

DARS Autism Program Report

Evidence-Based Treatment Approaches for Autism Spectrum Disorders:
A Review of the Literature and Recommendations



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Executive Summary

The Department of Assistive and Rehabilitative Services (DARS) Autism Program has provided Applied Behavior Analysis (ABA) services to children in Texas ages 3-8 with a diagnosis of Autism Spectrum Disorders (ASD) since 2008. The 83rd Texas Legislature directed the development and implementation of a plan for increasing the number of children receiving services through the program. As part of the plan, DARS has contracted with the Department of Special Education at the University of Texas at Austin to complete a synthesis of the literature, summary of evidence-based recommendations, and program evaluations in order to provide the most effective service. This document reports the outcomes in four sections: Evidence-Based Treatment Approaches for Autism Spectrum Disorders: A Review of the Literature; Review of DARS Data; Options for Service Delivery Treatment Models; and Assessments.

Section One: Evidence-Based Treatment Approaches for Autism Spectrum Disorders: A Review of the Literature

For the purpose of identifying the key elements associated with effective ASD treatments and supported by existing empirical studies, we conducted a systematic review of the literature pertaining to ASD. The results drawn from the systematic literature review served as the criteria for assessing the current DARS Autism Program. Extracted information used to answer seven key questions served as the evidence base for recommendations for DARS program revision and future directions. We implemented the literature search and data collection processes through a systematic search protocol and coding system. The articles initially selected through electronic and

manual searches (N=1,198) were screened against the inclusion/exclusion criteria. As a result, a total of 40 studies were selected for inclusion. To identify useful quality criteria related to effective outcome, we employed an analytic hierarchy process for data analysis. We analyzed the treatment programs of the selected studies using three criteria: categorization of treatments (i.e., ABA, Developmental, Hybrid, and Idiosyncratic models), study quality (i.e., good/fair and poor), and effectiveness (i.e., effective, ineffective, inconclusive, and not evaluated).

Findings

KQ 1. How effective are the comprehensive programs?

Of the four theoretical models, the evidence supports the ABA-based model in terms of positive effectiveness across the largest number of developmental domains.

The evidence supports the ABA-based model in terms of positive effectiveness. Therefore, from KQ 2 to KQ 4, we summarized the characteristics related to the ABA model, not other models in this summary. However we have provided the content related to KQ 2, 3, and 4 across all four models (ABA, Developmental, Hybrid, and Idiosyncratic) in section one.

KQ 2. What components of treatment programs are related to effective outcomes?

Intervention Strategies. Effective ABA-based programs utilized strategies that are behavior analytic in nature (e.g., shaping, prompting, prompt fading, discrimination training, task analysis, discrete trial teaching).

Child Development. ABA-based programs reference considering child development through the use of individualized programs based on the child's strengths and weaknesses.

Manuals. ABA-based programs reported use of a manual that prescribed how to implement the treatment protocol.

Parents' Roles/Involvement. ABA-based programs reported parent involvement ranging from attending informational sessions on autism, providing input on goals for goal setting, working alongside the therapists as a type of parent training and/or attending regular progress meetings.

KQ 3. What characteristics of treatment service delivery are related to effective outcomes?

Intensity and Duration of Treatment. Treatment intensity averaged approximately 29 hours (range 14 - 40) per week. Treatment duration averaged approximately 20 months of intervention (range 9 - 48).

Qualifications of Service Providers. Therapists' backgrounds were diverse. Training and supervision were more crucial components than therapists' qualifications. Supervisors should have extensive training and experience in treating children with ASD. For example, supervisors had at least 1500 hours or 2 years of experience and/or earned a Master's degree with competency in development and implementation of treatment programs (e.g., Board Certified Behavior Analysts) or directors of the clinic.

Activities Related to Training Therapists. Activities for training therapists included: use of an apprenticeship format, theoretical workshops, treatment observations, role-play with supervisors, one-to-one training and feedback, etc.

Supervision Activities. Supervision activities involved regular (weekly or biweekly) progress monitoring meetings, which lasted 1 to 2 hours and included the therapists, supervisors, and parents. During these meetings, program data were

reviewed, goals adjusted, mastery criterion set for new skills, and therapists were trained, if needed. Both positive and critical feedback on the therapists' abilities to implement strategies and collect ongoing data were provided.

Inclusion of Multi-disciplinary, Consultative, or Collaborative Approaches.

There was not sufficient evidence to determine differences in effectiveness of utilizing multi-disciplinary, consultative, or collaborative service delivery approaches.

KQ 4. What specific characteristics of children and families are related to effective outcomes?

Family Characteristics. ABA-based studies did not report race/ethnicity or SES. Developmental, hybrid and idiosyncratic-based studies also did not report race/ethnicity or SES.

Child Characteristics. Children have a diagnosis of Autistic disorder or PDD-NOS and no other major medical conditions. Average starting age was 40.1 to 49.1 months (range 22-84). Existing evidence is not sufficient to draw firm conclusions regarding child characteristics that are linked to more effective outcomes.

KQ 5. What are the best practices for inclusion of treatment services in an educational setting?

The number of studies that examined school-based programs in each theoretical model was too small to definitively determine which was more effective for each developmental area. However, there were more studies that produced effective outcomes across developmental areas for ABA school-based programs. Accordingly we summarized the major components related to service delivery and treatment modality of ABA school-

based treatment as the best practice for inclusion of effective treatment services in a school setting at this point in time.

The average of treatment hours was 23 hours (15 to 37 hours) per week. The range of treatment duration was 18 months (12 to 36 months). The average age at the start of the treatment services was 4 years old (3 years 11 months to 7 years 4 months). Treatment providers were trained therapists, teachers, and educational paraprofessionals. Training and supervising therapists were more important than the therapists' background. Supervisors need appropriate qualifications to train the therapists. The recommended qualifications for supervisors were: master's degrees in psychology or special education, becoming BCBA's or highly skilled ABA therapists. Programs should use a treatment protocol or manuals. Consultants or a multidisciplinary service model was recommended for inclusion of treatment services at school. Parents' active involvement was recommended to promote generalization of obtained skills into natural environments.

KQ 6. What are the funding options for treatment services?

Four of 13 studies that reported funding sources were from the U.S. The funding sources reported were public agencies, research grants, and mixture of both a medical assistance program and research grants. According to the studies' reports, none of the programs shared the cost of the treatment services with families.

KQ 7. What evidence supports long-term outcomes that verify positive changes in developmental trajectory?

Positive outcomes produced by early intensive programs were maintained up to 5 or 6 years after the post treatment evaluation. The 5 to 6 year follow-up studies

demonstrated that the control group, who received no program or different programs (e.g., less intensive treatment), showed significantly different outcomes from the treatment group. The results imply that if the participant does not receive the intensive programs at an early age (3-4 years old) they might not make the same level of improvement in their development trajectory after 5 or 6 years. The follow-up results may support that early intensive programs contribute to positive changes in later developmental trajectories. However, it is too soon to conclude that early intensive programs such as ABA-home programs produce positive changes in later developmental trajectories, because the body of evidence is insufficient.

Section Two: Review of DARS Data

The DARS Autism Program services are provided through six grant contractors which are local community agencies and organizations under contract to DARS to provide autism services: Autism Treatment Center (ATC); Center for Autism and Related Disorders (CARD); Child Study Center (CSC); Easter Seals North Texas (ESNTX); Mental Health and Mental Retardation Authority of Harris County (MHMRA); Texana Center (TEXANA). Any Baby Can (ABC) was a provider until August 2011.

Treatment Hours and Duration

The total average of treatment hours/month was 59.9 hours (approximately 15 hours/week) across seven contractors. The average range of treatment hours/month was 42.8 to 109.4 hours. The total average of treatment duration was 15 months. The overall range of treatment duration was from 1 to 27 months. The program allows for 24

months of services, thus this variation of up to 27 months of enrollment is due to months that a child did not receive a service but was enrolled.

Age at Start of Services

Overall, the most common age at start of services was 4 (29.3%), followed by 5 (21.4%) and 3 (19.7%). Starting age varied by contractor.

Outcomes Analysis

The DARS autism program employed a pre- and post-test method to evaluate the effectiveness of the program. Each contractor administered two assessment tools (the Pervasive Development Disorders Behavior Inventory [PDDBI] and the Psychoeducational Profile - third edition [PEP-3]) with each child prior to the initiation of services. They also administered the assessment tools when services were completed for those children who did not drop out of the program. There are significant limitations inherent in those pre- and post-test methodologies that prevent analyses of the data that allow for conclusions to be drawn regarding the effectiveness of the program.

Section Three: Options for Service Delivery Treatment Models

Evidence-based Effective Treatment Modality

Based on the evidence yielded by the review of the literature pertaining to models for comprehensive treatments of children with ASD, we recommend the ABA-based model be the central approach taken by the DARS Autism Program. Although there were some positive outcomes with other theoretical models, the evidence is not sufficient to recommend a change in model from the current DARS autism program.

Treatment Intensity and Duration. We recommend that at least 14 hours of treatment per week be provided. Higher levels of intensity (e.g., 20 – 30 hours/week) need to be implemented when duration of treatment is anticipated to be relatively shorter and/or when an individual's needs are deemed relatively higher. We recommend that the treatment period consist of at least 9 months. Longer durations (e.g., approximately 2 years) need to be applied when intensity of treatment is relatively lower; and based on individual needs as evidenced by progress (or lack thereof) as identified via on-going progress monitoring.

Service Provider Qualifications. The evidence suggested that training and supervision were more crucial components than therapists' qualifications. Therefore, therapist-focused recommendations center on training and supervision. The minimum supervisor qualification should be a BCBA credential with experience working with children with ASD.

Consistent Treatment Implementation. We recommend formalized training (e.g., didactic instruction; readings; in-situ training); regular supervision procedures (i.e., weekly or biweekly; 1-2 hours/week); utilizing a manual or common protocol; and on-going basis fidelity evaluation to maintain consistency of treatment implementation.

Parent Involvement. Parent input should be solicited during the planning stages in order to help individualize the child's treatment program. In order to train or encourage parent involvement, formal workshops that focus on basic behavioral principles, teaching strategies, behavior management strategies, and information pertaining to ASD should be offered.

Service Delivery Approach. We recommend using ongoing feedback and supervision between a trained supervisor and therapist or parent. Additionally we recommend utilizing multi-disciplinary (transdisciplinary) and consultative service delivery approaches in which professionals from different disciplines work together.

Characteristics of Children and Families. Services should begin as early as reasonably possible (e.g., approximately 36 months of age) as dictated by the identification of ASD, and at least by 80 months of age. Existing evidence is not sufficient to identify relations between diagnosis and severity of autism and more effective outcomes. Assessment and treatment practices should be individualized with a focus on those deficits and skills pertaining to the core characteristics of the ASD diagnosis for the purpose of program treatment planning. Existing evidence related to family characteristics is not sufficient to identify the characteristics that are linked to more effective outcomes.

Review of Child's Progress. Decisions about continued services, modification of the services and future plans should be discussed within the context of the child's progress (or lack thereof) as evidenced in the regularly reviewed data.

Significance of Child Development. We recommend utilizing an individualized program based on typical child development sequences.

Benefits and Risks of Implementation. Highly-intensive ABA programs can be effective for children with severe difficulties in intellectual, educational, and adaptive behavioral functioning. There was only one ABA-based longitudinal study that met the requirements for inclusion in the review. The strength of evidence is insufficient to draw

firm conclusions about which early ABA programs produce positive changes in later developmental trajectories. There is no identified evidence suggesting risks from the implementation of ABA-based programs for the children.

Evidence-based Effective Alternative Treatment Modality

ABA-based focused treatments target prioritized, specific behaviors of concern (e.g., problem behavior) and specific skill deficits (e.g., language and communication; self-help; social skills) rather than broad-based functioning across general domains. The treatments are empirically supported techniques and procedures that have been demonstrated to be effective in the decrease of behaviors of concern (e.g., problem behavior); and/or improvement in behavior deficits (e.g., language and communication; self-help skills; social skills). We summarized empirically supported ABA-based focused behavioral techniques and procedures identified by systematic reviews of the behavioral literature conducted pertaining to treatments for one (or more) of the core, or secondary areas of ASD. Through electronic literature searches, the three latest literature review studies in each target area (i.e., language and communication; social skills; challenging behavior; and adaptive behavior) between 2009 and 2014 were selected. These techniques and procedures can be used in a variety of service delivery modalities including consultation following initial assessment and treatment evaluations and relatively short, intense treatment implementation; approaches that emphasize caregiver (e.g., parents, teachers) training and on-going support, teaching, and feedback regarding the implementation of assessment and intervention procedures; and other relatively novel delivery methods such as telehealth and online communication systems (e.g., Skype; FaceTime).

Section Four: Assessments

Various assessment tools that were used in ABA-based comprehensive programs and that may also be used in ABA-based focused treatments were reviewed across core areas of ASD (e.g., social skills, communication, adaptive behaviors). We provided recommendations on assessment tools based on the needs identified from the DARS proposal (e.g., age ranges, purpose of assessments, administration times and qualifications), research literature, and many collective years of clinical experience working with individuals with ASD.

ABA-based Comprehensive Program Assessments

In the area of language and communication, we recommend the Peabody Picture Vocabulary Test, fourth edition (PPVT-4), which tests receptive language and the Expressive Vocabulary Test, second edition (EVT – 2), which tests expressive language. To assess the area of social skills, we recommend the Autism Diagnostic Interview, Revised (ADI-R). For assessment of challenging or problematic behavior, we recommend the Vineland Scales, second edition (Vineland-II). , We recommend the Vineland Scales, second edition (Vineland-II) to assess the area of adaptive behavior. In the area of autistic symptomology, we recommend the use of Autism Diagnostic Interview, Revised (ADI- R).

ABA-based Focused Treatment Assessments

In addition to individualized data collection to track an individual's progress, we recommend that all individuals in the focused ABA program also have two additional

assessments conducted prior to entering treatment: Childhood Autism Rating Scale, second edition (CARS-2) and Vineland Scales, second edition (Vineland-II).

Section 1

Evidence-Based Treatment Approaches for Autism Spectrum Disorders: A Review of the Literature

Introduction

Autism Spectrum Disorders (ASD)

Autism Spectrum Disorders (ASD) are defined as a group of complex and lifelong neurodevelopmental disorders which are characterized by varying degrees of pertinent deficits in two areas: social communication impairment and repetitive/restricted behaviors. Examples of social communication impairment include difficulties reciprocating and/or initiating social interactions, establishing or maintaining relationships, and engaging in age-appropriate social activities. Examples of repetitive/restricted behaviors include repetitive speech, excessive adherence to routines, and having highly restricted interests that are abnormal in intensity or focus.

The above definition is based on the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-V) published in May 2013. DSM is a standard diagnostic tool that is widely used by professionals to diagnose ASD. In the DSM-IV-TR, the prior version of DSM-V, ASD was characterized by core deficits in three areas: communication, social interaction, and behavior pattern. ASD also had five subcategories: Autistic Disorder, Asperger's Disorder, Childhood Disintegrative Disorder, Pervasive Developmental Disorder-Not Otherwise Specified, and Rett Syndrome. The DSM-V consolidated all subcategories under one diagnosis category of ASD; and added three levels of severity based on the amount of support required. Research has verified that Rett syndrome is a genetic disorder caused by a genetic mutation on the X chromosome. As a result, it was not consolidated within the ASD category in the DSM-V,

but treated as a separate diagnosis. For example, individuals with Rett syndrome may also have ASD.

Although researchers have endeavored to discover the mechanisms that are responsible for ASD, causes remain unknown. Recent research has found that genetic gene mutations that affect the structural, functional, and neurochemical differences in the brain may be associated with ASD symptoms (Freitag, 2007; Kaufmann & Silverman, 2010). Other research has focused on environmental factors that may trigger genetic risk factors; suggesting a combination of these factors is likely involved in ASD (Kinney, Barch, Chayka, Napoleon, & Munir, 2010). Although these findings have increased our knowledge regarding the etiologies of ASD, the specific factors responsible for ASD remain unclear. Consequently there are no known means to match treatments to the cause or prevention of the onset of ASD. Thus, the primary approach for treatment of ASD is to manage symptoms through behavioral or educational methods and approaches.

Need for Effective Treatments

In recent years, there has been a dramatic rise in the number of individuals diagnosed with ASD. Specifically, according to recent prevalence studies, approximately 1 in 68 children (or 14.7 per 1,000 eight-year-olds) are identified with ASD (CDC, 2014). These latest estimate data show an increase from the previous estimates reported in 2012 of 1 in 88 children (or 11.3 per 1,000 eight year olds; <http://www.cdc.gov/media/releases/2014/p0327-autism-spectrum-disorder.html>). As the population with ASD has grown, so has the demand for effective treatments. As a result of these increasing demands, a multitude of treatments have been established.

Unfortunately, many treatments lack empirical support in terms of effectiveness (Davis et al., 2013; Green et al., 2006; Mulloy et al., 2011). A negative side effect of the proliferation of empirically unsubstantiated treatments is confusion for parents, service providers, advocates, and government entities in terms of treatment decisions for individuals with ASD. As a result, an emphasis on evidence-based practices has emerged and is a critical standard for the treatment of ASD.

