

How Reversible is Social Dysfunction in Autistic Spectrum Disorders?

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Deficits in social function are among the core features of autism and other neurodevelopmental disorders. Recent conceptualizations of social cognition include multiple dimensions, including theory of mind, social perception, social knowledge, social attribution, and emotional perception and expression. Recent studies show that social cognition, like ‘standard’ cognition, is related to functional outcomes in neurodevelopmental disorders such as schizophrenia and autism, by mediating effects of other variables (e.g. standard cognition), or by acting independently. This representative discussion reviews social cognition and focuses on its relationships with autistic spectrum disorders (ASD), and with more standard measures of cognition. It then reviews attempts to improve outcomes in autism over the last 25 years. Useful treatments for ASDs focus are initiated early, have multiple treatment targets, and are comprehensive as possible. In this framework, social cognition offers a set of interrelated treatment targets that are important because they affect outcome, and are promising because they are at least partially distinct from more standard measures of cognition in their effects on outcome.

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INTRODUCTION

Neurodevelopmental disorders often involve multidimensional vulnerabilities that impede interpersonal, educational, occupational and other adaptive functioning. These vulnerabilities include cognitive dysfunctions, which are core features of many neurodevelopmental conditions and which often exert significant influence on outcomes in DSM-IV attention deficit/hyperactivity disorder (ADHD), bipolar disorder, schizophrenia and autism, among others. Until recently, attempts to improve cognition have had mixed results, depending on the disorder (e.g. more success in ADHD, less success in schizophrenia), the levels and types of cognitive functions involved (e.g. aspects of attention are generally more amenable to remediation than aspects of executive function) and the presence or absence of related problems (e.g. negative symptoms, psychosis and overall cognitive abilities).

Social cognition is another dimension of cognitive function that is related to functional outcomes that has been receiving increased attention.^{1,2} The growing recognition of its importance in neurodevelopmental disorders and in attempts to remediate functional deficits is reflected by the inclusion of social cognition in the NIMH-sponsored Measurement and Treatment Research to Improve Cognition in Schizophrenia

(MATRICS) Initiative, which was developed to assess standard battery.³ The development of social cognition, including an understanding of the ways in which it overlaps attempts to improve cognition in clinical trials with a Received and differs from other forms of cognition, and of ways to assess it effectively, offers potentially new approaches to intervention and treatment of social dysfunction in neurodevelopmental disorders. This review considers representative clinical aspects of social cognition, with an emphasis on autism, to assess its potential utility to identify useful treatment targets for efforts aimed at improving functional outcomes in neurodevelopmental disorders. We will first consider the nature of social cognition, followed by its relationships to autism and to other aspects of cognition, followed by a review of attempts to improve outcomes in autistic spectrum disorders (ASD), and then by a focus on prospects for the near future.

SOCIAL COGNITION

Deficits in social function are among the defining features of autism,^{4,5} and are among the core features of other neurodevelopmental disorders such as schizophrenia,^{6,7} and probably ADHD.⁸ At least one recent study that compared subjects with high functioning ASD with subjects with schizophrenia on a range of social cognition measures showed that they performed similar to each other, but worse than controls on most measures.⁹ Although the term ‘social cognition’ has come into widespread usage, it does not have a

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single definition, though it is often used to refer to a set of interrelated functions. One of these involves 'Theory of Mind', which refers to the capacities to understand or infer the thoughts or feelings of others.¹⁰⁻¹² It is intended to help explain how other people can have beliefs, wants, plans, or intentions that are distinct from ours. It also encompasses the use of irony, metaphors, sarcasm and *faux pas* as examples of ways of understanding the meaning or intent of others' statements beyond the literal, concrete meaning of the words. Moreover, the construct of 'Other's mental states and dispositions presumes first a concept of 'Self' and of understanding one's own mental states and dispositions. This conception of Theory of Mind, sometimes in combination with the ability to respond appropriately to other's inferred mental states, is subsumed or otherwise related to some conceptualizations of empathy and of empathizing.^{12,13}

