services, court cases have determined that Part B educational services need only provide meaningful benefit and are not required to be the best services possible (Dicker, 2013). Because federal dollars only account for a small portion of special education funding and the remaining costs are left to states, there is wide state-by-state variation in educational supports provided to children and youth with ASD. We discuss this issue in more detail in the final sections of this chapter.

Insurance Coverage for Diagnostic and Early Intervention Services

Given the support needs of children with ASD, which can include services directly related to the diagnosis as well as any and accompanying health conditions, healthcare costs are substantially higher for these children as compared to children who are typically developing (Buescher, Cidav, Knapp, & Mandell, 2014). Services provided to children with ASD in the United States can be covered by a combination of school agencies, insurance providers, and Medicaid, a federal and state program that helps with medical costs for some people with limited income and resources (Dicker, 2013). As of 2017, 46 U.S. states and the District of Columbia have passed legislation mandating insurance funding for ASD diagnostic services and interventions (National Conference of State Legislatures, 2018). Prior to these mandates, insurers often denied coverage for ASD-related services, citing a lack of clear evidence of effectiveness for most interventions (Mandell et al., 2016). These new mandates appear to have increased service utilization and the proportion of spending by insurers, and this is especially true for families who spend more on services (Candon et al., 2019).

However, even given that legislative mandates are widespread across states, there still remains ample variability in the nature of services covered, and the extent to which services are covered by private insurers. Due to federal restrictions, insurance coverage is limited to families with fully insured plans, which means those who are self-insured may not be covered (Candon et al., 2019). There is also variability across states in expenditure caps, which can range as low as $12,000 and as high as

$50,000 (Mandell et al., 2016). Because of limitations in study designs, it is not clear if insurance mandates have improved service access across all SES strata, but this might not the case given that low SES families are least likely to be insured. Due to a variety of factors, including barriers posed by insurers, the number of children with ASD who receive insurer-covered services is well below what would be expected given the prevalence of ASD (Mandell et al., 2016). Still, improvements in access to care under state insurance mandates are expected to continue into the future (Mandell et al., 2016).

At present, there is a lack of clarity and continued debate in regards to whether specific services should be covered by insurance providers, by local school systems, or be paid out of pocket by families (Bilaver, Cushing, & Cutler, 2016; Holland, 2010). Many states explicitly specify insurance coverage of applied behavioral analysis but leave requirements for other intervention and service types more vague (NCSL, 2018). This can lead families toward services that are more likely to be covered, regardless of their appropriateness or effectiveness.

Regional Variation in Service Access and Utilization

Another factor contributing to variability in service provision for children with ASD in the United States is geographic location. Programming enacted through Part C of IDEA is supported by way of federal formula grants, which are proportionally determined based upon the number of children under 3 years of age reported to reside in a given state (Noyes-Grosser et al., 2018). Federal funding contingent on population data is one reason for geographic differences in access to services, which is often stratified on rural and urban/suburban lines. For example, attaining an early diagnosis is often more difficult in rural as compared to urban or suburban areas (Antezana, Scarpa, Valdespino, Albright, & Richey, 2017; Kalkbrenner, Daniels, Emch, Morrissey, Poole, & Chen, 2011; Singh, Moody, Rigles, & Smith, 2018). Additionally, parents living in rural communities report reduced service availability than did those residing in urban environments (Centers for Disease Control, 2011). Delays in receiving diagnoses and support services often occur in rural areas due to limited overall awareness, inadequate screening procedures, and increased demands on families to travel greater distances to locations more equipped with available supports (Antezana et al., 2017).

Due to limitations in the health care systems within rural communities, families often rely more heavily on other sources, like the school community, for service support. One corollary of this is that, according to the SPSD, rural parents demonstrate lower rates of communicating concerns with healthcare providers as compared to nonrural parents. Within rural communities, healthcare providers are also more likely to encourage parents to consult school personnel than do healthcare providers within urban communities (Antezana et al., 2017; Centers for Disease Control, 2011).