With the emphasis on evidence-based practice, a considerable number of empirical studies have demonstrated that treatments based on the principles of Applied Behavior Analysis (ABA) are effective for individuals with ASD (see Matson, Tureck, Turygin, Beighley, & Rieske, 2012; Steege, Mace, Perry, & Longenecker, 2007). ABA is a systematic and empirical approach to assessment and intervention that has proven to be effective across a wide range of populations including individuals with ASD and other developmental disabilities; across a variety of contexts, including clinics, educational settings and homes; and across a variety of behaviors and skills including social, academic, and challenging behaviors (Steege, Mace, Perry, & Longenecker, 2007).

In addition, several clinical guidelines for ASD treatments have been developed in order to provide trustworthy information for stakeholders. Guidelines such as those provided by the National Research Council (NRC, 2001), the National Standards report by the National Autism Center (NAC, 2009), and the comparative effective review by the Vanderbilt Evidence-Based Practice Center (Agency for Healthcare Research and Quality, 2011) have outlined available, effective technologies; and the extent to which evidence of effectiveness of such treatments is supported by research. According to the National Standards Report (NAC, 2009), behavioral treatments based on ABA have

been deemed effective. The evidence of effectiveness was evaluated as “established” (i.e., “sufficient evidence is available to confidently determine that a treatment produces beneficial treatment effects for individuals on the autism spectrum”; p.32).

DARS Autism Program

In order to meet the growing demands of effective treatment services for the ASD population, the Department of Assistive and Rehabilitative Services (DARS) developed the Autism Program as a pilot project in fiscal year 2008. Through the project, treatment services that utilize an ABA approach have been offered to children ages 3-8 with a diagnosis of ASD. Initially, the Autism Program served two geographic areas of Texas: Houston and Dallas/Fort Worth. Subsequent increases in funding from the Texas legislature allowed the program to expand to Austin and San Antonio. Services are provided through contracts with local community agencies and organizations that provide ABA services.

The 83rd Texas Legislature directed the development and implementation of a plan for increasing the number of children receiving services through the program; and subsequently provided \$2.4 million in additional funding to expand services to two additional geographic areas. As part of the plan, DARS selected the Department of Special Education at the University of Texas at Austin to implement a comprehensive review; and provide evidence-based recommendations pertaining to the DARS Autism Program (e.g., to serve a greater number of children; efficiency). The evaluation process was administered through four steps, and the outcomes in each step were documented in this report. The components addressed are as follows:

- *Literature Review:* summarizing research outcomes on evidence-based ASD treatment, including intensity and duration of services, service location, child ages, parent and school involvement and additional service model characteristics.
- *Review of DARS Autism Program Data:* assessing data elements for children who have received program services and child outcome measures to assess indicators of child improvement.
- *Options for Program Revision:* developing multiple modified or alternative options for program changes that would result in a greater number of children receiving services, while maintaining positive consumer outcomes.
- *Review of Outcome Measurement Tools:* assessing the effectiveness of tools currently used by the Autism Program and recommendations for any changes to tools and/or administration procedures.

Based on the recommendations of the report, DARS will determine the most appropriate and effective changes to be made in the Autism Program in order for services to benefit the largest number of children with current appropriations while retaining key elements associated with the attainment of positive outcomes.

Purpose of the Literature Review

For the purpose of identifying the key elements associated with effective ASD treatments and supported by existing empirical studies, we conducted a systematic review of the literature pertaining to ASD. The results drawn from the following systematic literature review served as the criteria for assessing the current DARS Autism Program. Extracted information used to answer key questions (see below)

served as the evidence base for recommendations for DARS program revision and future directions.

Key Questions

In order to identify the key elements associated with effective ASD treatments we conducted a systematic literature review by focusing on the following key questions.

The key questions were developed based on the elements requested by DARS.

KQ 1. How effective are the comprehensive programs?

KQ 2. What components of treatment programs are related to effective outcomes?

KQ 3. What characteristics of treatment service delivery are related to effective outcomes?

KQ 4. What specific characteristics of children and families are related to effective outcomes?

KQ 5. What are the best practices for inclusion of treatment services in an educational setting?

KQ 6. What are the funding options for treatment services?

KQ 7. What evidence supports long-term outcomes that verify positive changes in developmental trajectory?

Methods

This section describes the literature search process, data collection system, and hierarchical analytic approach we used for data analysis. In the *literature search process* sub-section we describe the search strategies and inclusion/exclusion criteria used to select relevant articles. In the *data collection system* sub-section we describe the coding components and procedures used to reliably extract pertinent data from the chosen articles. In the *analytic hierarchy process* sub-section we explain how we categorized the chosen studies in order to analyze data related to addressing key questions.

Literature Search Process

The relevant literature was selected through a systematic search protocol we developed as shown in the left flow of the chart depicted in Figure 1-1. Our search consisted of database searches and manual searches (to identify additional studies not identified via electronic searches). Through these processes we obtained an initial pool of studies. We then identified studies with high-relevance through the systematic application of the inclusion criteria.

Database searches. We conducted electronic literature searches in September, 2013. In order to identify and retrieve studies, we utilized five databases: PsycINFO, Medline, ERIC, Education Source, and Academic Search Complete via EBSCOhost Research Databases service at the University of Texas libraries. The search terms employed in the database searches were as follows: “autism”, “pervasive developmental disorder”, “early”, “toddler or preschool”, “effectiveness”, “evaluation”, “behavior*”, “program”, “treatment”, “intervention”, NOT “pharmacology or drug”. We

limited the search to peer-reviewed studies from 1969 to 2013. The year limitation was determined based on the oldest and latest years available via the electronic search. The electronic search retrieved/yielded 1,188 articles.

Manual searches. We conducted hand searches by tracking references from six meta-analysis reviews (i.e., Eldevik et al., 2009; Makrygianni & Reed, 2010; Peters-Scheffer, Didden, Korzilius, & Sturmey, 2010; Reichow, 2012; Virués-Ortega, 2010; Warren et al., 2011) found in the database searches. A total of eight studies were identified from the meta-analysis studies (i.e., not database searches). We also searched the most current program evaluation reports from representative comprehensive programs. For this we contacted 10 comprehensive programs evaluated by the National Research Council (2001) by email or phone including: 1) Children's Unit at the State University of New York at Binghamton; 2) Developmental Individual-difference Relationship-based model (DIR) - Floor Time; 3) Douglass Developmental Disabilities Center at Rutgers University (DDDC); 4) Early Start Denver Model (ESDM); 5) Individualized Support Program at the University of South Florida at Tampa; 6) Learning Experiences, an Alternative Program for Preschoolers and their Parents (LEAP) Preschool at the University of Colorado School of Education; 7) Pivotal Response Model at the University of California at Santa Barbara; 8) Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH) at the University of North Carolina School of Medicine at Chapel Hill; 9) The University of California at Los Angeles (UCLA) Young Autism Project; and 10) Walden Early Childhood Programs at the Emory University School of Medicine. In addition, we checked other resources (e.g., Autism Speaks) for additional current comprehensive

programs developed after the NRC report was published. As a result we identified two additional programs (i.e., Relationship Development Intervention [RDI]; Social Communication/ Emotional Regulation/ Transactional Support [SCERTS]) and subsequently contacted those programs. Six programs provided us with publications and/or descriptions related to their program evaluation including: 1) DIR/Floor Time, 2) DDDC at Rutgers University, 3) ESDM, 4) Pivotal Response Model, 5) TEACCH, and 6) the UCLA Young Autism Project.

Furthermore we identified an additional list of current comprehensive programs provided in Odom et al. (2010). The Odom et al. list included the programs from NRC as well as additional programs. Odom et al. evaluated the comprehensive programs using the Scientific Merit Rating Scale (SMRS) that was used by the National Standards Report from the National Autism Center (NAC; 2009). SMRS is defined as “a means of objectively evaluating if the methods used in each study were strong enough to determine whether or not a treatment was effective for participants on the autism spectrum.” The range of the rating scale is 0 (poor) to 5 (strong). In addition to applying the described rating range, they evaluated evaluation studies of some comprehensive programs as “N/A” (i.e., the study was published in a non-peer reviewed journal). For our purposes, we tracked the studies evaluated as SMRS rating 2 or 3 (There were no studies rated as SMRS rating 0, 1, 4, or 5.); however most of them did not meet our inclusion criteria (The criteria are addressed below). For example, if the studies did not have a control group and compared within an experimental group using pre- and post-tests, they did not meet our inclusion criteria. Other studies were already in our

database search list. As a result, the number of included studies identified by contacting comprehensive programs was two.

A total of ten studies were identified through manual search (studies from meta-analysis reviews [N= 8], studies from contacting comprehensive programs [N = 2]). Therefore the total number of articles initially selected through electronic and manual searches was 1,198.

Inclusion and exclusion criteria. To select appropriate studies for establishing criteria for program evaluation, we developed inclusion/ exclusion criteria for our systematic literature review. The criteria are summarized in Table 1-1 below. This review included studies in which all participants of both experimental and control groups were diagnosed with ASD, including Autism, Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), and Asperger syndrome. The studies that included participants diagnosed with other disorders (e.g., Down syndrome, Attention Deficit Hyperactivity Disorder [ADHD]) were excluded based on the difficulty in determining distinctions in the results for the ASD population and mixed populations. Participants in the included studies were under 10 years old (based on the age range of the DARS autism program which is 3 to 8). This review included studies that evaluated comprehensive programs/interventions that addressed multiple developmental areas (e.g., cognitive area; language; adaptive behavior; the social area which measures social skill, social communication, and joint attention; and the emotional area which measures adjustment, depression, withdrawal, and psychosis), including those representing the core features of ASD (i.e., social interaction, communication, atypical behaviors). In order to identify high quality criteria for program evaluation, studies that

employed rigorous experimental designs for evaluating effectiveness were chosen. The experimental designs included randomized controlled trials and pre/post-tests with a control group (non-randomized). Studies that evaluated effectiveness using pre- and post-tests without a control group, single-subject designs, and individual case reports were excluded. The included studies reported quantitative outcome data for a minimum of 10 total participants. Last, the included studies were published in peer-reviewed journals in English. The initially selected articles (N=1,198) were screened against the inclusion/exclusion criteria. As a result, a total of 40 studies were selected/identified for inclusion.

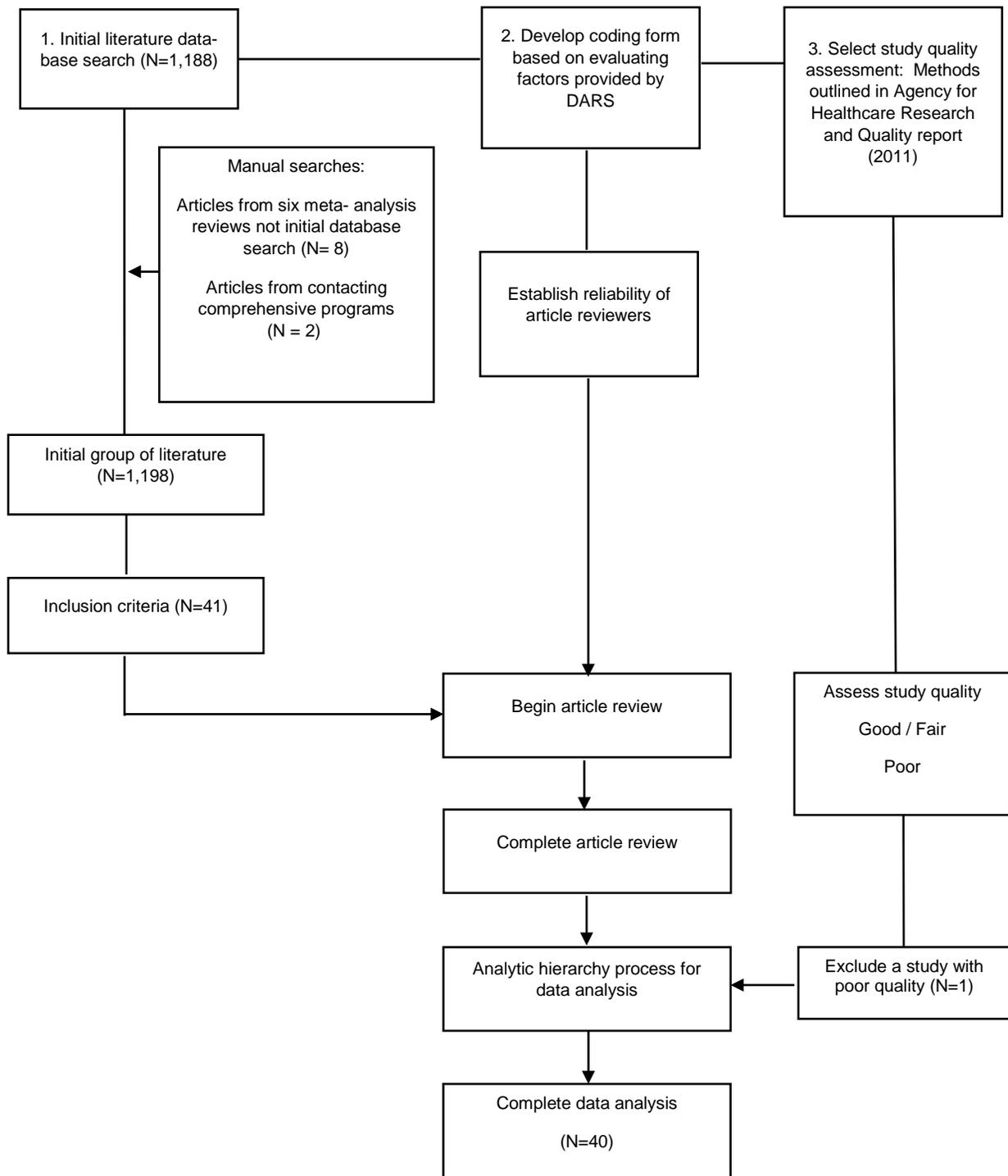


Figure 1-1. Process of Literature Review.

Table 1-1

Summary of Inclusion Criteria

1. All participants diagnosed with Autism Spectrum Disorders
 2. Participants under the age of 10
 3. Comprehensive programs/interventions that address multiple developmental areas including those representing the core features of autism spectrum disorder (i.e., social interaction, communication, atypical behaviors)
 4. Group research designs suitable for determining effectiveness of a program/intervention:
 - a. Randomized controlled trials
 - b. Pre/post-tests with control group (non-randomized)
 - c. The total number of participants ≥ 10
 5. Reports quantitative data
 6. Peer reviewed journals
 7. In English
-

Data Collection System

We utilized two coding procedures to extract relevant information from the selected/identified studies: coding for program evaluation criteria and coding for assessing quality of individual studies.

Coding for program evaluation criteria. A coding form was developed to extract data corresponding to the evaluation factors provided by DARS. This coding

form comprised 1) general information, 2) service delivery, 3) treatment modalities, 4) assessments, 5) outcomes, and 6) funding options. The general information component included participant characteristics, program characteristics, and inclusion/exclusion criteria. The service delivery component included treatment location, hours, duration, providers, treatment provider qualifications, use of collaborative or multidisciplinary team approach, extension of generalization and maintenance. The treatment modalities component included treatment components such as curricula or teaching strategies, understanding of the relationship of child development and treatment, treatment fidelity measures, and parent involvement. The assessment component included outcome measurement tools and methods for analyzing outcome data. The outcome component included outcome summary, reporting benefits and risks of implementation, and evidence of long-term outcomes to verify positive changes in developmental trajectory. The funding options component included insurance coverage of treatment services for autism or funding of treatment services from diverse agencies.

Assessing quality of studies. A second coding form was developed to assess the quality of selected individual studies. To identify useful quality criteria for program evaluation, it is essential that the evaluation criteria be established from the information drawn from acceptable quality (e.g., good or fair) studies. For this purpose, we employed the quality assessing methods used by Warren et al. (2011); originally outlined in the EPC Methods Guide for Effectiveness and Comparative Effectiveness Reviews. We chose this method because it provides clear and specific assessment components, and a scoring system to assess the quality of individual studies based on the described protocol. The quality assessment components consist of several sub-

questions (described below). More detailed information regarding the assessment component and scoring algorithm can be found in Warren et al.

Study design. 1) Did the study employ a group design (have a comparison group)? 2) Were the groups randomly assigned? 3) If no, was there an appropriate comparison group? 4) If yes, was randomization done correctly?

Diagnostic approach. 1) Was a valid diagnostic approach for ASDs used within the study, or were referred participants diagnosed using a valid approach? a) A clinical diagnosis based on the DSM-IV, in addition to the ADI-R and ADOS assessments. b) A clinical diagnosis based on the DSM-IV, in addition to either the ADI-R or ADOS assessment. c) A combination of a DSM-IV clinical diagnosis with another assessment tool other than ADI-R or ADOS; or the ADOS assessment in combination with another assessment tool except DSM-IV or ADI-R. d) Either a clinical DSM-IV-based diagnosis alone or the ADOS assessment alone. e) Neither a clinical DSM-IV-based diagnosis nor the ADOS assessment.

Participant ascertainment. 1) Was the sample clearly characterized (e.g., information provided to characterize participants in terms of impairments associated with their ASDs, such as cognitive or developmental level)? 2) Were inclusion and exclusion criteria clearly stated? 3) Was attrition reported? 4) Were characteristics of the drop-out group evaluated for differences with the participant group as a whole?

Intervention characteristics. 1) Was the intervention fully described? 2) Was treatment fidelity monitored in a systematic way? (for non-medical interventions) 3) Was adherence to the intended treatment process measured and reported? (for medical

interventions; this item did not apply to the current review) 4) Did the authors report differences in or hold steady all concomitant interventions?