Social perception or social sensitivity is a second, related area of social perception that focuses on the ability or abilities to understand or 'read' social cues. This includes the ability to 'read' or otherwise understand social cues that may be expressed through one's tone of voice, physical gestures, body posture or movements, facial expressions, contexts in which words are spoken, and perception of the nature of relationships.^{2,14} Social perception is positively related to community functioning in schizophrenia.¹⁵ Social knowledge is a third area that is particularly related to social perception, but that emphasizes knowledge of how to respond in particular social situations, such as how to order food in a restaurant.

Attribution of causality is a fourth area related to social cognition that has particular relevance to social function.² Individuals with schizophrenia and with autism both show attribution biases,^{16,17} though they may differ from each in form or expression. Individuals with schizophrenia, for example, are more vulnerable to perceive hostility or to blame others, for example, in periods that are marked by high levels of paranoid symptoms. Similarly, individuals with ASD show deficits in the perception and expression of emotions¹² that often differ in expression from those demonstrated by individuals with schizophrenia or other neurodevelopmental disorders, such as ADHD.⁸ In addition to these five areas that are frequently related to social cognition, other areas are related to social cognition and are also often impaired or abnormal in autism and other neurodevelopmental conditions, such as the development of joint attention, orienting, visual processing style and eye contact.¹⁸ As noted above, each of these dimensions of social function are related to others, and their division into separate dimensions is partly heuristic. Nevertheless, the utilization of relatively discrete descriptions and definitions facilitates their utility as potential treatment targets for intervention strategies.

SOCIAL COGNITION AND AUTISM

The importance of developing intervention strategies for social cognitive deficits in ASD is emphasized by the importance of the roles ascribed to it in conceptualizations of autism. Diagnostic criteria for DSM-IV autistic disorder, for

example, include impaired social interaction, together with communication deficits and repetitive, restricted and stereotyped patterns of behavior, as the essential clinical criteria required for the diagnosis.¹⁹ Although forthcoming changes in DSM-5 will likely combine communication deficits with deficits in social function to produce a social communication / social interaction criterion,²⁰ deficits in social function will remain a core concept in ASD. Moreover, impaired social function also plays central roles in theories about the nature of autism. Barron-Cohen's theory of empathizing – systemizing, for example,^{12,21} postulates that deficits in empathizing represent an overarching central deficit that includes a range of weaknesses in social functioning and social communication. In contrast, the systemizing side of this dichotomous conceptualization is intended to account for cognitive strengths in understanding the structure and future behavior of repetitive, regular systems. This view is consistent in many ways with one proposed by Happé,^{22,23} which emphasizes weak 'central coherence'. This view attempts to account for difficulties in synthesizing local information (i.e. details) into global perspectives. Accordingly, people with ASD would perform better at tasks that require analysis of rule-based details (a bottom-up approach), than they would at tasks that require synthetic (top-down) approaches. The empathizing - systemizing and weak central coherence approaches may work in complementary or sequential manners.

SOCIAL COGNITION AND STANDARD COGNITION

Social cognition relies on and overlaps with 'standard' cognition. The latter includes multiple domains such as overall cognitive abilities, attention, declarative memory, and measures of executive function, such as learning, processing speed and conceptualization, among others. Research underlying the development of the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) battery, which is a reliable, valid cognitive consensus battery designed for use in clinical trials,³ showed the presence of separable, identifiable cognitive functions that might serve as useful treatment targets for cognitive enhancement strategies.²⁴ Other studies have also shown the presence of both separable and general cognitive factors in neurodevelopmental disorders, such as schizophrenia.²⁵⁻²⁷

As noted, cognitive deficits are often core features of neurodevelopmental disorders, including ASD, and are particularly important because they are related to functional outcomes.^{28,29} The extent to which they account for variance in outcome, however, varies depending on the measures used, sample characteristics and functional outcomes assessed, but their effects are often in the small to medium range.³⁰ Measures of social cognition are promising treatment targets because they reflect separable, distinct domains from standard cognitive domains^{31,32} and are also related to functional outcome.^{1,7,33,34} The nature of their relationships to standard cognition varies; they may serve to mediate effects of standard cognition on outcome,³⁴ and they may also produce effects on outcome independently.¹ Notably, some effects of social cognition on functional outcome exceed those of standard cognitive measures.^{1,33}

INTERVENTIONS: WHERE ARE WE GOING?