There may also be differences between rural and urban/suburban communities in terms of the supports they most value. For example, within more metropolitan regions, behavior supports are held in higher regard than in rural communities while rural communities place a higher value on speech and language therapies than do families in nonrural areas (Murphy & Ruble, 2012). This difference can be explained by how readily available families perceive such services within their communities. Speech and language therapies are available on-site in most schools while behavior support services are generally provided in off-site clinics or through privately contracted professionals in the home. As noted previously, it is generally preferable for children to receive early intervention services in the home; however, within rural communities this can be particularly challenging. Qualified professionals often reside considerable distances from rural families, requiring significant travel time for service provision (Meadan, Meyer, Snodgrass, & Halle, 2013; Mello et al., 2016). There is also variability in the types of service providers more easily accessible within communities. Speech language pathologists (SLPs) are more prevalent across both rural and metropolitan regions while board-certified behavior analysts (BCBAs) are more representative in nonrural areas (Mello et al., 2016). It is possible that this discrepancy is explained by BCBA being a relatively new profession in comparison to SLP, and thereby BCBAs have a less widespread presence than SLPs (Mello et al., 2016).

To counter these challenges, video-, teleconferencing, and other internet-based technologies are increasingly used to train educators and caretakers within rural communities on how to implement best practices at home and in the classroom (Boisvert, Lang, & Andrianopoulos, 2010; Gibson, Pennington, Stenhoff, & Hopper, 2010; Meadan, Meyer, Snodgrass, & Halle, 2013). Such "telehealth" methods are also useful for service providers to observe, assess, or screen a child remotely, and develop plans and interventions regarding his or her behavior, communication, and/or academic success (Gibson et al., 2010). While these pathways to service and consultation certainly have limitations, they offer the potential for meaningful access to rural communities that otherwise might have very little.

Ethnic and Racial Disparities in Access to Diagnosis and Support Services

Although there is no evidence that suggests racial or ethnic differences in either incidence or prevalence of ASD either in the United States or globally (Bertrand et al., 2001; Mandell, Listerud, Levy, Pinto-Martin, 2002), researchers have consistently found racial and ethnic variation in the rates of ASD diagnosis and documentation of ASD (Liptak et al., 2008; Magaña, Lopez, Aguinaga & Morton, 2013; Mandell et al., 2009; Zuckerman et al., 2014). For instance, Mandell et al. (2009) reported that non-White children (i.e., African American, Hispanic, Asian and other ethnicities) were less likely than White children to have documentation of an ASD diagnosis.

Furthermore, while the prevalence of having documentation of an ASD diagnosis was consistently lower for African American children than for White children across children of all IQ levels, in Hispanic and Asian populations, the disparity in documentation was even greater among children with IQs lower than 70 (Mandell et al., 2009).

Mandell et al. (2002) discussed the reasons why early diagnosis and having accurate documentation of ASD are essential. First, early interventions in response to timely diagnosis have demonstrated positive changes in children's development outcomes as many interventions are considered more effective with younger children (Vivanti et al., 2016). Second, due to the heightened risk of having a subsequent child with ASD, parents stand to derive substantial benefit from early diagnosis of their first child. Third, the Individuals with Disabilities Act (PL 94–142) mandates the public education system to provide children with special education and related services. Early identification is important to give time for schools to properly plan to provide FAPE to eligible students.

Early diagnosis is also important because the current healthcare system requires documentation of diagnosis in order to access mental health–related and psychiatric services. For example, children with ASD who lived in regions with low percentages of White residents were less likely to use psychotropic medications than children with ASD who lived in regions with high percentages of White residents (Mandell et al., 2009). Magaña et al. (2013) reported that Latino families received significantly fewer special services such as children's recreational programs, psychological services, family support services (respite), or intensive autism therapy than White families and voiced the need for improvements in such unmet services. Furthermore, Latino families with limited English proficiency more frequently reported experiencing barriers related to ASD knowledge, lower trust in service providers, and fewer therapy hours than non-Latino White families (Zuckerman et al., 2017).