Outcomes measurement. 1) Did outcome measures demonstrate adequate reliability and validity (including inter-observer reliability for behavior observation coding)? 2) Were data collected from appropriate sources? 3) Were outcomes coded and assessed by individuals blinded to the intervention status of the participants?

Statistical analysis. 1) For randomized controlled trials, was there an intent-to-treat analysis? 2) For negative studies, was a power calculation provided? 3) For observational studies, were potential confounders and effect measure modifiers captured? 4) For observational studies, were potential confounders and effect measure modifiers handled appropriately?

Reliability of review. In order to review the selected articles with a high degree of reliability, two reviewers participated in training and examining sessions to assess the coding forms, to evaluate whether obtained data were consistent across scorers, and to assess whether each coding item measured what it was intended to collect. If there was disagreement between reviewers, they discussed what information was needed to answer the key questions, then established consensus on coding methods for the item. After the examining and training sessions, reviewers independently coded two pilot articles with both coding forms and calculated inter-observer agreement (IOA). The IOA coding form for program evaluation criteria was 89% and the IOA for assessing study quality was 83.3%. An acceptable level of agreement is over 80% (NAC, 2009).

Analytic Hierarchy Process for Data Analysis

To identify useful quality criteria related to effective outcome, we employed an analytic hierarchy process for data analysis. We analyzed the treatment programs of the selected studies using three criteria: categorization of treatments, study quality, and effectiveness. For categorization of treatments, we first designated two standards of categorization: program theoretical model and main treatment location. The programs of the studies could be categorized into four types of theoretical model: ABA, a developmental model, a hybrid model that combines ABA and developmental models, and an idiosyncratic model. Table 1-2 summarizes the programs included and the definition of each theoretical model. With regard to the main treatment location, studies are categorized according to authors' reports for the main treatment location or the majority of therapy time spent in each setting: home, school, or clinic. Therefore, the categorization of treatment programs was made by combining the two standards, and the selected studies were organized into the following combined categories: ABA – Home, ABA – School, ABA – Clinic, Developmental – Home, Developmental – School, Developmental – Clinic, Hybrid – Home, Hybrid – School, Hybrid – Clinic, Idiosyncratic – Home, Idiosyncratic – School, Idiosyncratic – Clinic.

Table 1-2

Summary of the Programs and Characteristics in Each Theoretical Model

Categorization	Program Name	Definition
ABA Model	<ul style="list-style-type: none"> ▪ Lovaas-model approach ▪ Early Intensive Behavioral Intervention (EIBI) ▪ Intensive behavior analytic based on Lovaas model 	Behavioral oriented approach based on ABA principles and strategies such as reinforcement, shaping, chaining, prompting, modeling, fading, discrimination learning, and task analysis using teaching formats such as discrete trial teaching (DTT).
Developmental Model	<ul style="list-style-type: none"> ▪ DIR/Floortime ▪ Focused Playtime Intervention (FPI) ▪ Hanen's More Than Words (HMTW) ▪ Scottish Early Intervention Program ▪ Social Communication Intervention 	Developmental oriented approach based on cognitive development theory and interpersonal development via social communication, social interactions, or play process.
Hybrid Model	<ul style="list-style-type: none"> ▪ Early Start Denver Model (ESDM) ▪ Learning Experiences and Alternative Program for preschoolers and their parents (LEAP) ▪ Barnet Early Autism Model (BEAM) ▪ Joint Attention Symbolic Play Engagement and Regulation (JASPER) ▪ Intervention for Interpersonal Synchrony (IS) 	Both behavioral and developmental oriented approach that influences intervention goals, procedures, and evaluation. For example, using behavioral analytic teaching strategies (e.g., reinforcement, shaping, chaining, prompting, and modeling) based on developmental oriented goals and curriculum within a mix of teaching formats and methods such as DTT (clinician-led) and naturalistic teaching (child-led).

Categorization	Program Name	Definition
Idiosyncratic Model	<ul style="list-style-type: none"> ▪ Treatment and Education of Autistic and Related Handicapped Children (TEACCH) ▪ Keyhole Intervention Program ▪ Treatment , Research and Education for Autism and Developmental Disorders (TRE-ADD) ▪ Management Intervention for Problem Behavior 	Use varied approaches that are difficult to classify as one of the three theoretical models above. For example, TEACCH is based on several approaches such as social learning theory, developmental, and behavioral approach (Odom. et al., 2010).

Next, we considered study quality. Specifically, we arranged the studies in each category based on their evaluated quality (i.e., good/fair or poor). Therefore, when the aforementioned grouped studies were analyzed, we discriminated information data in the good/fair studies from those in the poor and dropped the poor quality study.

Last, we considered the effectiveness of the treatment. To identify useful criteria to be utilized for program evaluation, we endeavored to differentiate data in the grouped studies related to effective outcomes from those with non-effective outcomes. However, there is considerable difficulty in determining and reporting specific totals pertaining to effective and/or ineffective outcomes for multiple developmental areas. That is because the programs of the selected studies produced different outcomes of effectiveness across different developmental areas. For this reason we provided a summary of effectiveness across developmental areas in each category (e.g., ABA – Home, ABA – School, ABA – Clinic or ABA, hybrid, developmental category) addressing key question number one. Related to the summary of effectiveness, the rest of the key questions were addressed in each category. We analyzed the collected data through the analytic

hierarchy process; the results and outcomes of the analysis are presented in the following section.

Results

The results are organized according to the key questions that guided the review process; and pertain to the 40 identified, empirical studies. For each key question, the results are summarized across four theoretical models (i.e., ABA, developmental, hybrid, and idiosyncratic). Sub-elements that required additional analysis are addressed within each question. The main results related to the key questions are also summarized in tables and figures below.

KQ1. How effective are the comprehensive programs?

To identify and present the evidence of the effects of comprehensive programs we first conducted the quality evaluation of the relevant studies and then summarized the effects reported across different developmental areas.

Figures KQ1-1 – KQ1-4 summarize the number of studies and results of effects across the four theoretical models. The Y-axis for Figures KQ1-1 – KQ1-4 represents the number of studies. A black bar represents the number of studies that reported positive effects on a specific developmental area. A white bar represents the number of studies that did not report positive effects on a developmental area. The number (indicated by the Y-axes) indicated by the total bar (combining black and white bars) is the number of studies that examined the effects of the program on the specified developmental area. For example, in the case of language area in ABA-based programs, the total number of studies that evaluate the effects of the ABA program on the language area is 10 out of 18 (the total number of the studies of ABA-based programs

was 18). Of the 10 studies, eight (80%) reported the ABA program as effective for developing language ability, whereas two studies (20%) reported the program as ineffective on language.

In the following sections, for each theoretical model we provide an analysis of the overall effectiveness of developmental areas across studies. We then summarize the overall results as “effective”, “ineffective”, “inconclusive” or “not evaluated”. “Effective” refers to over 50% of studies that measured a particular developmental area within the theoretical model reported effectiveness in that developmental area. “Ineffective” refers to less than 50% of studies that measured a particular developmental area within the theoretical model reported effectiveness in that developmental area. “Inconclusive” refers to approximately 50:50 of studies that measured a particular developmental area within the theoretical model reported effectiveness and ineffectiveness in that developmental area. “Not evaluated” refers to the study did not examine a particular developmental area within the theoretical model. In addition, Appendix A presents more detailed information of effectiveness across developmental areas according to setting for each theoretical model.

ABA-based Programs

The total number of studies that evaluated ABA-based programs was 19 but one study was excluded because the quality was poor. Therefore, 18 studies (45%) were used to evaluate the effectiveness in ABA-based programs. The quality of five studies (28%; home-1; school-1; clinic-3) was good (Cohen et al., 2006; Fava et al., 2011; Sallows et al., 2005; Zachor et al., 2007, 2010). The quality of 13 studies (72%; home-8; school-4; clinic-1) was fair (Eikeseth et al., 2002, 2007, 2012; Fernell et al., 2011;

Howard et al., 2005; Lovaas, 1987; Magiati et al., 2007; McEachin, 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Smith et al., 2000; Strauss et al., 2012). In the ABA-based programs, a variety of developmental areas were examined. The total number of studies evaluating the effects on the language area was 10 out of 18. Of these studies, eight (80%) reported the ABA program as effective (Eikeseth et al., 2002; Fava et al., 2011; Howard et al., 2005; Remington et al., 2007; Sallows et al., 2005; Smith et al., 2000; Strauss et al., 2012; Zachor et al., 2007), whereas two studies (20%) reported as ineffective (Cohen et al., 2006; Magiati et al., 2007). The total number of studies evaluating the effects on adaptive behavior was 16. Seven studies (44%) reported the program as effective (Cohen et al., 2006; Eikeseth et al., 2002, 2007, 2012; Howard et al., 2005; Remington et al., 2007; Sallows et al., 2005), whereas nine studies (56%) reported as ineffective (Fava et al., 2011; Fernell et al., 2011; Magiati et al., 2007; McEachin, 1993; Reed et al., 2007; Reed & Osborne, 2012; Smith et al., 2000; Strauss et al., 2012; Zachor et al., 2007). The total number of studies evaluating the effects on problem behavior was five. Four studies (80%) reported the program as effective (Eikeseth et al., 2007, 2012; Remington et al., 2007; Strauss et al., 2012), whereas one study (20%) reported as ineffective (Reed et al., 2007). The total number of studies evaluating the effects on social development was three. One study (33%) reported the program as effective (Sallows et al., 2005), whereas two studies (67%) reported as ineffective (Smith et al., 2000; Zachor et al., 2007). Two studies (McEachin, 1993; Smith et al., 2000) evaluated the effects on emotional development and reported the program as ineffective. The total number of studies that evaluated the effects on cognitive development was 15. Ten studies (67%) reported the program as

effective (Cohen et al., 2006; Eikeseth et al., 2002, 2007; Howard et al., 2005; Lovaas, 1987; McEachin, 1993; Reed et al., 2007; Remington et al., 2007; Smith et al., 2000; Sallows et al., 2005) whereas five studies (33%) reported as ineffective (Fava et al., 2011; Magiati et al., 2007; Reed & Osborne, 2012; Zachor et al., 2007, 2010). The total number of studies that evaluated the effects on the severity of ASD symptoms was nine. The severity of ASD symptoms was measured in the studies using assessment tools such as Autism Diagnostic Interview-Revised, Gilliam Autism Rating Scale, Autism Diagnostic Observation Schedule, and/or Childhood Autism Rating Scale. Five studies (56%) reported the program as effective (Eikeseth et al., 2012; Fava et al., 2011; Reed & Osborne, 2012; Strauss et al., 2012, Zachor et al., 2007) whereas four studies (44%) reported as ineffective (Fernell et al., 2011; Magiati et al., 2007; Reed et al., 2007; Zachor et al., 2010).

The developmental areas evaluated most by ABA-based programs were adaptive behavior and the cognitive area, followed by language and severity of ASD symptoms. The results suggested that ABA-based programs were effective in the areas of language (80%), problem behavior (80%), and cognition (67%). The effects on adaptive behavior and severity of ASD symptoms were inconclusive because the proportions of effectiveness and ineffectiveness indicated in the results were similar. The ABA-based programs were shown to be ineffective with regard to the social and emotional areas.

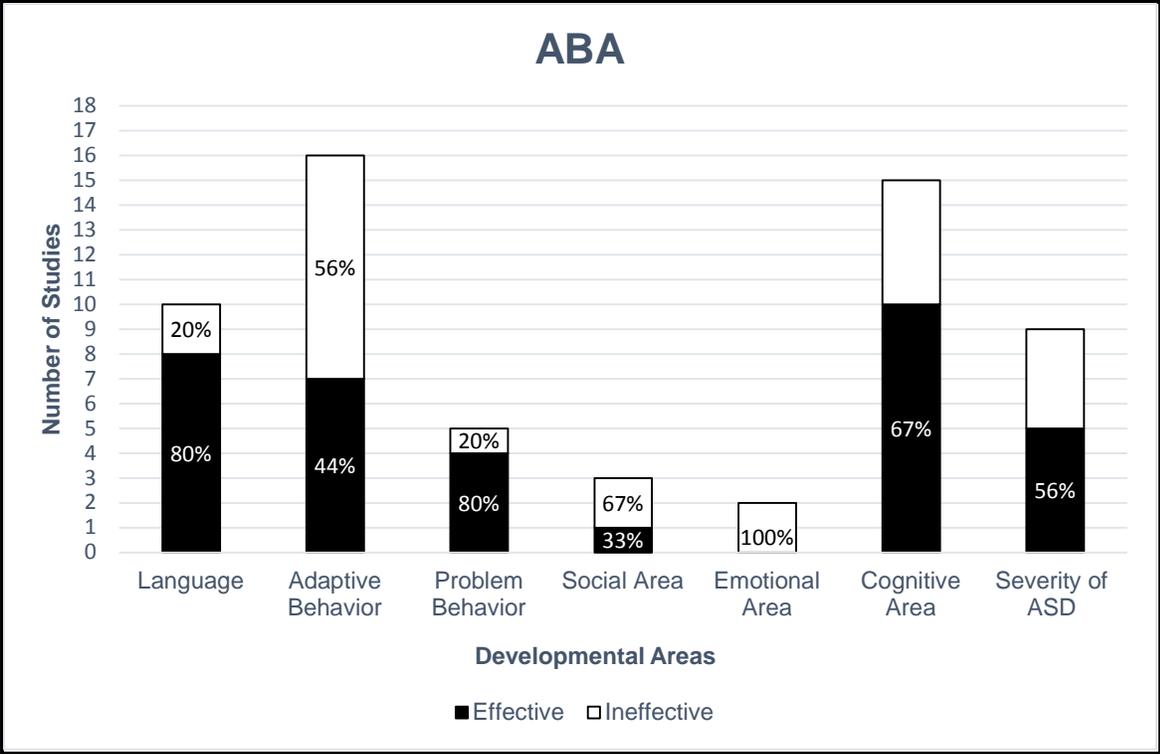


Figure KQ1-1. Summary of Results of ABA-based Programs.

Developmental-based Programs

The total number of studies that evaluated developmental-based programs was five (12.5%). The quality of two studies (40%; home-1; school-0; clinic-1) was good (Aldred et al., 2004; Siller et al., 2013). The quality of three studies (60%; home-1; school-0; clinic-2) was fair (Carter et al., 2011; Pajareya & Nopmaneejumrulers, 2011; Salt et al., 2002). No study was rated poor. There was no study that evaluated school-based programs using a developmental approach.

In the developmental-based programs, the areas of problem behavior and emotion were not evaluated. The total number of studies that evaluated the effects on the language area was four out of five. One study (25%) reported the program as effective (Aldred et al., 2004), whereas three studies (75%) reported as ineffective (Carter et al., 2011; Salt et al., 2002; Siller et al., 2013). The total number of studies that

evaluated the effects on adaptive behavior was three. One study (33%) reported the program as effective (Salt et al., 2002), whereas two studies (67%) reported as ineffective (Aldred et al., 2004; Carter et al., 2011). The total number of studies that evaluated the effects on the social area was one (Carter et al., 2011); and the cognitive area was also one (Siller et al., 2013). Each study reported that the program was ineffective on social and cognitive areas, respectively. The total number of studies that evaluated the effects on the severity of ASD symptoms was three. Two studies (67%) reported the program as effective (Aldred et al., 2004; Pajareya & Nopmaneejumrulers, 2011), whereas one study (33%) reported as ineffective (Carter et al., 2011).

The total number of studies that evaluated developmental-based programs (12%) was relatively smaller than the other programs. The developmental area evaluated most by the developmental-based programs was language, followed by adaptive behavior, and severity of ASD symptoms. The results suggested that developmental-based programs failed to demonstrate effectiveness on language (75%), adaptive behavior (67%), and social and cognitive areas. The effects of developmental-based programs on problem behavior and emotion area were not evaluated. However, the programs were effective on the severity of ASD symptoms (67%) when compared to other areas.

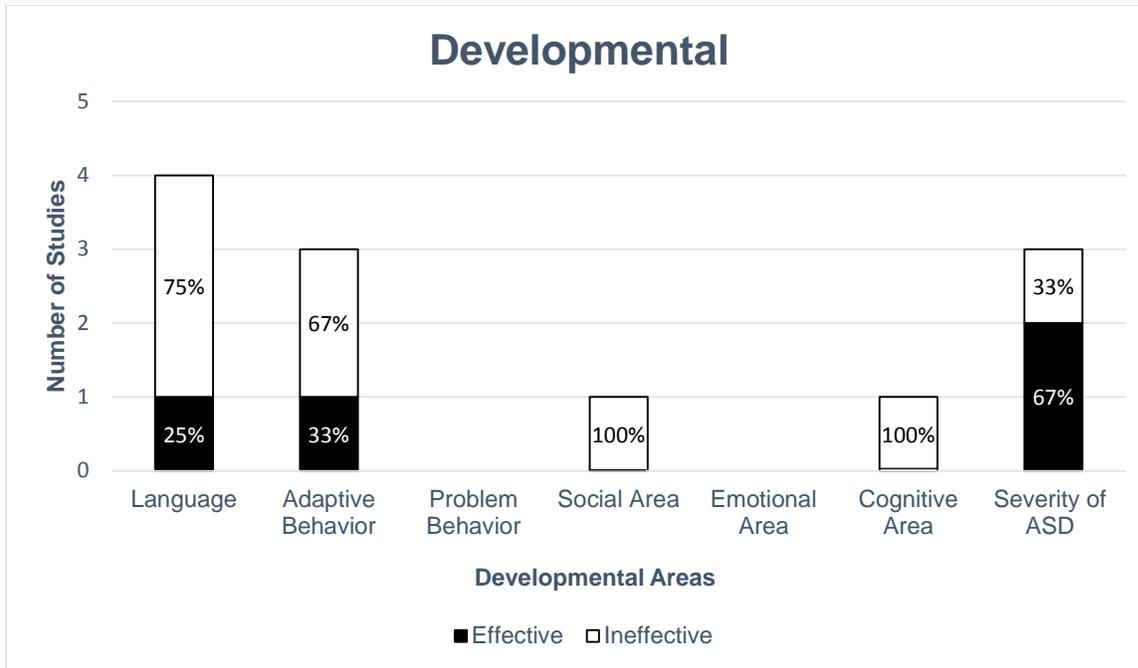


Figure KQ1-2. Summary of Results of Developmental-based Programs.