The foregoing discussion emphasizes two points. First, ASDs and other neurodevelopmental disorders such as schizophrenia are characterized by impairments in social cognition, and second, these impairments are related to functional outcomes that are at least partially distinct from those predicted by standard cognitive measures. This makes them important potential treatment targets, and raises the issue of whether they are actually treatable.

For a long time ASDs were considered untreatable. In 1987, however, Lovaas and colleagues³⁵ suggested that with intensive intervention using applied behavioral analysis, improvement in some children was possible to some degree. This report gave rise to a growing body of research. Individual studies suggested that some children who received early intervention showed larger gains in terms of cognitive and adaptive functioning and early educational attainment than children without such intervention.³⁶⁻⁴⁰ Largely in response to these studies, ASD was conceptualized into a group of disorders marked by plasticity and heterogeneity. Subsequently, research focused on social cognition, social communication and behavioral impairments using highly structured approaches, developmental approaches, and integrative approaches. Over the last 10 years, there has been an evolution of possible intervention methods for children with ASD resulting in promising suggestions for quality, quantity, type and onset of treatment.

In 2002, the National Research Council (NRC) launched and documented research on treatment effectiveness in early childhood.⁴¹ Shortly after the publication of the NRC document,⁴² identified 6 core components for effective educational practice among school-age children: 1) Individualized supports and services that are matched to the profile of the children through an individualized education program success, 2) Systematic instruction in the educational process, 3) Structured learning environment requiring a curriculum that is clear to students and staff, 4) Specialized curriculum content in areas such as social engagement, initiation and responding to social bids, as well as recreational and leisure skills, 5) Using a functional approach to replace difficult behavior with appropriate behavior, and 6) Family involvement. Subsequently research on both the onset of intervention, and type of intervention gave hope for further possibilities. We next review several critical features of intervention efforts, starting with the onset of intervention

ONSET OF INTERVENTION

Intensive, specialized and early intervention in toddlers who are suspected of having ASD is a significant factor in long-term prognosis.⁴³⁻⁴⁵ Children who receive early interventions (before the age of 5) are more likely to develop fewer out of control behaviors, better communication skills,⁴⁶ better language development, better symbolic play and better outcomes for educational placement and communication. In addition, early intervention attenuates the severity of deficits that interfere with subsequent development.⁴⁷

EARLY IDENTIFICATION

To be able to provide early care, early identification is crucial. Thus, pediatricians play a critical role in the early detection of children at risk for ASD. In recent years, early markers have been identified with techniques such as retrospective video analysis (social, communication, and play behaviors before the age of 2;⁴⁸), and prospective longitudinal cohort studies following children below the 2 age of two previously hypothesized to be at risk.⁴⁹ It is suggested that pediatricians 1) follow the early screening guidelines of the American Academy of Pediatrics, and 2) collaborate with the children's families and important providers to identify the behaviors that place a child at risk for ASD. The markers identified to be crucial are (for an overview see Prelock, & Nelson,⁵⁰): 1) Mutual gaze (problems establishing intersubjective social contact), 2) shared gaze (establish joint attention to another subject or object), 3) pointing or showing (express interest in objects), 4) vocalizing (gain attention), responding to name, attending to caregiver's voices (recognition of familiar voices), 5) showing interest in other children or people (establish early social interactions), and 6) pretending in play (symbol use, representations of objects).