Latino children with ASD are diagnosed later (2.5 years later) and less frequently than non-Latino White children with similar clinical autistic symptoms (Mandell et al., 2002; Zuckerman et al., 2014). However, when diagnosed, Latino children with ASD have been shown to have more severe autistic symptoms than non-Latino White children (Mandell et al., 2002). Relatedly, Mandell et al. (2002) also reported that African American children with ASD receive a diagnosis at older ages and are more likely to be misdiagnosed as having a conduct disorder or adjustment disorder than White children, while Latino children are more likely to be misdiagnosed as having specific language impairment.

Taken together, these reports indicate that lower rates of ASD diagnosis and delayed diagnosis among ethnic and racial minorities can be explained by contextual or environmental factors rather than clinical presentation. Differences in access to support or advocacy systems, cultural differences such as conceptualization of ASD among non-White parents (Zuckerman et al., 2014), language barriers, families' and school authorities' interpretations of symptoms, lack of awareness of available services, and absence of services or institutions that provide culturally sensitive support (Alegría et al., 2007) have all been cited as limitations in providing proper diagnostic services to ethnic and racial minorities.

Meanwhile, Smedley et al. (2003) attribute ethnic and racial disparities to federal laws and policies controlling healthcare provision. For instance, immigration status has been highlighted as a potential factor in the racial and ethnic disparities in diagnosis and service provision. Latino families with children with ASD voiced that they were unwilling to visit healthcare facilities due to fear of exposing their immigration status (Alegría et al., 2007). Furthermore, Fountain and Bearman (2011) reported that when policies protecting client privacy in regards to immigration status were in place in California, the rates of ASD diagnosis of Latino children and White children were similar, but when they were not in place, the rates of ASD diagnosis of Latino children were significantly lower than those of White children. Therefore, the underrepresentation of ASD among minority populations is also susceptible to the effects of state and federal immigrant policies (Fountain and Bearman 2011; Mandell et al., 2002).

Implications

In the Standards for Culturally and Linguistically Appropriate Services, the U.S. Department of Health and Human Services (DHHS) Office of Minority Health (OMH) instructed healthcare institutions to consider healthcare as "a cultural construct, arising from beliefs about the nature of disease and the human body" and cultural issues as "central in the delivery of health services treatment and preventive interventions" (U.S. DHHS, 2010, p. 80863 as cited in Smedley et al., 2003). Therefore, because culture and language influence how health is conceptualized, and how healthcare supports are provided and received, Smedley et al. (2003) have argued that increased responsiveness to culture and language will improve the quality of care not only for minority patients but all patients.

While more state and federal guidelines are requiring healthcare systems to be sensitive to the growing diversity of U.S. healthcare consumers, Smedley et al. (2003) offer additional recommendations for alleviating ethnic and racial disparities. For instance, they urge healthcare institutions, legislators, and regulators to develop policies that (a) bolster stable healthcare provider-patient relationships (e.g., accessibility of primary care providers, reasonable patient loads for primary physicians), (b) increase the proportion of healthcare professionals who are ethnic and racial minorities, (c) provide more funding and resources to the U.S. DHHS Office of Civil Rights to address and enforce civil rights laws, and (d) equalize access to insurance plans by encouraging public healthcare insurance programs like Medicare to provide higher quality plans to ethnic and racial minorities.

Conclusion

In the United States, federal law provides for diagnostic and support services for eligible children with ASD and their families. However, these services are not distributed equally across a variety of demographic variables including race, ethnicity, immigration status, and geographic location. Health insurance and educational systems should cover the costs of services deemed necessary, but there are wide variations by state. Healthcare workers and other support providers should be aware these disparities and develop and implement policies that will mitigate these effects.

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Correction to: Clinical Guide to Early Interventions for Children with Autism

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Mary Kate Frisch provided her valuable contribution to chapter 4 "Understanding and Addressing Restricted and Repetitive Behaviors in Children with Autism" of this book. However, the author's name was inadvertently added to chapter 3 instead of chapter 4. This error has been corrected in this version of the book.

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