Hybrid-based Programs

The total number of studies examining hybrid-based programs was eight (20%). The quality of one study (12%; home-1; school-0; clinic-0) was good (Dawson et al., 2010). The quality of seven studies (88%; home-1; school-3; clinic-3) was fair (Goods et al., 2013; Kasari et al., 2006, 2012; Landa et al., 2011; Reed et al., 2013; Rogers et al., 2012; Strain & Bovey, 2011). No study was poor.

In the hybrid-based programs, the emotional area was not assessed. The total number of studies that evaluated the effects on language was seven out of eight. Four studies (57%) reported the hybrid-based program as effective (Dawson et al., 2010; Kasari et al., 2012; Reed et al., 2013; Strain & Bovey, 2011), whereas three studies (43%) reported as ineffective (Goods et al., 2013; Landa et al., 2011; Rogers et al., 2012). The total number of studies that evaluated the effects on adaptive behavior was three. Two studies (67%) reported the program as effective (Dawson et al., 2010; Reed

et al., 2013), whereas one study (33%) reported as ineffective (Rogers et al., 2012). The total number of studies that evaluated the effects on problem behavior was three. One study (33%) reported the program as effective (Strain & Bovey, 2011), whereas two studies (67%) reported as ineffective (Dawson et al., 2010; Reed et al., 2013). The total number of studies that evaluated the effects on social area was four. Two studies (50%) reported the program as effective (Kasari et al., 2006; Strain & Bovey, 2011), whereas two studies (50%) reported as ineffective (Goods et al., 2013; Landa et al., 2011). The total number of studies evaluating the effects on the cognitive area was three. Two studies (67%) reported the program as effective (Dawson et al., 2010; Kasari et al., 2012), whereas one study (33%) reported as ineffective (Reed et al., 2013). The total number of studies that evaluated the effects on the severity of ASD symptoms was three. One study (33%) reported the program as effective (Strain & Bovey, 2011), whereas two studies (67%) reported as ineffective (Dawson et al., 2010; Reed et al., 2013).

The developmental area evaluated most by hybrid-based programs was language, followed by the social area. The results suggested that hybrid-based programs were effective in the areas of adaptive behavior (67%) and cognition (67%). The effects on the language and social areas were inconclusive because the proportions of effectiveness and ineffectiveness indicated in the results were similar. The effects on the emotional area were not evaluated. The hybrid-based programs were shown to be ineffective with regard to problem behavior and severity of ASD symptoms.

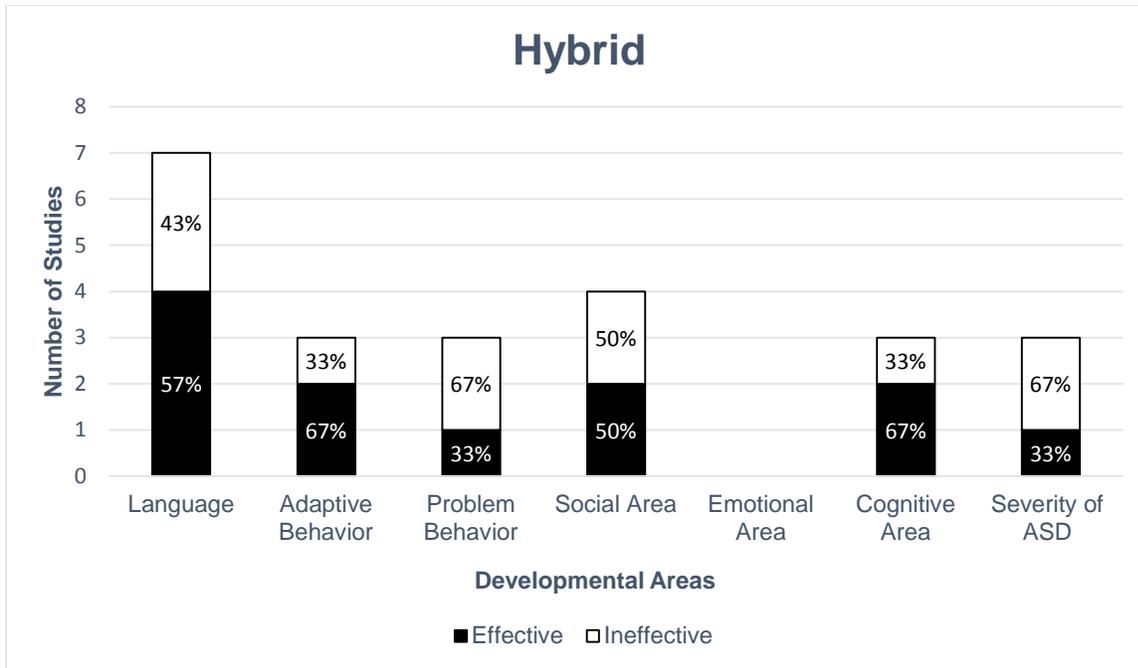


Figure KQ1-3. Summary of Results of Hybrid-based Programs.

Idiosyncratic-based Programs

The total number of studies examining idiosyncratic-based programs was nine (22.5%). The quality of all of nine studies (100%; home-5; school-3; clinic-1) in this category was fair (Boyd et al., 2013; Jocelyn et al., 1998; Ozonoff et al., 1998; McConkey et al., 2010; Perry & Condillac, 2010; Schertz et al., 2013; Sofronoff et al., 2004; Tsang et al., 2007; Welterlin et al., 2012).

In the idiosyncratic-based programs, a variety of developmental areas were examined; however the number of studies that examined each developmental area was relatively small. The total number of studies that evaluated the effects on language was four out of nine. Two studies (50%) reported the program as effective (Jocelyn et al., 1998; Schertz et al., 2013), whereas two studies (50%) reported as ineffective (Boyd et al., 2013; Welterlin et al., 2012). The total number of studies that evaluated the effects on adaptive behavior was three. Two studies (67%) reported the program as effective

(McConkey et al., 2010; Tsang et al., 2007), whereas one study (33%) reported as ineffective (Welterlin et al., 2012). The total number of studies that evaluated the effects on problem behavior was one (Sofronoff et al., 2004); the study reported the program as effective on decreasing problem behavior. The total number of studies that evaluated the effects on social area was four. Two studies (50%) reported the program as effective (Schertz et al., 2013; Sofronoff et al., 2004), whereas two studies (50%) reported as ineffective (Boyd et al., 2013; Jocelyn et al., 1998). The total number of studies that evaluated the effects on emotional area was one (Jocelyn et al., 1998). This study reported the program as ineffective. The total number of studies that evaluated the effects on cognitive area was two. One study (50%) reported the program as effective (Tsang et al., 2007); and one study (50%) reported as ineffective (Jocelyn et al., 1998). The total number of studies evaluating the effects on the severity of ASD symptoms was two (Boyd et al., 2013; McConkey et al., 2010). Both studies reported the programs as ineffective.

The developmental areas evaluated most by idiosyncratic-based programs were language and social areas, followed by adaptive behavior. The results suggested that idiosyncratic-based programs were effective in the areas of adaptive behavior (67%) and problem behavior. The effects on language, social, and cognitive areas were inconclusive because the proportions of effectiveness and ineffectiveness indicated in the results were similar. The idiosyncratic-based programs were shown to be ineffective with regard to the emotional area and severity of ASD symptoms.

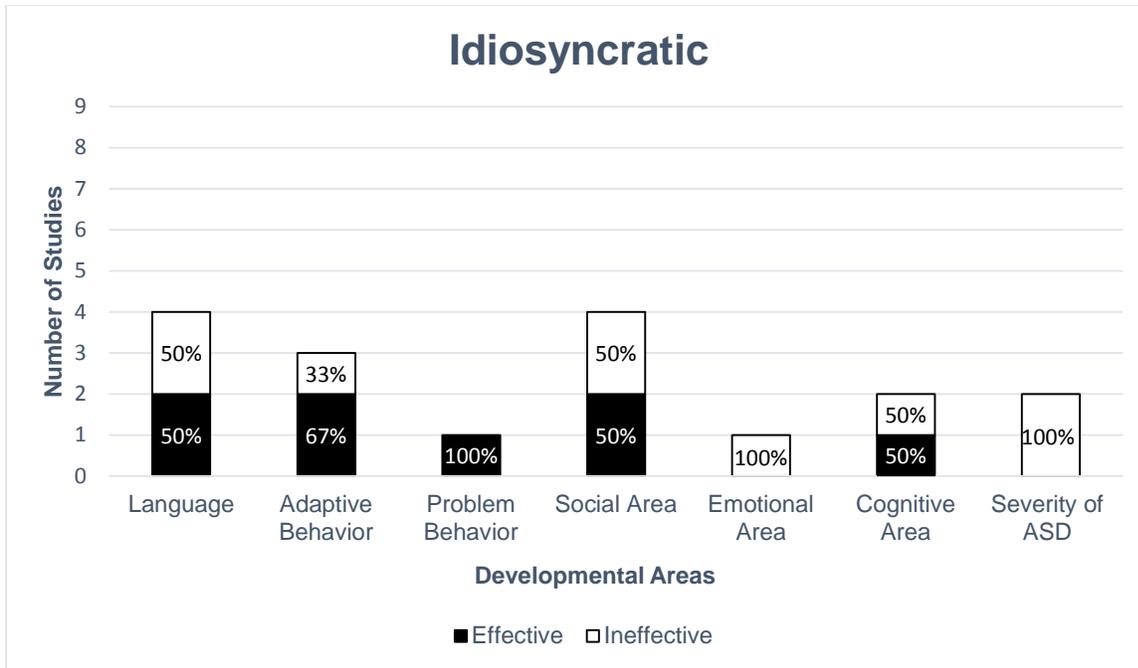


Figure KQ1-4. Summary of Results of Idiosyncratic-based Programs.

To summarize, based on the results pertaining to each developmental area (see Figure KQ 1-5 below), in the area of language, ABA-based programs were effective; hybrid and idiosyncratic-based programs were inconclusive; and developmental based programs were ineffective. In the area of adaptive behavior, hybrid and idiosyncratic-based programs were effective; ABA-based programs were inconclusive; and developmental-based programs were ineffective. In the area of problem behavior, ABA and idiosyncratic-based programs were effective; developmental-based programs were not evaluated; and hybrid-based programs were ineffective. In the social area there were no effective programs; hybrid and idiosyncratic-based programs were inconclusive; and ABA and developmental-based programs were ineffective. The majority of studies across the four theoretical models evaluated the emotional area less than other areas. ABA and idiosyncratic-based programs were ineffective. Hybrid- and developmental-based programs were not evaluated. In the cognitive area, ABA and hybrid-based

programs were effective; idiosyncratic-based programs were inconclusive; and developmental-based programs were ineffective. In terms of the severity of ASD symptoms, developmental based programs were effective; hybrid and idiosyncratic-based programs were ineffective; and ABA-based programs were inconclusive.

	ABA	Developmental	Hybrid	Idiosyncratic
Language	Effective	Ineffective	Inconclusive	Inconclusive
Adaptive Behavior	Inconclusive	Ineffective	Effective	Effective
Problem Behavior	Effective	Not evaluated	Ineffective	Effective
Social Area	Ineffective	Ineffective	Inconclusive	Inconclusive
Emotional Area	Ineffective	Not evaluated	Not evaluated	Ineffective
Cognitive Area	Effective	Ineffective	Evaluated	Inconclusive
Severity of ASD	Inconclusive	Effective	Ineffective	Ineffective

Figure KQ 1-5. Overall Results across Developmental Area by Program Type.

KQ2: What are the components of treatment programs related to effective outcomes?

For each of the theoretical models (ABA, developmental, hybrid, idiosyncratic) and settings pertaining to each model, we examined the components of treatment programs (i.e., developmental considerations, use of a manual or protocol, parent involvement, fidelity) only from studies that reported effective outcomes for at least one of the dependent variables measured (and excluded studies without effective outcomes). Developmental considerations describe if and in what way the treatment took into consideration child development. The use of a manual or protocol component describes whether the majority of studies in the designated category utilized a document or

resource to direct the implementation of the program. Parent involvement describes the roles parents played in their child's treatment. Fidelity describes whether the study reported any measurement of how accurately the service provider implemented the treatment. Table 1-3 of treatment program components summarizes these components according to theoretical models (i.e., ABA, hybrid and idiosyncratic) and settings (i.e., home, school, clinic). The number of studies with effective outcomes is listed according to each setting. "Yes" indicates at least 50% of the studies of that category (e.g., ABA in the home setting) reported information for the component. "No" indicates that less than 50% reported information for the component. Studies reporting non-significant outcomes for *all* measured variables in the study were not included in the discussion of intervention components related to effective outcomes.

It should be noted it is not possible to draw firm conclusions about potential relations between positive study outcomes and specific, individual variables relating to treatment program components (i.e., developmental considerations, use of a manual or protocol, parent involvement, fidelity) or settings (i.e., home, school, clinic). Further, this was the case across each of the theoretical models. We are unable to draw firm conclusions about potential relations between positive study outcomes and specific, individual components of treatment programs because none of the variables were isolated within the context of any of the reviewed studies.

Table 1-3

Summary of Treatment Program Components

Theoretical Model	Setting	Developmental	Use of Manual or Protocol	Parent Involvement	Fidelity
ABA	Home - 8	No	Yes	Yes	No
	School - 3	Yes	Yes	Yes	No
	Clinic - 4	Yes	No	Yes	Yes
Developmental	Home - 1	Yes	No	Yes	No
	School - 2	Yes	Yes	Yes	No
	Clinic - 0	n/a	n/a	n/a	n/a
Hybrid	Home - 2	Yes	Yes	Yes	Yes
	School - 3	Yes	No	Yes	Yes
	Clinic - 2	Yes	Yes	No	Yes
Idiosyncratic	Home - 4	No	Yes	Yes	No
	School - 2	Yes	No	Yes	No
	Clinic - 1	Yes	No	Yes	No

Note. Yes = 50% or more of the studies in the category reported the component.

ABA-based Programs

Out of 18 studies in the ABA category, 15 reported significant results for at least one of the dependent variables measured in each respective study (Cohen et al., 2006; Eikeseth et al., 2002; 2007; 2012; Fava et al., 2011; Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Sallows et al., 2005; Smith et al., 2000; Strauss et al., 2012; Zachor et al., 2007).

Treatment strategies under the ABA-based model included applying principles based in operant conditioning (e.g., reinforcement, shaping, prompting, modeling, fading,

discrimination learning, task analysis) using teaching formats such as Discrete Trial Teaching (DTT) and naturalistic teaching (e.g., incidental teaching, natural environment teaching) to target functional skills such as communication and social skills. Many of the studies in this category referenced the “Lovaas model” or “Early Intensive Behavioral Treatment” (EIBT; Lovaas, 1987). This seminal paper by Ivar Lovaas was the first to describe a randomized control trial using the DTT format. In DTT, sessions last approximately 50 to 60 min. The therapists conducted anywhere from 3 to 8 trials or 8-14 trials in a sitting, with 1-2 min or 5-10 min breaks between sittings, depending on the child (Cohen et al., 2006; Reed et al., 2007). Although multiple skills may be targeted within one session, they are individualized to the child’s needs and abilities such that simpler skills are mastered prior to moving on to more complex skills. Therapists collect data across most, if not all sessions, and program decisions are based on the progress demonstrated and reflected in the collected data. All skill programs have clear mastering criteria to determine when skill programs should be changed. The mastery criteria include demonstration of generalization of skills in more naturalistic and less structured conditions, in different settings or with people who were not in the training sessions. For example, skill mastery was defined by the child demonstrating 80-90% accuracy across 2-3 days of intervention across two or more tutors (Cohen et al., 2006; Strauss et al., 2012). Concept mastery was defined as 90% accuracy of 5 to 10 novel targets within a concept. After mastery, skills and concept were tested in more naturalistic settings maintained by available contingencies in the natural environment.