EARLY INTENSIVE BEHAVIORAL INTERVENTION

Around the same time as Iovannone et al⁴² identified the core components for effective educational practice, Green et al⁵¹ – based on Lovaas' original suggestions and later empirical investigations – described the Early Intensive Behavioral Intervention (EIBI) programs (including the Lovaas treatment approach). They proposed the following common elements:

- Individualized and comprehensive intervention, addressing all skill domains (ie., social cognition, interaction, behavior, and communication)
- Behavior analytic procedures to build new repertoires and reduce interfering behavior (e.g., prompting, differential reinforcement, incidental teaching, task analysis)
- Intervention directed by one or more individuals with advanced training in applied behavior analysis and experience with young children with autism
- The selection of intervention goals and short-term objectives that are guided by normal developmental sequences
- Parental involvement as active co-therapists
- Intervention initially delivered one-to-one, with gradual transitioning to small-group and large-group formats
- Beginning interventions in the home, which are then carried over into other environments (e.g., community settings), with gradual, systematic transitions to preschool, kindergarten, and elementary school classrooms, as children develop skills required for the mastery of those settings
- Intensive, year round programming, with 20-30 hours of structured sessions per week plus informal instruction and practice throughout most waking hours
- Program duration of two or more years
- Starting interventions in preschool year (3-4 years of age)

The first empirical results on the treatment effectiveness of EIBI, published by Lovaas et al in 1987,³⁵ were promising: 47% of the children in the treatment group achieved an IQ score greater than 85 and could be placed in a general education classroom or could successfully complete the first grade. They⁵² followed-up with a report that suggested that much of the gains of these children with best outcomes were maintained for 6 years. Children who received greater than 7 years of EIBI, however, did not show good progress. Subsequent follow-up reports showed mixed results, and stirred a debate and many replications.^{36,53,54} Birnbauer and Leach^{40,55} for example, randomly assigned 28 children with a mean IQ of 51 to either an intensive treatment group (the UCLA / Lovaas model with an average of 25 hours/week of individual treatment per year with reduced intervention over the next 1-2 years) or a control group. Gains in IQ points in the treatment group showed a mean of 15 (although average IQ remained in the impaired range) in comparison to the control group. Most of the children demonstrating large IQ gains, however, were within the subgroup *pervasive development disorder not otherwise specified*, whereas children with classically defined *autistic disorder* showed only modest changes. Thus, even though Lovaas' findings could be replicated, the effect was less dramatic for the children in whom the approach was originally recommended (i.e., classic autistic disorder).

In the last few years, two systematic reviews,⁴⁰ and four out of five meta-analyses,^{54,56} showed EIBI to be the a promising intervention method for children with ASD.⁵⁷⁻⁶⁰ Howlin and Asgharian⁵⁶ included 11 studies (randomized control trial, participants younger than 6 years of age, at least 12 hours intervention per week for at least 1 year), and showed that the amount of treatment hours among the EIBI groups was significantly greater. However, the variety of treatment approaches (especially among treatment resistant individuals), the variety of measurement approaches, and a lack of transparency in both quality and quantity of pre- and post-treatment assessment led Howlin and Agharin to conclude that average effects of EIBI were favorable compared to controls, but the identification of reliable predictors of outcome was impossible due to the great variability across children.

Reichow and Wolery⁵⁴ addressed similar questions, and drew similar conclusions. They included 11 studies (N=251, no control group) and reported the Standardized Mean Change effect size (SMC) for IQ to be 0.69 (0.39-1.00) for the 95% Confidence Interval (CI). Although they included a meta-analysis in their systematic review, they did not use standardized mean difference effect sizes (SMD), which are less methodologically rigorous than standardized mean change effect sizes. They also included studies that used Pivotal Response Treatment and Group Intensive Family Training, respectively,⁵⁴ which significantly differs from the EIBI training described in the manual, as did.⁶⁰ These differences in methodology are potentially important confounds for meta-analyses.⁶¹

