

KQ 1. Effects of Behavioral Interventions on Core and Commonly Associated Symptoms in Children With ASD

Studies of Early Intensive Behavioral and Developmental Interventions

We located 37 papers comprising 25 unique studies addressing early intensive behavioral and developmental interventions. The studies included five RCTs of good quality, six of fair quality, and one of poor quality. Individual studies using intensive University of California, Los Angeles (UCLA)/Lovaas-based interventions, the Early Start Denver Model (ESDM), the Learning Experiences and Alternate Program for Preschoolers and their Parents (LEAP) program, and eclectic variants reported improvements in outcomes for young children. Improvements were most often seen in cognitive abilities and language acquisition, with less robust and consistent improvements seen in adaptive skills, core ASD symptom severity, and social functioning.

Young children receiving high-intensity applied behavior analysis (ABA)-based interventions over extended timeframes (i.e., 8 months–2 years) displayed improvement in cognitive functioning and language skills relative to community controls (Table B). However, the magnitude of these effects varied across studies. This variation may reflect subgroups showing differential responses to particular interventions. Intervention response is likely moderated by both treatment and child factors, but exactly how these moderators function is not clear. Despite multiple studies of early intensive treatments, intervention approaches still vary substantially, which makes it difficult to tease apart what these unique treatment and child factors may be. Further, the long-term impact of these early skill improvements is not yet clear, and many studies did not follow children beyond late preschool or early school years.

Studies of high-intensity early intervention services also demonstrated improvements in children's early adaptive behavior skills, but these improvements were more variable than those found for early cognitive and language skills. Treatment effects were not consistently maintained over followup assessments across studies. Many studies measured different adaptive behavior domains (creating within-scale variability), and some evidence suggests that adaptive behavior changes may be contingent on baseline child characteristics, such as cognitive/language skills and ASD severity.

Evidence for the impact of early intensive intervention on core ASD symptoms is limited and mixed. Children's symptom severity often decreased during treatment, but these improvements often did not differ from those of children in control groups. Better quality studies reported positive effects of intervention on symptom severity, but multiple lower quality studies did not.

Since our previous review, there have been substantially more studies of well-controlled low-intensity interventions that provide parent training in bolstering social communication skills. Although parent training programs modified parenting behaviors during interactions, data were more limited about their ability to improve broad developmental skills (such as cognition, adaptive behavior, and ASD symptom severity) beyond language gains for some children. Children receiving low-intensity interventions have not demonstrated the same substantial gains in cognitive skills seen in the early intensive intervention paradigms.

Social Skills Studies

We located 13 studies addressing interventions targeting social skills, including 11 RCTs. The overall quality of studies improved in comparison with the previous review, with 2 good-quality and 10 fair-quality studies. Social skills interventions varied widely in terms of scope and intensity. A few studies replicated interventions using the Skillstreaming model, which uses a published treatment manual (i.e., is manualized) to promote a consistent approach. Other studies incorporated peer-mediated and/or group-based approaches, and still others described interventions that focused on emotion identification and Theory of Mind training. The studies also varied in intensity, with most interventions consisting of 1–2 hour sessions/week lasting approximately 4–5 weeks. However, some of the group-based approaches lasted 15–16 weeks.

Most studies reported short-term gains in either parent-rated social skills or directly tested emotion recognition. However, our confidence (strength of evidence) in that effect is low (Table B). Although we now have higher quality studies of social skills interventions that demonstrate positive effects, our ability to determine effectiveness continues to be limited by the diversity of the intervention protocols and measurement tools (i.e., no consistent outcome measures used across studies). Studies also included only participants considered "high functioning" and/or with IQ test scores >70, thus limiting generalization of results to children with more significant impairments. Maintenance and generalization of these skills beyond the intervention setting are also inconsistent,

with parent and clinician raters noting variability in performance across environments.

Play-/Interaction-Focused Studies

Since our previous review, more studies of well-controlled joint attention interventions across a range of intervention settings (e.g., clinician, parent, teacher delivered) have been published. This growing evidence base includes 11 RCTs of good and fair quality and suggests that joint attention interventions may be associated with positive outcomes for toddler and preschool children with ASD, particularly when targeting joint attention skills themselves as well as related social communication and language skills (Table B). Although joint attention intervention studies demonstrated changes within this theoretically important domain, data are more limited about their ability to improve broad developmental skills (such as cognition, adaptive behavior, and ASD symptom severity) beyond direct measures of joint attention and related communication and language gains over time.

Specific training that used naturalistic approaches to promote imitation (e.g., Reciprocal Imitation Training) was associated with some improvements, not only in imitation skills, but also potentially in other social communication skills (such as joint attention). Additionally, parent training in a variety of play-based interventions was associated with enhanced early social communication skills (e.g., joint attention, engagement, play interactions), play skills, and early language skills.

Studies of Interventions Targeting Conditions Commonly Associated With ASD

Six RCTs (five good and one fair quality) of interventions addressing conditions commonly associated with ASD identified for the current update measured anxiety symptoms as a primary outcome. Five of these studies reported significantly greater improvements in anxiety symptoms in the intervention group compared with controls. Two found positive effects of cognitive behavioral therapy (CBT) on the core ASD symptom of socialization, and one reported improvements in executive function in the treatment group. The one RCT that did not find a significant benefit of CBT compared it with social recreational therapy rather than with treatment as usual or a wait-listed control group.

The studies examining the effects of CBT on anxiety had largely consistent methodologies. Six studies provided followup data reflecting treatment effects that lasted beyond the period of direct intervention. Two common

factors limit the applicability of the results, however. Due to the nature of CBT, which is often language intensive and requires a certain level of reasoning skills to make abstract connections between concepts, most studies included only children with IQs much greater than 70. These studies report positive results regarding the use of CBT to treat anxiety in children with ASD (Table B). They also report some positive results in socialization, executive function, and communication; however, these results were less robust, and it is unclear in some studies if these improvements exceeded improvements related to the impact of ameliorated anxiety itself.

Additional data in the current review relate to parent training to address challenging behavior. Specifically, one fair-quality study combined a parent-training approach with risperidone. This combination significantly reduced irritability, stereotypical behaviors, and hyperactivity, and improved socialization and communication skills. However, these effects were not maintained at 1 year after treatment.

Other Behavioral Studies

Two RCTs (one fair and one poor quality) examined neurofeedback and found some improvements on parent-rated measures of communication and tests of executive function. Three fair-quality RCTs reported on sleep-focused interventions, with little positive effect of a sleep education pamphlet for parents in one, improvements in sleep quality in treatment arms (melatonin alone, melatonin + CBT) in another, and some improvements in time to fall asleep in one short-term RCT of sleep education programs for parents. One poor-quality study of parent education to mitigate feeding problems reported no significant effects.

KQ 2. Modifiers of Treatment Effects

Among the potential modifiers or moderators of early intensive ABA-based interventions, younger age at intake was associated with better outcomes for children in a limited number of studies. Greater baseline cognitive skills and higher adaptive behavior scores were associated with better outcomes across behavioral interventions, but again, these associations were not consistent. In general, children with lower symptom severity or less severe diagnoses improved more than participants with greater impairments. Many studies (e.g., social skills, CBT) restricted the range of participants' impairment at baseline (e.g., recruiting only participants with IQs >70), limiting understanding of intervention impact on broader