In the procedures described by Lovaas (1987), high rates of problem behaviors were reduced through the use of time-out, ignoring, shaping of alternative behaviors

and, as a last resort, the delivery of a loud “no” and other contingent physical aversive approaches. Although several studies referenced following the Lovaas or similar model through the use of manuals (Eikeseth et al., 2012; Howard et al., 2005; Reed et al., 2007; Reed & Osborne, 2012; Sallows et al., 2005), multiple studies explicitly stated omitting the use of contingent physical punishment procedures (Reed et al., 2007; Sallows et al., 2005). Eight studies referenced specifically planning for generalization by working on discrete skills in other natural settings (e.g., home) or with peers in small groups (Cohen et al., 2006; Eikeseth et al., 2002; Eikeseth et al., 2012; Fava et al., 2011; Lovaas, 1987; Smith et al., 2000; Strauss et al., 2012; Zachor et al., 2007). The first year of treatment concentrated on individual-focused skills (reducing self-stimulatory and aggressive behaviors, building compliance to verbal requests, imitation skills, establishing the beginnings of appropriate toy play). The second year of treatment emphasized expressive and early abstract language and focused on more social and community based skills including interactive play with peers. The third year of treatment emphasized pre-academic tasks and observational learning (learning by observing other children learning) within preschool placement programs.

ABA-home. Out of nine ABA-based studies in the home setting, eight reported significant results for at least one of the dependent variables measured (Cohen et al., 2006; Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Smith et al., 2000). Three studies took the children’s development into consideration by individualizing goals and objectives from ongoing evaluations such as standardized assessments and direct observational measurement (Howard et al., 2005; Remington et al., 2007; Smith et al., 2000).

However, only one study specified taking into consideration typical developmental trajectory when developing the child's individualized treatment program (Remington et al., 2007). Five studies (Lovaas, 1987; McEachin et al., 1993; Reed et al., 2007; Reed & Osborne, 2007; Smith et al., 2000) reported use of a treatment manual or protocol during treatment (e.g., Maurice, Green, & Foxx, 2001; Maurice, Green, & Luce, 1996; Lovaas et al., 1980). Two studies referenced the manual by Lovaas (1980). Parent involvement was reported in seven studies (Cohen et al., 2006; Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Remington et al., 2007; Smith et al., 2000). The majority of studies did not provide the amount of time (hours/week) that parents were involved in the treatment. Describing the roles from least to most intensive, parents participated in their child's treatment by learning how to interact with their children more effectively through group workshops on core topics (e.g., theoretical principles of ABA, teaching strategies, functional communication and data record; Cohen et al., 2006; Howard et al., 2005), providing opportunities for their child to generalize skills outside of therapy sessions (Howard et al., 2005; Lovaas 1987; McEachin 1993), providing input on priorities and goals (Cohen et al., 2006; Howard et al., 2005; Remington et al., 2007), or working alongside therapists for approximately 5 hours/week for the first 3 months of treatment (Smith et al., 2000) or serving as co-therapists as part of their child's intervention team (Remington et al., 2007). One study reported treatment fidelity as part of their procedures (Cohen et al., 2006). Cohen et al. (2006) chose a random sample of videotaped sessions of therapists with the child and asked raters external to the treatment program to rate them for adherence to the procedural protocols. However, researchers did not report results for these procedures.

ABA-school. Out of five ABA-based studies in the school setting, three reported significant results for at least one of the dependent variables measured (Eikeseth et al., 2002, 2007, 2012). All three studies were individualized to meet the children's needs and guided by developmental sequences. Two out of three studies reported using a manual (Eikeseth et al., 2002, 2012). In all three studies, parents participated in their child's treatment, although the roles varied in intensity. Parents attended initial parent training seminars on autism, participated in parent training and/or treatment for 4 to 10 hours/week (Eikeseth et al., 2002, 2012), implemented maintenance and generalization programs in the home and community (Eikeseth et al., 2002), or participated in weekly reviews of the child's progress with the therapists and supervisors for up to 2 hours (Eikeseth et al., 2002, 2012). None of the three studies reported fidelity measures.

ABA-clinic. There were four ABA-based studies in the clinical setting that reported significant results for at least one of the dependent variables measured (Fava et al., 2011; Sallows et al., 2005; Strauss et al., 2012; Zachor et al., 2007). Two studies utilized a cross-setting complementary staff and parent-mediated treatment model in which treatment was alternated from clinic to home, back to clinic and so on for the duration of the treatment. For instance, treatment was conducted for 25 hours/week by therapists in the clinic for a 1-week rotation, followed by at least 10 hours/week conducted by the parent in the home for a 3-week rotation (Strauss et al., 2012) or 26 hours/week by the therapists in the clinic for a 3-week rotation, followed by 12 hours/week by the parents in the home for 3 weeks, followed by a 1-week follow-up in the clinical setting (Fava et al., 2011). Home-based treatments followed an individual treatment plan (Fava et al., 2011; Strauss et al., 2012). All four studies took the

children's development into account by individualizing treatment programs to meet the children's strengths and needs. One out of four studies (Fava et al., 2011) reported the specific assessment used to evaluate strengths and needs (Assessment of Basic Language and Learning Skills or ABLLS-R; Partington & Sundberg, 1998). One out of four studies utilized a manual, the "Me Book" by Ivar Lovaas (Sallows et al., 2005). All four studies reported parent involvement. Parent roles included: providing input for goals and participating in a weekly review of the child's progress with the therapists (Fava et al., 2011; Sallows et al., 2005; Strauss et al., 2012; Zachor et al., 2007), attending a 4-week parent training (i.e., one week theoretical workshop totaling 15 hours, one week observation of treatment in play rooms in the clinical setting totaling 5-6 hours, one week of video observation of one-to-one sessions totaling 5-6 hours, and one week of participating in supervised one-to-one sessions totaling 6 hours; Fava et al., 2011; Strauss et al., 2012), and a more intensive role as a co-therapist (i.e., implementing supervised parent-directed treatment application totaling 5 hours/week at the clinic every month and 19 hours/week of treatment to the child in the home setting (Fava et al., 2011; Strauss et al., 2012). A fidelity protocol to ensure the treatment was correctly carried out was in place for two studies (Fava et al., 2011; Strauss et al., 2012). Strauss (2012) conducted video observation ratings of therapy sessions. However neither study provided results.

Developmental-based Programs

Out of five studies in the developmental category, three studies reported significant results for at least one of the dependent variables measured (Aldred et al., 2004; Pajareya & Nopmaneejumruslers, 2011; Salt et al., 2002). Developmental based

studies focused primarily on social-developmental or social-communicative approaches through play, communication and social interactions. Two of the studies focused on increasing the quality of parental responsiveness and communication by teaching parents how to encourage communicative exchanges or the back and forth interaction of communication (Aldred et al., 2004; Pajareya & Nopmaneejumruslers, 2011). Treatment strategies included observing the child's cues, following the child's lead, and responding to or expanding on any child-initiated communication.

Developmental-home. Out of two developmental-based studies, one reported significant results for at least one of the dependent variables measured (Pajareya & Nopmaneejumruslers, 2011). The treatment program was based on following the child's lead and interests and individualized to the child's current level of functional development to achieve treatment goals. Although the study outlined that the target treatment was based on the DIR/Floortime™ intervention developed by Greenspan and Wieder, authors did not report using a manual to direct therapists (i.e., parents) in the implementation of the program. Parents attended a 3 hours lecture on the basic concepts of DIR technique and biological challenges of the children with ASD, observed the therapists modeling the strategies and then independently demonstrated the same skills, and were asked to practice Floortime™ and semi-structured problem-solving activities for a minimum of 20 hours/week at home. The authors did not report fidelity measures.

Developmental-school. Out of three developmental-based studies, two reported significant results for at least one of the dependent variables measured (Aldred et al., 2004; Salt et al., 2002). However, one study (Salt et al., 2002) did not fully describe the

treatment program but referenced other studies (Salt et al., 1999; 2001), which could not be located. Therefore the following description refers to one study (Aldred et al., 2004). The authors referenced child development by centering treatment on the developmental progression of early-prelinguistic skills. A treatment protocol was utilized, although the authors did not provide any additional specific details. Parents' involvement included attending a series of psycho-educational workshops and monthly treatment sessions for 6 months in which the therapists gave feedback to the parents based on videotaped interactions between parents and children. Parents were also asked to spend 30 min per day practicing the strategies at home in order to generalize them to natural daily routines. Finally, the authors did not report the use of any fidelity protocols.

Developmental-clinic. There were no developmental-based studies in the clinical setting.

Hybrid-based Programs

Out of eight hybrid-based studies, seven reported significant results for at least one of the dependent variables measured (Dawson et al., 2010; Goods et al., 2013; Kasari et al., 2006; 2012; Landa et al., 2011; Reed et al., 2013; Strain & Bovey 2011). Hybrid-based studies were characterized by a focus on developing goals based on a developmental curriculum but using science-based teaching strategies (e.g., shaping, chaining, operant conditioning) within a mix of teaching formats (e.g., DTT, pivotal response training, naturalistic teaching, or milieu teaching). Interventions were a mix of clinician-led (DTT) and child-led methods (naturalistic teaching). Naturalistic teaching included incidental teaching and natural environment teaching in which the therapist

targeted language goals by contriving more naturalistic opportunities in the environment to elicit child-initiated communication. These opportunities often involved the therapist following the child's interests and choosing materials that match the child's interests to engage the child. For example, Kasari et al. (2006) began sessions with DTT for 5 to 8 minutes to introduce target skills. The therapist then moved to working on the same goal with the child, but on the floor using more naturally occurring opportunities. Therefore, the sessions began in a very structured, therapist-led format but progressed to a more child-led, semi-structured format. While on the floor, the therapist interacted with the child by narrating what the child was doing, expanding on what the child said, providing eye contact, giving corrective feedback, and making environmental adjustments to facilitate the child's social and communicative attempts. Another characteristic of hybrid-based studies included a child-driven focus of treatment (e.g. following the child's lead and interest in activities, commenting or expanding on what the child says, presenting frequent ecologically valid opportunities to initiate and respond through the use of highly motivating materials to elicit child-initiated communication).

Hybrid-home. There were two hybrid-based studies in the home setting that reported significant results for at least one of the dependent variables measured (Dawson et al., 2010; Reed et al., 2013). Both of the programs took into account the child's needs (Reed et al., 2013) or were based on a developmentally informed curriculum (Dawson et al., 2010). In both cases, protocols were utilized and are available upon request to the paper's authors. Parents were asked to participate in their child's treatment program, although only one study outlined specific details of the parents' role. In Dawson et al. (2010), parents were taught the teaching strategies and

asked to use them during everyday activities (e.g., feeding, bath time, and play) at home. Parents reported spending an average of 16.3 hours/week using the strategies. Out of two studies, treatment fidelity was measured in one study to demonstrate the therapists' competency for implementing the treatment correctly (Dawson et al., 2010).

Hybrid-school. There were three hybrid-based studies in the school setting that reported significant results for at least one of the dependent variables measured (Goods et al., 2013; Landa et al., 2011; Strain & Bovey, 2011). Child development was considered by developing the program based on preschool models and curricula (Strain & Bovey, 2011), on developmental goals (Goods et al., 2013) and/or the child's individual developmental profile (Landa et al., 2011). However, only one program referenced using a manual (Strain & Bovey, 2011). In two of three studies, parents were encouraged to participate through attending parent training about autism and strategies although they were not necessarily required to commit to any specific number of hours (Landa et al., 2013; Strain & Bovey, 2011). All three studies reported treatment fidelity protocols through a frequency count of completed treatment components or procedural rating scale (Goods et al., 2013; Landa et al., 2011; Strain & Bovey, 2011).

Hybrid-clinic. Out of three hybrid-based studies in the clinical setting, two reported significant results for at least one of the dependent variables measured (Kasari et al., 2006; 2012). However, the Kasari et al. (2012) is a follow-up of the Kasari et al. (2006) study and did not include any additional intervention. The following describes the treatment components from Kasari et al. (2006). The treatment plans were developed based on the results from the initial assessments (e.g., Early Social-Communication Scales, Structured Play Assessment and the 15-minute videotaped interaction with the

mother). Authors developed a manual, which was available upon request. Parents were not included in the child's treatment program. The research coordinator conducted fidelity measures using a checklist reflecting the procedure protocol during randomly chosen sessions. However, fidelity results were not reported.

Idiosyncratic-based Programs

There were nine idiosyncratic-based studies. Seven studies reported significant results for at least one of the dependent variables measured (Jocelyn et al., 1998; McConkey et al., 2010; Ozonoff et al., 1998; Perry & Condillac, 2010; Schertz et al., 2013; Sofronoff et al., 2004; Tsang et al., 2007). Idiosyncratic studies were not characterized by any one type of treatment strategy or focus. Three studies used TEACCH principles (e.g., structured learning environments, focus on visual supports, use of a schedule to help the child anticipate future events; Ozonoff & Cathcart, 1998; McConkey et al., 2010; Tsang et al., 2007). Four studies focused intensively on parent-training, using a variety of methods (e.g., group training, lectures, videotapes, discussion and print materials) to convey information on autism characteristics, management of problem behaviors, rigid behaviors, anxiety management, facilitating language and social development, and enhancing the mutual enjoyment of interactions between parents and their children with autism (Jocelyn et al., 1998; Perry & Condillac, 2010; Schertz et al., 2013; Sofronoff et al., 2004).

Idiosyncratic-home. Out of five idiosyncratic-based studies in the home setting, four reported significant results for at least one of the dependent variables measured (Ozonoff et al., 1998; McConkey et al., 2010; Schertz et al., 2013; Sofronoff et al., 2004). One of four studies individualized the program to meet the child's developmental needs,

focusing on the child's emerging skills as determined from the Psychoeducational Profile-Revised (PEP-R) assessment (Ozonoff et al., 1998). Two out of four studies used a treatment protocol or manual (Schertz et al., 2013; Sofronoff et al., 2004) and therapists completed a checklist according to the manual to indicate that all the treatment components had been completed (Sofronoff et al., 2004). All four studies reported parent involvement in various capacities. Parents provided input on setting goals (Ozonoff et al., 1998; McConkey et al., 2010) and agreed to conduct treatment for approximately 30 minutes per day at home (Ozonoff et al., 1998; Schertz et al., 2013), or participated in a parent training workshop and learned strategies from therapists (McConkey et al., 2010; Sofronoff et al., 2004). One of four studies reported use of a fidelity of implementation checklist, but did not provide any measured results as part of the study (Schertz et al., 2013).

Idiosyncratic-school. Out of three idiosyncratic-based studies in the school setting, two reported significant results for at least one of the dependent variables measured (Jocelyn et al., 1998; Tsang et al., 2007). One of the two programs made efforts to take the child's development into account by developing the treatment program in consultation with developmental counselors (Jocelyn et al., 1998). Neither of the two studies reported any information on use of a manual or protocol. One of two studies reported parent involvement (Jocelyn et al., 1998). Parents were invited to be active team members who met for three meetings: prior to treatment, during treatment and after treatment. They also participated in educational seminars. Neither of the two programs reported information on fidelity protocols.

Idiosyncratic-clinic. There was one idiosyncratic-based study in the clinical setting that reported significant results for at least one dependent variable (Perry & Condillac, 2010). The program used results from a comprehensive developmental and diagnostic assessment to determine individualized goals appropriate for each child. No specific information was given about this assessment or the use of any protocol or manual to prescribe teaching strategies. Parents participated in a weekly session that was divided into three parts: didactic group instruction, working directly with their child under a therapist's supervision, and parent support and review with the therapists in a group setting. During the group instruction, the children worked one-on-one with their therapist while the parents received instruction about the basics of autism, behavioral teaching principles (e.g., selecting goals, instructional skills), family issues and stress management. During the supervised therapy with their child, therapists coached and provided feedback and encouragement to parents as they conducted therapy with their child. During the parent support group, parents received homework readings and exchanged information and support with other parents while their child was engaged in a group activity. No fidelity measures were reported.

KQ3: What are the characteristics of treatment service delivery related to the effective outcome?

For each of the theoretical models (ABA, developmental, hybrid, idiosyncratic) and settings (home, school, clinic) pertaining to each model, we examined general characteristics of treatment service delivery (i.e., intensity of treatment in hours; duration of treatment; qualifications of therapists; qualifications of supervisors; therapist training activities; supervision activities; multidisciplinary approach; service model type such as

collaborative or consultative model; and frequency of progress review) only from studies that reported effective outcomes for at least one of the dependent variables measured (and excluded studies without effective outcomes). Intensity of treatment refers to the average number of treatment hours per week and range across the studies in the respective group. For the majority of studies, the authors did not delineate between prescribed treatment hours or actual reported treatment hours. Duration of treatment refers to how long the treatment lasted, reported in months and years. The qualifications of therapists and supervisors refer to the educational and professional background reported for therapists and supervisors. The training of therapists refers to the strategies and activities used to teach therapists to conduct therapy. The supervision activities refer to specific activities the supervisors conducted during the treatment in order to monitor therapists' performances and the child's programming. The multidisciplinary approach refers to the inclusion of professionals from different professional specializations who consulted for or worked with children in the program. The service model type refers to whether the program utilized a consultative or collaborative service model. In a consultative model, the professional or supervisor met with therapists or parents to advise or provide direction for future treatment implementation. In a collaborative model, the professional worked alongside or in conjunction with the therapists to provide treatment. Frequency of progress review refers to how often the child's progress was reviewed in order to determine continuation of the program. Figure KQ 3-1 summarizes therapist and supervisor qualifications and training components according to theoretical models (i.e., ABA, hybrid and idiosyncratic) and settings (i.e., home, school, clinic). Table 1-4 and 1-5 summarize the inclusion of multidisciplinary

personnel, service delivery model and frequency of progress review for continuation of services. For both tables, “Yes” indicates at least 50% of the studies of in the respective category (e.g., ABA in the home setting) reported information for the component. “No” indicates that less than 50% of the studies in the respective category reported information for the component. Overall trends according to the theoretical models (i.e., ABA, hybrid and idiosyncratic) are also noted. “Yes” indicates at least 50% of the studies in the respective model (e.g., ABA-based studies across all settings) reported information for the component. “No” indicates that less than 50% of the studies in the respective model reported information for the component. Studies reporting non-significant outcomes for all measured variables in the study were excluded in the discussion of service delivery components related to effective outcomes.