Eldevik et al.⁵⁷ replicated and extended Reichow and

Wolerys⁵⁴ systematic review with a meta-analysis that 1) employed SMD measures, 2) required more uniformity in outcome measures, 3) added a meta-analysis of changes in adaptive behavior, 4) assessed interrater reliability for the literature research, and 5) analyzed raw data. They found a large effect size for IQ change (SMD = 1.10, range 0.87-1.33 for the 95% CI), and a medium SMD (0.66, range: 0.41-0.90 for the 95% CI) for the Adaptive Behavior Composite (ABC) score. The rigorousness of Eldevik et al.'s meta-analysis (full scale IQ, age, adaptive behavior scores, 2 year intervention required) however, led to a smaller sample (Total number of studies = 9; number of children = 297-153 in EIBI groups, 105 in control groups, and 39 in comparison groups), and the significant differences of EIBI could not be tied exclusively to differences in treatment, but may be influenced by general differences in frequency of supervision and training (greater amount in EIBI groups). Despite the limitations, however, these analyses suggest that EIBI should be the treatment of choice for children with ASD when compared with no intervention or with more eclectic approaches.

Spreckley and Boyd⁵⁹ restricted their inclusion criteria to comparative group research designs, which left them with 4 studies (N=76: Treatment group = 41, Control group = 35). They used the parent-directed EIBI group of the Sallows and Graupner⁶² study as a control and concluded that EIBI was not superior to standard care for both IQ (SMD = 0.38 for the 95% CI) and AB (SMD = 0.30 for the 95% CI). The parent-directed EIBI group, however, received greater than 30 hours of EIBI per week, using the same curriculum as therapists used in the clinic-directed EIBI group (> than 30 hours per week as well). Thus, the parent directed EIBI group was neither equivalent to standard care, nor to a traditional no-treatment control, and leaves questions about its usability as such.⁶³ The smaller effect sizes may be due to the comparison of two similar groups, rather than due to ineffectiveness of the EIBI treatment. Eldevik et al.⁶³ excluded the Sallows and Graupner study for the named reason, and⁵⁷ calculated the SMC, which is calculated with respect to change scores and not post-treatment differences between groups.

Several studies that implemented state-of-the-art meta-analytical methods, however,^{54,58,60} showed that long-term, comprehensive applied behavior analytic (ABA) interventions have large effects on IQ (SMC and SMD = 1.19, range: 0.91-1.47 for the 95% CI), language development, acquisition of daily living skills and social functioning (SMC and SMD for AB = 1.09, range: 0.70-1.47 for the 95% CI). Virue's-Ortega⁶⁰ included a sensitivity analysis (looking at both effect sizes) and suggested that studies with control groups, in comparison to studies without a control group, had a larger weighted mean effect size for IQ but a respective smaller one for AB. SMC could be considered a potential confound due to its inability to take account of maturation effects.⁶⁴ Results of these analyses supported the conclusion that behavioral programs are effective in improving several developmental aspects in children with ASD, even relative to eclectic-control programs. Most prominently, intensity and duration, parental training and the baseline adaptive behavior abilities of the children proved to be significant predictors of

treatment outcome such as IQ (SMC = 0.95; SMD = 0.57 for the 95% CI) and Adaptive Behavior (AB; SMC = 0.42; SMD = 0.97 for the 95% CI).

In conclusion (for an overview see ⁶⁴) EIBI can be a powerful intervention for children with ASD, producing large IQ gains and/or improvements in adaptive behavior. Multiple descriptive reviews support this conclusion,⁶⁵⁻⁶⁷ and support the use of comprehensive treatment models. Despite this positive outcome however, EIBI has not been effective for all the children with ASD. Specific program characteristics vary across and within programs,⁶⁸ what makes it difficult to understand which treatment components show exactly which effects. Most prominently, further investigations are needed to understand the effects of EIBI on social language abilities.⁵⁰

TYPE OF INTERVENTION

More recently, the National Autism Center (NAC; <http://www.nationalautismcenter.org>) published a report in which the current level of evidence for behavioral and educational interventions - on social cognition, interaction, behavior, and communication - used for children and young adults with ASD (younger than 22) were identified based on a review and analysis of 775 peer-reviewed research studies across the last 50 years. Eleven treatments were considered as leading to favorable outcomes for children with ASD (for an overview see Prelock, & Nelson⁵⁰): 1) The antecedent package (e.g., time delay, reinforcement, fading, prompting, cueing): teaching communication, interpersonal skills, play self-regulation, learning readiness, personal responsibility; 2) the behavioral package (e.g., chaining, contingency mapping modeling): teaching academic communication interpersonal learning, play, self; 3) Comprehensive behavioral treatment of young children (e.g., discrete trial, incidental teaching): teaching higher cognitive functions, interpersonal skills, motor skills, play, personal responsibility; 4) Joint attention interventions: teaching communication and interpersonal skills; 5) modeling (e.g., live, self, video modeling): teaching communication, cognition, social, play, personal responsibility; 6) naturalistic teaching strategies (e.g., focused stimulation, milieu teaching): teaching communication, interpersonal skills, learning readiness, play; 7) Peer training package (eg., circle of friends, buddy skills, integrated play groups, peer mediation); 8) pivotal response training: teaching communication, interpersonal skills, play; 9) schedules: teaching self-regulation; 10) self-management: teaching interpersonal skills, and self-regulation, and 11) story-based intervention package (eg., social stories): teaching interpersonal skills, and self-regulation.

These interventions can be divided into three groups of approaches: 1) Traditional behavioral, 2), Social-pragmatic developmental, and 3) Contemporary. Overall, behavioral interventions received the strongest support by the NAC. In the traditional behavioral approach highly prescribed teaching structures to teach one-on one are being used (predetermined correct response). Behavioral interventions use an applied behavioral analysis approach used in classrooms, home-based programs and community based

programs to support communication, social, and adaptive skills in children with ASD. Examples would be changing situational events, to increase liked, and decrease disliked behavior (antecedent package), teach alternatives (behavioral package), using behavior analytical procedures delivered one-to one (comprehensive behavioral treatment of young children, referred to as ABA programs), teaching responding to social bids (joint attention intervention), and behavior modeling. A prominent example for the use of behavioral intervention practices would be one of the core deficits of ASD according to DSM-IV; the stereotypic and repetitive behaviors (SRBs) and stereotyped patterns of behaviors, interests, and activities (including repetitive motor movements, inflexible need for routine, restricted and repetitive interests, or intense, constant interest in particular parts of an object). A recent review by Patterson, Smith, and Jelen⁶⁹ across 10 case studies (N=17; 14 males, 3 females, age 2 years and 11 month to 26 years) reported a decrease in SRBs. The review itself however (limited by effect and size), and a recent review by Leekam, Prior, and Uljarevic⁷⁰ - although acknowledging behavioral intervention as the best so far - suggest a more systematic approach taking a developmental perspective targeting subgroups of SRBs.

A social-pragmatic developmental approach on the other hand, would follow the child's lead, using reinforcement in the natural environment and emphasizing initiation and spontaneity (naturalistic teaching strategies). As an example, caregivers may join a child's play and use playful obstruction to increase the interaction with the interventionist^{71,72} or with their peers (peer training package). Wetherby and Woods,⁷³ for example, investigated a parent implemented individualized curriculum in the natural environment (as a preliminary study for the Early Social Interaction Project) for children younger than 2 years of age. Although the study seems limited by the lack of baseline comparisons and documentations of parental implementation, the results showed both significant within and between group differences in social interaction (greater with intervention).