It should be noted it is not possible to draw firm conclusions about potential relations between positive study outcomes and specific, individual variables relating to the characteristics of treatment service delivery (e.g., intensity of treatment in hours; duration of treatment; qualifications of therapists; qualifications of supervisors; therapist training activities; supervision activities; multidisciplinary approach; service model type such as collaborative or consultative model; and frequency of progress review). Further, this was the case across each of the theoretical models. We are unable to draw firm conclusions about potential relations between positive study outcomes and specific, individual variables relating to the characteristics of treatment service delivery because none of the variables were isolated within the context of any of the reviewed studies.

Table 1-4

Summary of Therapist and Supervisor Components

	Setting	Therapist qualifications	Therapist activities	Supervisor qualifications	Supervision activities
ABA	Home	Yes	No	Yes	No
	School	Yes	No	Yes	Yes
	Clinic	No	Yes	Yes	No
	Overall	Yes	No	Yes	No
Developmental	Home	Yes	Yes	No	Yes
	School	Yes	Yes	No	No
	Clinic	n/a	n/a	n/a	n/a
	Overall	Yes	Yes	No	Yes
Hybrid	Home	Yes	Yes	Yes	No
	School	Yes	No	No	No
	Clinic	Yes	Yes	No	Yes
	Overall	Yes	No	No	No
Idiosyncratic	Home	Yes	Yes	No	No
	School	No	No	No	No
	Clinic	No	No	No	Yes
	Overall	No	No	No	No

Note. Yes = 50% or more of the studies in the category reported the component.

Table 1-5

Summary of Service Delivery Components

	Setting	Multidisciplinary	Service model	Progress review
ABA	Home	No	No	No
	School	No	Yes	No
	Clinic	No	Yes	No
	Overall	No	Yes	No
Developmental	Home	No	Yes	No
	School	No	Yes	No
	Clinic	n/a	n/a	n/a
	Overall	No	Yes	No
Hybrid	Home	Yes	Yes	No
	School	No	No	No
	Clinic	No	No	No
	Overall	No	No	No
Idiosyncratic	Home	No	Yes	No
	School	Yes	Yes	No
	Clinic	No	Yes	No
	Overall	No	Yes	No

Note. Yes = 50% or more of the studies in the category reported the component.

ABA-based Programs

Out of 18 studies in the ABA category, 15 reported significant results for at least one of the dependent variables measured in each respective study (Cohen et al., 2006; Eikeseth et al., 2002; 2007; 2012; Fava et al., 2011; Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Sallows et al., 2005; Smith et al., 2000; Strauss et al., 2012; Zachor et al., 2007). The following outlines the service delivery components for the 15 ABA-based studies according to three settings (home, school and clinic).

ABA–home. Out of 10 ABA-based studies in the home setting, eight reported significant results for at least one of the dependent variables measured in each respective study (Cohen et al., 2006; Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Smith et al., 2000). Two studies differentiated treatment hours based on age in which children younger than 3 years of age received between 22.5 to 30 treatment hours (range 20 to 30 hours) per week and children older than 3 years of age received between 30.5 to 35.5 treatment hours (range 26 to 40 hours) per week (Cohen et al., 2006; Howard et al., 2005). Of the remaining six studies, the average number of treatment hours was 32.7 hours (range 18.4 to 40 hours). All eight studies reported treatment duration data, which averaged 20.6 to 22.1 months (range 9 to 36 months). In four of eight studies, the therapists were college students (Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Smith et al., 2000). In three studies, the therapists were tutors (Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007). In one study, the therapists were people recruited from the community (Cohen et al., 2006). Four of eight studies provided information on therapist qualifications. In two studies, the undergraduate therapists worked a minimum of 6 months under supervision (Lovaas, 1987; McEachin et al., 1993). In two studies, therapists were required to pass a rigorous behavior observation assessment evaluating their accuracy or proficiency on conducting DTT, and a competency knowledge test (Cohen et al., 2006; Smith et al., 2000). In addition, one study also required therapists to receive favorable ratings from their supervisors (Smith et al., 2000). Six of eight studies reported supervisor qualifications. In three studies, supervisors were Board Certified Behavior Analysts (BCBA; Reed et al., 2007;

Reed & Osborne 2012; Remington et al., 2007) or master teacher-level Comprehensive Application of Behavior Analysis to Schooling (CABAs ; Reed et al., 2007) and with a Ph.D. (Remington et al., 2007). In two studies, the supervisors were graduate students in behavior analysis or master's level clinicians (Cohen et al., 2006; Howard et al., 2005) and with two or more years of experience in providing EIBT (Cohen et al., 2006). In one study, the supervisors were senior student therapists with a minimum of 1500 hours of one-to-one treatment experience at the UCLA Young Autism Project, who demonstrated mastery of research pertaining to ABA treatment, and satisfactory scores during behavior observation of skill at designing and implementing treatment plans, satisfactory ratings from other supervisors (Smith et al., 2000). None of the eight studies reported therapist training activities. Two of eight studies reported supervision activities. In one study, supervision activities included extended team meetings at regular intervals such as every 2 months (Remington et al., 2007). In the second study, clinic supervisors trained and provided ongoing performance feedback to therapists, although specific training procedures were not reported (Cohen et al., 2006). None of the eight studies reported a multidisciplinary approach component. Two of eight studies reported a consultative model in which consultants attended the meetings approximately every 2 months and were available through phone or email to provide additional clinical supervision (Cohen et al., 2006; Remington et al., 2007). None of the studies reported information regarding the frequency of progress review to continue services.

ABA –school. Out of five ABA-based studies in the school setting, three reported significant results for at least one of the dependent variables measured in each respective study (Eikeseth et al., 2002, 2007, 2012). All three studies reported treatment

hours, which averaged 23 treatment hours (range 15 to 37 hours) per week. The average treatment duration is 18 months (range 12 to 36 months). In the three studies, therapists were aides (Eikeseth et al., 2002, 2007) and teachers (Eikeseth et al., 2002, 2007, 2012). Most of the therapists did not have any experience in ABA or EIBI prior to treatment. Supervisor qualifications were reported in all three studies, which included a minimum of 1500 hours experience implementing UCLA treatment (Eikeseth, 2002), professional behavior analysts with extensive research and clinical experience with the UCLA model (Eikeseth et al., 2007) or a minimum of bachelor's degree in psychology of pedagogy, although half had master's degree in psychology or speech pathology and one supervisor had a BCBA (Eikeseth et al., 2012). One out of three studies reported therapist training activities. Training consisted of an apprenticeship format in which supervisors set up the children's programs and the therapists implemented them, but received in-vivo feedback from supervisors. Therapists also received hands-on training during weekly meetings (Eikeseth et al., 2002). All of the studies reported supervision activities. Weekly two-hour supervision meetings were held for each child. The child, primary caregiver, therapists, and supervisor attended. At the meetings, the child's treatment program was modified and updated based on the child's development during the preceding week. Also, therapists and parents received hands-on training (Eikeseth et al., 2002, 2007, 2012). None of the studies reported a multidisciplinary approach component. All of the studies followed a consultative model in which the supervisors advised therapists and parents through ongoing meetings and supervision. None of the studies reported information regarding the frequency of progress review to continue services.

ABA – clinic. There were four ABA-based studies in the clinical setting that reported significant results for at least one of the dependent variables measured (Fava et al., 2011; Sallows et al., 2005; Strauss et al., 2012; Zachor et al., 2007). Of the four studies, the average number of treatment hours was 30.65 hours (range 14 to 35 hours) per week. The average treatment duration is 21 months (range 12 to 48 months). Three of four studies employed staff as therapists (Fava et al., 2011; Sallows & Graupner 2005; Strauss et al., 2012) in which one study described therapists as skilled behavior therapists (Zachor et al., 2007) and two studies additionally included parents as co-therapists (Fava et al., 2011; Strauss et al., 2012). One of four studies reported therapist qualifications. The therapist had to be at least 18 years old and have a minimum of one year in college (Sallows & Graupner, 2005). Two of four studies reported the supervisor qualification component, which included a Bachelor of Arts degree in psychology, one-year experience as a therapist, two full years of full-time experience as a senior therapist, completion of a 9-month internship at UCLA for one study (Sallows et al., 2005) and the director of the clinic for the second study (Fava et al., 2011). Two of four studies reported a variety of therapist training activities. In one study, therapists underwent a theoretical workshop lasting one week (15 hours), followed by one week of treatment observations in play rooms (6 hours) and videoed observations of one-to-one session under supervision (6 hours), and concluded with one week of participation in supervised one-to-one sessions (5 hours) and direct treatment application (10 hours; Fava et al., 2011). In the second study, therapists received 30 hours of training, which included a minimum of 10 hours of one-to-one training and feedback while working with their assigned child (Sallows et al., 2005).

Supervision was reported in all four studies, although specific activities were described in only one of four studies. In one study, parents received one hour of weekly supervision with the child's therapist and/or supervisor. Such supervision provided (1) individualized advice and guidelines aimed to facilitate parental observation of child behavior change and the appropriate application of teaching strategies, (2) checks that essential criteria for target progress has been measured and achieved (Strauss et al., 2012). One of four studies reported a multidisciplinary approach consisting of a speech therapist and occupational therapist who consulted with the therapist teams (Zachor et al., 2007). Two studies were consultative and two were collaborative. In the two consultative studies, there was a weekly consultation by the senior author or clinic supervisor (Sallows et al., 2005) or by other professionals such as the speech therapist or occupational therapist. In the two collaborative studies, parents and therapists worked together to provide therapy across school and home environments (Fava et al., 2011; Strauss et al., 2012). None of the studies reported information regarding the frequency of progress review to continue services.

Developmental-based Programs

Out of five studies in the developmental category, three studies reported significant results for at least one of the dependent variables measured (Aldred et al., 2004; Pajareya & Nopmaneejumruslers, 2011; Salt et al., 2002). The following outlines the service delivery components for the three developmental-based studies according to three settings (home, school and clinic).

Developmental-home. Out of two developmental-based studies in the home setting, one reported significant results for at least one of the dependent variables

measured (Pajareya & Nopmaneejumruslers, 2011). The treatment hours averaged 15.2 hours/week. The treatment duration is 3 months. Parents served as the therapists. Prior to the start of the study, parents attended a one-day training workshop presented by the first author, to learn about the DIR/Floortime™ model. The first author held degrees in rehabilitation medicine, training in the DIR/Floortime model from books, manuals, the Floortime DVD series and experience as a home consultant for 2 years before the study started. Parents also received a 3-hour DVD lecture of the workshop (e.g., the basic concept of DIR, the biological challenges of ASD, details of Greenspan's "Six Functional Developmental Levels"). Although supervision was reported, it was not clear who the supervisors were or their qualifications. Training of parent-therapists included the use of modeling by the trainer, asking parent trainees to independently demonstrate the same skill, and the trainer coaching or providing feedback about their performance. The training lasted 1.5 hours and focused on teaching parents to observe their child's cues, follow the child's lead, and implement the Floortime™ techniques that were appropriate for their child's current level of functional development to achieve the identified goals. Supervision consisted of a supervisor following up with families at the end of the first month. The supervisor used modeling and coaching feedback to improve parents' performances with their children. The feedback focused on replacing controlling and intrusive responses with responses aimed at facilitating two-way communication between parents and their children. Goals, methods and techniques of the home program were also refined during this time to maximize the child's progress. No information was provided on the inclusion of a multidisciplinary approach. The program

was considered a consultative model. None of the studies reported information regarding the frequency of progress review to continue services.

Developmental-school. Out of three developmental-based studies, two reported significant results for at least one of the dependent variables measured (Aldred et al., 2004; Salt et al., 2002). However, one study (Salt et al., 2002) did not fully describe the treatment program but referenced methods in other studies (Salt et al., 1999; 2001), which could not be located. Therefore the following description refers to one study (Aldred et al., 2004). Treatment intensity was approximately 3.5 hours/week (i.e., 0.5 hours daily). Treatment duration was approximately 12 months. During the first 6 months, the parents and child attended a monthly treatment session followed by less frequent maintenance sessions during the remaining 6 months. The therapists were parents, who attended a series of parental psycho-educational workshops prior to the start of the treatment program. The authors defined “psycho-educational” as promoting the understanding of the early communication stages that precede development of language and meaningful communication. No other therapist or supervisor qualifications were reported. Therapist training consisted of reviewing videotaped interactions between the therapist (parent) and child and discussing changes to the parent interaction and communication responses. These were recorded in a written program and the pace of work adapted to the family’s progress. No information was provided on supervision activities or the inclusion of a multidisciplinary approach. The format of therapist training was through a consultative model. None of the studies reported information regarding the frequency of progress review to continue services.

Developmental-clinic. There were no developmental-based studies in the clinical setting.

Hybrid-based Programs

Out of eight hybrid-based studies, seven reported significant results for at least one of the dependent variables measured (Dawson et al., 2010; Goods et al., 2013; Kasari et al., 2006; 2012; Landa et al., 2011; Reed et al., 2013; Strain & Bovey 2011). The following outlines the service delivery components for hybrid-based studies according to three settings (home, school, and clinic).

Hybrid-home. There were two hybrid-based studies in the home setting that reported significant results for at least one of the dependent variables measured (Dawson et al., 2010; Reed et al., 2013). Both studies reported treatment hours, which averaged 21.2 treatment hours (range 6.4 to 31.5 hours) per week. In one study, half of the 31.5 hours were conducted in the clinic by therapists (15.2 hours) and the other half at home by parents (16.3 hours; Dawson et al., 2010). The average treatment duration is 17 months (range 10 to 24 months). The direct providers included therapists (Dawson et al., 2010; Reed et al., 2013) and parents (Dawson et al., 2010). Only one study reported therapist qualifications. Therapists were only required to have a baccalaureate degree (Dawson et al., 2010). One of two studies reported supervisor qualifications. Supervisors were graduate-level, trained lead therapists who had a minimum of 5 years' experience providing early intervention to young children with autism (Dawson et al., 2010). One of two studies reported training activities for the therapists. Training consisted of 2 months training by the lead therapist, weekly supervision meetings with the lead therapist; therapists trained to competency (completing coursework, passing

tests, mastering intervention and demonstrating fidelity of 85% of maximum scores on fidelity instrument; Dawson et al., 2010). Both of the studies reported supervision by lead therapists or qualified facilitators but did not report any specific supervision activities. Both studies also reported the inclusion of multidisciplinary professionals. In one study, there was ongoing consultation from a clinical psychologist, speech-language pathologist, and developmental behavioral pediatrician. An occupational therapist provided consultation as needed (Dawson et al., 2010). The second study included a speech-language pathologist (SLP), occupational therapists (OT), and educational psychologist (Reed et al., 2013). One of the two studies reported both a consultative and collaborative model for different aspects of the program. The multidisciplinary staff consulted on intervention objectives and strategies. Both studies cited using a collaborative service model. In the first study, sessions were observed at least biweekly by the lead therapist and every 3 months by the speech-language pathologist. Parents and therapists collaborated such that the parents chose teaching objectives from the curriculum that they viewed as high priority and therapists provided parents training in ESDM strategies to address the objectives (Dawson et al., 2010). In the second study, trained facilitators established the program under the direction of an Advisory Teacher with additional input from an SLP, OT, educational psychologist and parents/family. A sensory curriculum was also devised and monitored by an occupational therapist (Reed et al., 2013). None of the studies reported information regarding the frequency of progress review to continue services.

Hybrid-school. There were three hybrid-based studies in the school setting that reported significant results for at least one dependent variable measured (Goods et al.,

2013; Landa et al., 2011; Strain & Bovey, 2011). All studies reported treatment hours, which averaged 8.6 hours (1 to 15 hours) per week. The average treatment duration is 11 months (range 3 to 24 months). Two of three studies reported qualifications of the therapists. In one study, therapists were graduate students in educational psychology and experienced in intervention methods with children with autism (Goods et al., 2013). In the second study, therapists were preschool staff members with advanced degrees (Strain & Bovey, 2011). None of the studies reported supervisor qualifications. One of three studies reported training activities for therapists. The educational model for training therapists consisted of seven-phases: a) presentation of skill area to be learned in written/presentation format; b) discussion of skill area between trainee(s) and trainer(s); c) demonstration of skill by trainer with simultaneous observation by trainee(s); d) in-vivo practice by trainee(s) with observation and feedback provided by trainer; e) evaluation of trainee competency based on direct observation or permanent product; f) training of on-site supervisor to support direct-line replication staff; and g) follow-up training and maintenance checks on a 6 to 8 week basis (Strain & Bovey, 2011). None of the studies reported supervision activities or the inclusion of other multidisciplinary professionals. One of three studies reported using a consultative model (Strain & Bovey, 2011). None of the studies reported information regarding the frequency of progress review to continue services.

Hybrid-clinic. Out of three hybrid-based studies in the clinical setting, two reported significant results for at least one of the dependent variables measured (Kasari et al., 2006; 2012). However, the Kasari et al. (2012) is a follow-up of the Kasari et al. (2006) study and did not include any additional intervention. The following describes the

treatment components from Kasari et al. (2006). The treatment hours were 2.5 hours/week. The treatment duration was 5-6 weeks. Therapists were trained graduate-level students in educational psychology. Supervision qualifications were not reported. Training for therapists consisted of practicing with two to three pilot subjects while under constant supervision prior to the start of the study. Supervision activities included weekly supervision by the primary investigator and three times per week supervision by the research coordinator throughout the duration of the study. Multidisciplinary personnel and use of a consultative or collaborative model were not reported. None of the studies reported information regarding the frequency of progress review to continue services.

Idiosyncratic-based Programs

There were nine studies that were idiosyncratic-based. Seven studies reported significant results for at least one of the dependent variables measured (Jocelyn et al., 1998; McConkey et al., 2010; Ozonoff et al., 1998; Perry & Condillac, 2010; Schertz et al., 2013; Sofronoff et al., 2004; Tsang et al., 2007). The following outlines the service delivery components for idiosyncratic-based studies according to three settings (home, school, and clinic).

Idiosyncratic-home. Out of five idiosyncratic-based studies in the home setting, four reported significant results for at least one of the dependent variables measured (Ozonoff et al., 1998; McConkey et al., 2010; Schertz et al., 2013; Sofronoff et al., 2004). The average number of treatment hours was 2.28 hours (1 to 4.5 hours) per week. The average treatment duration is 5 months (range of 1.5 months to 11 months). The therapists included parents (Ozonoff et al., 1998; McConkey et al., 2010; Schertz et al.,

2013; Sofronoff et al., 2004), intervention coordinators (Schertz et al., 2011), graduate level students (Ozonoff et al., 1998; Sofronoff et al., 2004), and speech and language therapists with experience and interest in autism (McConkey et al., 2010). Three of four studies reported therapist qualifications. Intervention coordinators had master's degrees in early childhood education and an Ed.S. degree in counseling (Schertz et al., 2011). The graduate-level students were students at the University of Utah in the department of psychology (Ozonoff et al., 1998) or clinical master's or Ph.D. students completing internships at the Behaviour Research and Therapy Centre at the University of Queensland who were trained in the use of techniques and delivery of materials of the program (Sofronoff et al., 2004). Although three of four studies reported the occurrence of supervision, information on the specific supervisor qualifications were not reported. In one study, there were "layers" of supervision such that parent-therapists were supervised by staff therapists, who were then supervised by a registered psychologist or study authors (Ozonoff et al., 1998). Of the two remaining studies, researchers or study authors supervised staff therapists (Schertz et al., 2011) or staff therapists supervised parents (Ozonoff et al., 1998). No information was provided regarding staff therapist training. However, three of four studies reported information on parent-therapist training (Ozonoff et al., 1998; Schertz et al., 2011; Sofronoff et al., 2004). In a clinical setting, one staff therapist modeled intervention strategies while a second therapist explained the techniques in detail to the parent-trainee. Additionally, specific practice activities were provided in written format for parents to try at home (Ozonoff et al., 1998). In a second study, the therapists video-recorded the parents interacting with their children and then facilitated a guided reflection using the recording, in relation to the lesson on

the targeted outcome and mediated learning principle of that week. Then the therapists reviewed the next targeted outcome and principle in the sequence, along with accompanying print material and video example of the new strategies. Additional print materials sent home with the parents outlined what the child was expected to learn, how the parent could apply the featured principle to promote the current outcome, a brief vignette illustrating the lesson and additional examples of parent-child interactive activities (Schertz et al., 2011). In the third study, parents participated in either a one-day group workshop or six individual one-hour sessions. During the group workshop, six learning components were reviewed in one sitting whereas in the six individual sessions, one component was reviewed each week. No specific information regarding the strategies used to teach these components were provided (Sofronoff et al., 2004). All four studies reported the occurrence of supervision, however only one study reported specific supervision activities. During each one-week follow-up in the clinic setting, therapists asked parents to demonstrate what strategies and activities they were implementing at home and provided parents with suggestions for fine-tuning and modifying the activities. Staff therapists also went to the child's home on at least one occasion during the treatment to directly observe parental teaching methods and the home teaching environment (Ozonoff et al., 1998). One of four studies reported the inclusion of a multidisciplinary approach. A "steering committee" consisting of a speech-language pathologist, educator, psychologist and University personnel worked to plan, implement, and evaluate stages of the intervention (McConkey et al., 2010). Two of the four studies reported a collaborative model. In the second study, as parents became more familiar with the program and implementation strategies, parents were provided

more freedom and responsibility to select, design, and carry out the home programs, while therapists began to fade out their presence (Ozonoff et al., 1998). None of the studies reported information regarding the frequency of progress review to continue services.

Idiosyncratic-school. Out of three idiosyncratic-based studies in the school setting, two reported significant results for at least one of the dependent variables measured (Jocelyn et al., 1998; Tsang et al., 2007). The average number of treatment hours was 28.2 hours (21.4 to 35 hours) per week. The range of treatment duration was 3 to 12 months with an average of 7.5 months. The direct providers included specially trained program staff members called “Autism Behavior Specialists” (Jocelyn et al., 1998) and teachers (Tsang et al., 2007). Specific information regarding qualifications for therapists or supervisors was not reported. Training activities for therapists and supervision activities were likewise not reported. One study (Jocelyn et al., 1998) reported using a multidisciplinary approach that was both collaborative and consultative. A social worker and behavior therapist worked together to provide services to the families. The social worker discussed basic information about autism, inquired about the families’ perspectives on autism, and answered any questions or concerns regarding goals, expectations and the child’s development. The behavior therapist reviewed behavioral strategies with the families and provided on-site consultations at the child’s day-care centers. Information on the frequency of progress review to determine continuation of services was not reported.

Idiosyncratic-clinic. There was one idiosyncratic-based study in the clinical setting (Perry & Condillac, 2010). The number of treatment hours was 3 hours/week.

The treatment duration was approximately 3 months. The direct providers included trained staff as therapists; however therapist qualifications were not reported. Supervisors included senior therapists and a psychologist; however additional supervisor qualifications were not reported. The study also did not report information on therapist training activities. Supervision activities included supervisors circulating and providing support and supervision to the therapists during the first half of the one-to-one session with the child and again to both parents and therapists during the second half of the one-to-one session while the child's therapists provided coaching, feedback, and encouragement to parents working with their children. Information regarding the inclusion of a multidisciplinary approach was not reported. The parent-training format followed a consultative model. There was no information provided on the frequency of progress review to continue services.

KQ4. What specific characteristics of children and families related to effective outcomes?

For each of the theoretical models (ABA, developmental, hybrid, idiosyncratic) and settings (home, school, clinic) pertaining to each model, we examined family and child characteristics only from studies that reported effective outcomes for at least one of the dependent variables measured (and excluded studies without effective outcomes). Family characteristics describe reported race/ethnicity and socioeconomic status (SES). Child characteristics describe age at start of treatment and diagnosis and/or severity.

It should be noted that with two notable exceptions (i.e., a potential relation between effectiveness of the Lovaas model and higher levels of severity of autism diagnosis; a potential relation between severity of autism and effectiveness of

idiosyncratic model in the home; see below) it is not possible to draw firm conclusions about potential relations between positive study outcomes and specific, individual variables relating to family and child characteristics (i.e., race/ethnicity; SES; age at start of treatment; diagnosis and/or severity). Further, this was the case across each of the theoretical models. We are unable to draw firm conclusions about potential relations between positive study outcomes and specific child and family characteristics because none of the variables were isolated within the context of any of the reviewed studies.

ABA-based Programs

Out of 18 studies in the ABA category, 15 reported significant results for at least one of the dependent variables measured (Cohen et al., 2006; Eikeseth et al., 2002; 2007; 2012; Fava et al., 2011; Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Sallows et al., 2005; Smith et al., 2000; Strauss et al., 2012; Zachor et al., 2007). The following describes the family and child characteristics for the 15 ABA-based studies according to three settings (home, school, and clinic).

ABA-home. Out of nine ABA-based studies in the home setting, eight reported significant results for at least one of the dependent variables measured (Cohen et al., 2006; Howard et al., 2005; Lovaas, 1987; McEachin et al., 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Smith et al., 2000). Two of eight studies reported race/ethnicity (Howard et al., 2005; Smith et al., 2000). Both reported over 50% of families who participated in the studies were Caucasian. The majority of studies did not provide specific information regarding SES for the families. The average starting age of children across all studies is 39.6 months (range 32 to 48 months). All of the

studies required participants to have a diagnosis of autistic disorder or pervasive developmental delay not otherwise specified (PDD-NOS) by an independent and qualified professional, according to the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994) or revised fourth edition (DSM-IV-R; American Psychiatric Association, 2000) and did not include children who had any other additional major medical conditions (e.g., Down syndrome, seizures, deafness). Lovaas (1987) conducted analyses of variance on eight pretreatment dependent measures (i.e., chronological age at diagnosis, chronological age at start of treatment, prorated mental age, recognizable words, toy play, self-stimulation, and abnormal speech) to determine if any were significantly related to outcomes (gauged by IQ and educational placement) in the experimental group and control group 1. Although both groups received the same type of treatment, the experimental group received higher intensity of treatment (i.e., 40 hours) compared to the control group 1 (i.e., 10 hours). In addition, control group 1 also received a variety of treatments from other resources in the community such as those provided by small special education classes. Prorated mental age was the only variable that was significantly related to outcome in both groups. Reed & Osborne (2012) conducted a regression analysis and found that the effectiveness of a Lovaas-modeled 30 hours/week, 9-month ABA program appeared to increase with the severity of autism diagnosis. The more severe the autism diagnosis, the more gains were made on the composite score or average of three individual measures: intellectual, educational and adaptive behavior. The control groups of this study (i.e., one special education classroom based program and two home-based programs for children with special

educational needs) showed an inverse relationship in which as severity of autism diagnosis increased, gains on the composite score decreased. However, this difference was significant between the ABA group and only one of the control groups. Remington et al., (2007) reported a statistical main effect for the group receiving ABA treatment compared to the control group who were not receiving ABA treatment. In an attempt to determine variables associated with higher gains, they then compared two subgroups within the effective ABA treatment group: the top six children who made the most gains compared to the six children who made the least gains. The exploratory analyses suggested that children who responded most positively to the treatment differed from the children who responded least positively at baseline in several ways. They had higher IQ, higher mental age, higher Vineland Composite (a measurement of adaptive behaviors), higher Communication and Social Skills scores, lower Vineland Motor skills scores, more behavior problems reported on the Developmental Behavior Checklist by both mothers and fathers, more autistic symptoms reported on the Developmental Behavior Checklist Autism Algorithm by both mothers and fathers, and fewer hours of intervention in Year 2. Great caution should be applied when interpreting these relationships between variables as they are garnered through statistical analyses rather than more rigorous experimental analyses. In addition, caution should be used because replication of the results has yet to be reported.

ABA-school. Out of five ABA-based studies in the school setting, three reported significant results for at least one of the dependent variables measured (Eikeseth et al., 2002, 2007, 2012). None of the studies reported family characteristics such as race/ethnicity or SES. The average starting ages across the three studies were 40.3 to

81.3 months (range 25 to 84 months). Two of three studies required a diagnosis of autistic disorder or PDD-NOS according to the tenth edition of the International Statistical Classification of Diseases and Related Health Problems (ICD-10; World Health Organization, 1993) and no major medical conditions (e.g., Down syndrome, seizures, deafness).

ABA-clinic. There were four ABA-based studies conducted in clinical settings that reported significant results for at least one of the dependent variables measured (Fava et al., 2011; Sallows et al., 2005; Strauss et al., 2012; Zachor et al., 2007). Family characteristics such as race/ethnicity or SES were not reported. The average treatment starting age across the four studies was 41 to 44 months (range 22 to 81 months). All studies also required a diagnosis of autism or PDD-NOS by an independent examiner and the absence of any major medical issues (e.g., seizures, hearing deficiencies).

Developmental-based Programs

Out of five studies in the developmental category, three studies reported significant results for at least one of the dependent variables measured in each respective study (Aldred et al., 2004; Pajareya & Nopmaneejumrulers, 2011; Salt et al., 2002). The following outlines the family and child characteristics for developmental-based studies according to three settings (home, school, and clinic).

Developmental-home. Out of two developmental-based studies in the home setting, one reported significant results for at least one of the dependent variables measured (Pajareya & Nopmaneejumrulers, 2011). The study was conducted in Thailand; however family characteristics such as race/ethnicity or SES were not reported. The starting ages of the children were between 24 and 72 months. Exclusion

criteria for the study included additional diagnoses aside from autistic disorder, geographical inaccessibility for follow-up, and/or parents who were not literate or with chronic psychiatric or physical illnesses.

Developmental-school. Out of three developmental-based studies in the school setting, two reported significant results for at least one of the dependent variables measured (Aldred et al., 2004; Salt et al., 2002). However, one study (Salt et al., 2002) did not fully describe the treatment program but referenced methods in other studies (Salt et al., 1999; 2001), which could not be located. Therefore the following description refers to one study (Aldred et al., 2004). Most families were Caucasian. Families were predominately middle class, but contained a wide range of educational and income levels. The starting age of children was 24 to 71 months. Children were given a clinical diagnosis of autistic disorder by the assessing professional and fulfilled the full diagnostic criteria for classical autism on the Autism Diagnostic Interview. Exclusion criteria included the presence of a severe global developmental delay, first languages other than English, diagnosis of visual or hearing impairments, and/or parents with known chronic psychiatric or physical illnesses.

Developmental-clinic. There were no developmental-based studies conducted in clinical settings.

Hybrid-based Programs

Out of eight hybrid-based studies, seven reported significant results for at least one of the dependent variables measured (Dawson et al., 2010; Goods et al., 2013; Kasari et al., 2006; 2012; Landa et al., 2011; Reed et al., 2013; Strain & Bovey 2011).

The following outlines the characteristics of families and children for hybrid-based studies according to three settings (home, school, and clinic).

Hybrid-home. There were two hybrid-based studies conducted in the home setting that reported significant results for at least one of the dependent variables measured (Dawson et al., 2010; Reed et al., 2013). One of the two studies reported the majority of families as Caucasian (72.9%), followed by multiracial (14.6%), Latino and Asian (both 12.5%; Dawson et al., 2010). Neither of the studies reported SES. The average starting treatment age across both studies was 36.8 months (range 30 to 43.6 months). Children were required to have an independent diagnosis of autism or PDD-NOS according to the DSM-IV-TR and to not be receiving any other major interventions for the duration of the study (Reed et al., 2013). Exclusion criteria included the presence of a neurodevelopmental disorder of known etiology (e.g., fragile X syndrome), any major physical problems such as a chronic serious health condition, seizures at the time of entry, and/or the use of psychoactive medications (Dawson et al., 2010).

Hybrid-school. There were three hybrid-based studies in the school setting (Goods et al., 2013; Landa et al., 2011; Strain & Bovey, 2011). Both studies reported race/ethnicity. In one study, a majority of families were Caucasian (79%; Landa et al., 2011). In the second study, over half of the children were identified as African-American, Hispanic or Asian (Goods et al., 2013). Most studies did not report SES. The average starting age of treatment across the three studies was 38.2 to 46.2 months (range 28.6 to 60 months). Two of three studies specified that the children were required to have a clinical diagnosis of autism for inclusion (Goods et al., 2013; Landa et al., 2011). Additionally, one study only included children who used less than 10 spontaneous

functional and communicative words as indicated by parent and teacher report during baseline assessments (Goods et al., 2013). A second study (Landa et al., 2011) required a non-verbal mental age of at least 8 months as indicated by the Mullen Scales of Early Learning (MSEL; Mullen, 1995).

Hybrid-clinic. Out of three hybrid-based studies in the clinical setting, two reported significant results for at least one of the dependent variables measured (Kasari et al., 2006; 2012). However, the Kasari et al. (2012) is a follow-up of the Kasari et al. (2006) study and did not include any additional intervention. The following describes the treatment components from Kasari et al. (2006). The majority of families were Caucasian. SES was not reported. The average starting age was 43.2 months. To participate, children were required to meet the ADI-R or ADOs criteria for autism. Exclusion criteria included the presence of seizures, they were 5 years of age or older, there was a presence of additional medical diagnoses (e.g., genetic syndromes), and/or they were geographically inaccessible for follow-up visits.

Idiosyncratic-based Programs

There were nine idiosyncratic-based studies. Seven studies reported significant results for at least one of the dependent variables measured (Jocelyn et al., 1998; McConkey et al., 2010; Ozonoff et al., 1998; Perry & Condillac, 2010; Schertz et al., 2013; Sofronoff et al., 2004; Tsang et al., 2007). The following outlines the family and child characteristics for idiosyncratic-based studies according to three settings (home, school, and clinic).

Idiosyncratic-home. Out of five idiosyncratic-based studies in the home setting, four reported significant results for at least one of the dependent variables measured

(Ozonoff et al., 1998; McConkey et al., 2010; Schertz et al., 2013; Sofronoff et al., 2004).

Two of four studies reported families as primarily Caucasian (Ozonoff et al., 1998;

Schertz et al., 2013). None of the studies reported SES measures. Across the four studies, the average starting age was 47.9 to 63.4 months (range 24 to 144 months).