A more contemporary approach (ie., pivotal response training) combines behavioral techniques and developmental principles in an empirically validated play-based intervention to address the core deficits of autism^{74,75} which seems an especially important treatment subject for children and young adults with Asperger's syndrome. Examples would be teaching key behaviors like motivation (pivotal response training), using visual supports to complete tasks (schedules), teaching children to regulate their own behavior by identifying the behavior, recording it and reinforcing expected behavior (self-management), and describing situations in which expected behaviors are to occur using writing (story-based intervention package). Warren et al.^{45,75,76} for example, evaluated the effectiveness of the Early Start Denver Model (ESDM), in which applied behavior analysis techniques are embedded within a functional developmental framework for children with ASD (mean age: 23 months; intervention at least 2 years). Children with ESDM showed larger gains in both IQ and ABC at follow up. Results suggest, however, that explicit supervision for

parents and the community is required. In addition, the average age enrollment was close to 2 years, thus, questions on the effectiveness of ESDM among toddlers remain unanswered. Another approach that may be promising would be music therapy. A recent review of 20 articles on music intervention in ASD⁷⁷ concluded, however (in line with the NAC report), that although music intervention has been used to facilitate social cognition as well as social, behavioral and communication skills, further research is required to specify the contribution of these interventions to the maintenance and generalization of these skills.

WHO INTERVENES?

Another important factor apart from early intervention and specificity in training by health professionals and teachers (i.e. school systems) is intervention by the caregivers. Parental training consists of home-based, parent-delivered intervention to improve social communication and manage challenging behaviors of children with ASD.⁷⁶ Parents are usually invited to initial workshops, and monthly intervention sessions. Interestingly, in a study by Drew et al.⁴³ parents in the intervention group (N=12) reported greater word use among their children, but the investigators reported a decrease in IQ points among the children in the treatment group whereas the IQ in the control group remained stable (N=12). Although most likely due to a ceiling effect at baseline (children in the treatment group showed higher initial IQs), these results may underline the importance of 1) intense supervision and support of parents with ASD children, and 2) the likelihood of a positive result due to the combined intervention of trained health professionals and supervised parents.

Green et al,⁷⁸ who compared usual interventions to a combination of usual interventions and parent training (N=153 randomly assigned to one of the two groups), similarly suggest that parent training may improve not only parent-child interactions rated by parents, but also by independent assessors. Teachers' ratings of language and communication on the contrary, remained the same pre and post intervention, which may be explained by a rater-bias.⁷⁹ In conclusion, even though parent training seem to be somewhat effective, studies show mixed results,^{75,76} and more likely support parent training in addition to a more systematic and rigorous intervention program by health professionals.

CONCLUSION

Overall, much effort has been made to address deficits in social cognition in ASDs, as part of broader efforts to improve adaptive and intellectual functioning. Important factors underlying successful efforts thus far include 1) early assessment and intervention, 2) addressing all aspects of social cognition, social interaction, behavior and communication, and 3) involving the broadest and most comprehensive approaches available. The increasing emphasis on social cognition, relative to the history of other behavioral intervention efforts in autism over the last 25 years, shows that efforts to remediate social dysfunctions and improve outcomes will be approached most effectively by

embedding them in the most comprehensive programs available to address related clinical problems. This point is also suggested by recent meta-analyses showing that social cognition effects on functional outcomes, while significant, are often modest in magnitude,¹ similar to the situation for standard cognition.³⁰

Nevertheless, the growing recognition of social cognition as a significant contributor to functional outcome, both as a mediator of other effects (e.g. standard cognition) and independently, emphasizes our early stage of intervention efforts and the need to explore additional approaches. Accordingly, we are hopefully on the threshold of an increased effort to utilize a range of recent approaches to target specific aspects of social cognition in ASDs. These include the use of cognitive enhancement therapies, such as computer-assisted, brain-based approaches that have shown positive effects in schizophrenia,⁸⁰⁻⁸² and pharmacological approaches such as the administration of oxytocin,^{83,84} among others. While we do not yet know the extent to which deficits in social cognition are reversible in ASDs, there is thus reason for cautious optimism for the near future.

CONFLICT OF INTEREST

None.

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