Three of four studies required a diagnosis of autism or scores above the designated cut-off levels on the ADOS (McConkey et al., 2010; Ozonoff et al., 1998; Schertz et al.,

2013). Ozonoff et al. (1998) compared a treatment group using a home-based TEACCH program in addition to regular school placements to regular school placements without the TEACCH program. The results showed a statistical group effect on the

Psychoeducational Profile-Revised assessment (PEP-R; Schopler, Reichler, Bashford, Lansing & Marcus, 1990) indicating the home program was effective in improving

cognitive and developmental skills. Correlations were then conducted to determine which pretreatment variables best predicted improvement. In the treatment group,

pretreatment scores on the PEP-R and Cognitive Verbal subscales of the PEP-R were significantly, positively correlated. Childhood Autism Rating Scales (CARS; Schopler,

Reichler & Renner, 1988) were significantly, negatively correlated with increased

change scores. Since a higher CARS score indicates an increased severity of autism,

the negative correlation indicates that the higher the CARs score, the less improvement was made and vice versa. These results indicate that mild autism and good language

skills predicted better outcomes in this home intervention. There were no significant correlations between the independent and dependent variables in the control group.

Idiosyncratic-school. Out of three idiosyncratic-based studies in the school setting, two reported significant results for at least one of the dependent variables

measured (Jocelyn et al., 1998; Tsang et al., 2007). One of two studies reported race/ethnicity with the majority of families as Caucasian (Jocelyn et al., 1998). The remaining study was conducted in Hong Kong and did not report race/ethnicity. One of two studies reported an SES score of 43 according to the Hollingshead's four-factor index of social status (Jocelyn et al., 1998). For child characteristics, one of two studies reported age at the start of services, which was between 3 and 5 years (Tsang et al., 2007). Both studies reported requiring a diagnosis of PDD or autistic disorder according to the DSM III-R (Jocelyn et al., 1998) and DSM-IV criteria (Tsang et al., 2007). Exclusion criteria included the presence of a severe physical disability that would preclude the completion of developmental test items (Jocelyn et al., 1998).

Idiosyncratic-clinic. There was one idiosyncratic-based study in the clinical setting that reported significant results for at least one of the dependent variables measured (Perry & Condillac, 2010). Family characteristics such as race/ethnicity and SES were not reported. The study took place in Ontario, Canada. The average starting treatment age was 44.3 months (range 23 months to 66 months). No inclusion or exclusion criteria were reported.

KQ 5. What are the best practices for inclusion of treatment services in an educational setting?

To identify the best practices for inclusion of treatment services, we analyzed the data from two groups, school-based programs and programs conducting generalization into a school setting, by a number of characteristics related to inclusion of treatment services across the four theoretical models.

School-based Programs

The total number of studies examining school-based programs was 11 (27%). There were five studies of ABA-school based programs (Eikeseth et al., 2002, 2007, 2012; Fernell et al., 2011; Zachor et al. 2010), three studies of hybrid-school based programs (Goods et al., 2013; Landa et al., 2011; Strain & Bovey, 2011) and three studies of idiosyncratic-school based programs (Boyd et al., 2013; Jocelyn et al., 1998; Tsang et al., 2007) but no school-based programs were evaluated in the developmental-based approach. The quality of one study (Zachor et al. 2010) was good and the rest were fair. Figures KQ 5-1, 2, and 3 summarize the effectiveness of the programs from the three approaches (ABA, hybrid, and idiosyncratic) across developmental areas.

In the ABA-school-based programs, the developmental area most assessed was adaptive behavior, followed by cognitive and severity of ASD symptoms. All five studies in the ABA-school-based program category assessed adaptive behavior: Three of those studies (60%) reported the program as effective for improving adaptive behavior (Eikeseth et al., 2002; 2007; 2012) and two studies (40%) reported as ineffective (Fernell et al., 2011; Zachor et al. 2010). Three studies measured cognitive ability; two studies reported the program as effective for increasing cognitive ability (Eikeseth et al., 2002, 2007), but one study reported as ineffective (Zachor et al. 2010). Three studies evaluated the severity of ASD symptoms; one study reported the program as effective for decreasing symptom severity levels (Eikeseth et al., 2012) but two studies reported as ineffective (Fernell et al., 2011; Zachor et al. 2010). Two studies measured the level of problem behaviors. Both reported the program as effective for decreasing those

behaviors (Eikeseth et al., 2007; 2012). One study measured language ability and reported the program as effective (Eikeseth et al., 2002). There were no studies to assess the effectiveness on social or emotional areas in the ABA-school-based programs.

In the hybrid-school-based programs, all three studies assessed language and social areas. In terms of language, one study (33%) reported the program as effective for language ability (Strain & Bovey, 2011), but two studies (67%) reported as ineffective (Good et al. 2013, Landa, et al., 2011). Similarly, in terms of the social area, one study (33%) reported the program as effective for social ability (Strain & Bovey, 2011), but two (67%) reported as ineffective (Good et al. 2013, Landa, et al., 2011). In addition, one study evaluated problem behavior and reported the program as effective in reduction of these behaviors (Strain & Bovey, 2011). One study measured the severity level of ASD symptoms and reported the program as effective on reducing the symptoms (Strain & Bovey, 2011). There were no studies to assess the effectiveness on emotional or cognitive areas in the hybrid-school-based programs.

In the idiosyncratic-school-based programs, two out of three studies measured language, social and cognitive areas. One study reported the program as effective on language (Jocelyn et al., 1998), but the other reported as ineffective (Boyd et al., 2013). Similarly, in terms of the cognitive area, one study reported the program as effective (Tsang et al., 2007) but the other reported as ineffective (Jocelyn et al., 1998). All studies that examined the effectiveness on social areas (Boyd et al., 2013; Jocelyn et al., 1998), emotional areas (Jocelyn et al., 1998), and severity of ASD symptoms (Boyd

et al., 2013) reported the program as ineffective. There were no studies to assess the effectiveness on problem behavior in the idiosyncratic-school-based programs.

The number of studies that examined school-based programs in each theoretical model was too small to determine which was more effective for each developmental area. However, according to the collected data, ABA school-based programs were supported by more studies that produced effective outcomes across language, adaptive behavior, problem behavior, and cognitive areas. However, the social and emotional areas were not examined in the ABA school-based programs. On the other hand, idiosyncratic school-based programs examined effectiveness on social and emotional areas. All the studies (two for social area and one for emotional area) were proven as ineffective in those areas. Hybrid school-based programs also evaluated the effectiveness of the program in the social area, but it also was ineffective for the area. Accordingly we summarized the major components related to service delivery and treatment modality of ABA school-based treatment as the best practice for inclusion of effective treatment services in a school setting at this point in time.

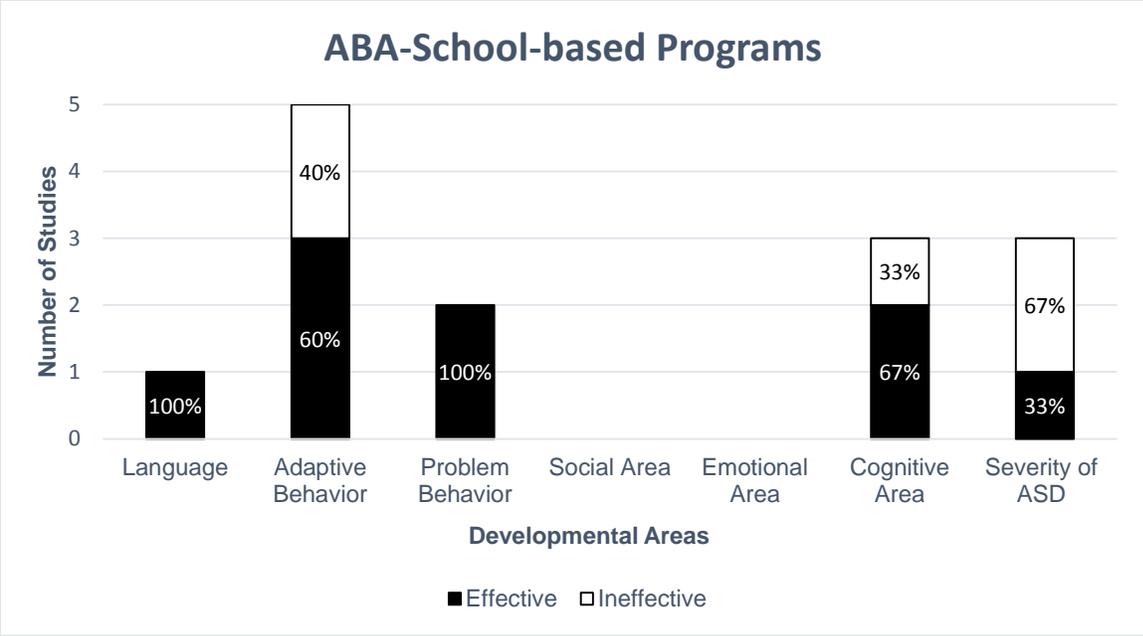


Figure KQ 5-1. Effectiveness of ABA-School-based Programs across Developmental Areas

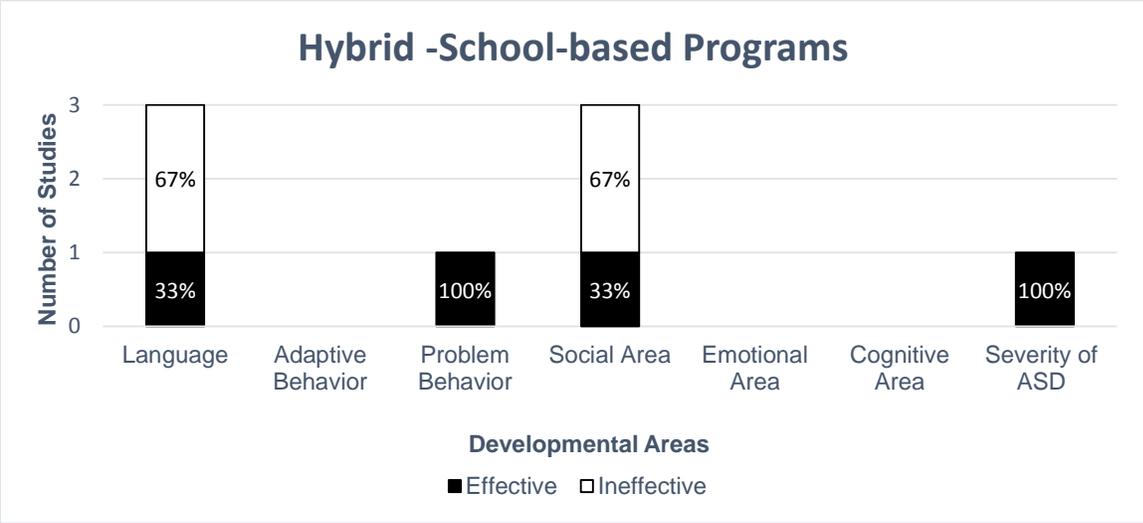


Figure KQ 5-2. Effectiveness of Hybrid-School-based Programs across Developmental Areas.

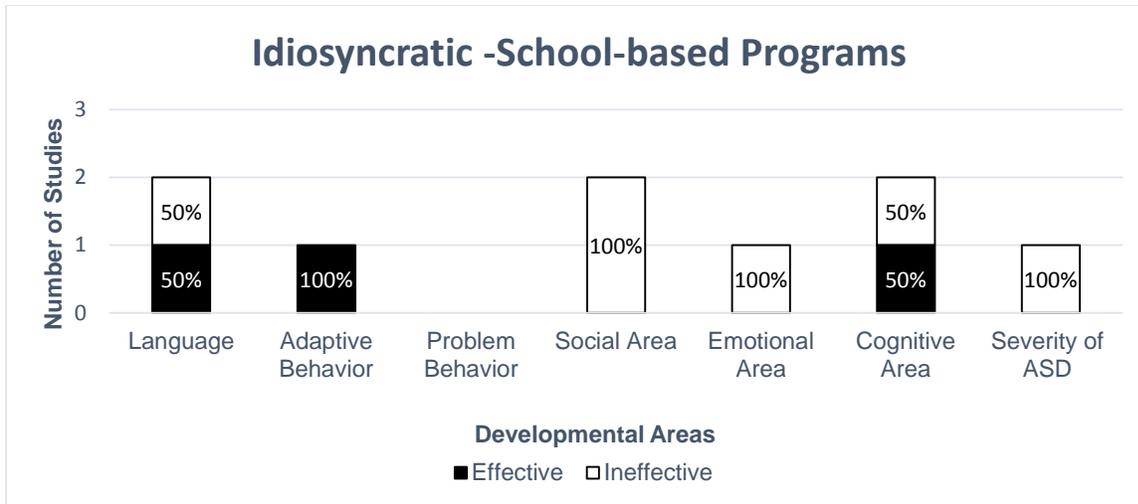


Figure KQ 5-3. Effectiveness of Idiosyncratic-School-based Programs across Developmental Areas.

Best practices for inclusion of ABA school based services. Out of five ABA-based studies in the school setting, three reported significant results for at least one of the dependent variables measured in each respective study (Eikeseth et al., 2002, 2007, 2012). The average of treatment hours was 23 hours (15 to 37 hours) per week. The range of treatment duration was 18 months (range 12 to 36 months). The average age at the start of the treatment services was 4 years old (3 years 11 months to 7 years 4 months). The majority of treatment providers were teachers and educational paraprofessionals (i.e., aids). With regard to treatment provider qualifications reported in the studies, supervisors usually had a minimum of 1500 hours experience implementing UCLA treatment (Eikeseth, 2002), professional behavior analysts with extensive research and clinical experience with the UCLA model (Eikeseth et al., 2007) or a minimum of a bachelor's degree in Psychology or Pedagogy, although half had a master's degree in Psychology or Speech Pathology and one supervisor was a BCBA (Eikeseth et al., 2012). Teachers and educational paraprofessionals involved in the

programs had diverse backgrounds and no training or experience with EIBI or ABA prior to treatment. Two out of three studies used formal treatment protocols or manuals (Eikeseth et al., 2002, 2012). Training consisted of an apprenticeship format in which supervisors set up the children's programs and the therapists implemented them, but received in-vivo feedback from supervisors. Therapists also received hands-on training during weekly meetings (Eikeseth et al., 2002). All of the studies reported supervision activities. Weekly two-hour supervision meetings were held for each child. The child, primary caregiver, therapists, and supervisor attended. At the meetings, the child's treatment program was modified and updated based on the child's development during the preceding week. Also, therapists and parents received hands-on training (Eikeseth et al., 2002, 2007, 2012). However, none of the three studies reported fidelity measures. None of the studies reported a multidisciplinary approach component. All of the studies followed a consultative model in which the supervisors advised therapists and parents through ongoing meetings and supervision.

The programs emphasized the importance of active parental involvement. The parents learned how to apply the strategies used at school in the home for maintenance and generalization purposes. Parents attended initial parent training seminars on autism, participated in parent training and/or treatment for 4 to 10 hours/week (Eikeseth et al., 2002, 2012), implemented maintenance and generalization programs in the home and community (Eikeseth et al., 2002), or participated in weekly reviews of the child's progress with the therapists and supervisors for up to 2 hours (Eikeseth et al., 2002, 2012). Two out of three studies reported that treatment at school may be effective for some 4 to 7-year-old children with ASD. They may benefit from the ABA school-based

programs as much as younger children from this program. There was no information available related to an approach or regularity of review of the participants' progress to determine whether or not the participants needed continued services. The intervention goals were established to fit the needs of each individual child and were directed by typical child development milestones. Based on this, the programs based treatment objectives of participant children within child developmental sequences.

Programs Conducted Generalization

There were six studies that administered generalization of the treatment program into the school setting. Four studies were ABA-based programs. Of these, three studies were home-based (Cohen et al., 2006; Lovaas, 1987; Smith et al., 2000) and one study was clinic-based (Sallows et al., 2005). Two studies were idiosyncratic-home-based programs (Ozonoff et al., 1998; McConkey et al., 2010). There was a limitation in that these studies did not provide quantitative data related to generalization. Most of them provided brief information about how to extend their program to a school setting. Therefore, we summarized the descriptive data; however these practices are uncertain in terms of best practices with positive effectiveness because they did not provide supporting empirical data.

In these studies, they initially implemented their programs in more structured sessions (1:1 contact) in the setting originally planned (e.g., home or clinic) to achieve the treatment goal for the beginning period. After some time (e.g., after 1 year) they encouraged the obtained treatment goal to be generalized into the school setting (small or large group contact in a natural environment). For example, Sallow et al. (2005) conducted an ABA-clinic-based treatment program for 40 hours/week. During year 2,

they gradually decreased the treatment hours to 37 as the participant children entered school. They extended the treatment goal (e.g., social interaction and play) with staff to siblings, and then to peers. As the children acquired the target goal, they participated in an inclusion preschool for 2 or 3 hours for 1 or 2 days per week. In addition, if the participants reached first grade levels of academic proficiency, they taught common classroom rules and skills related to school activities with several peers at home as practice sessions before they started school. For consistent implementation of the treatment program protocols or strategies, the therapists who conducted the treatment program visited the participant children's school and directly joined in the school program to assist the children (e.g., Sallow et al., 2005); or helped school staff use the strategies for the participants as a consultant (e.g., McConkey et al., 2010); however, McConkey et al. did not specify how often they provided such direct or indirect services for generalization.

KQ 6. What are the funding options for treatment services?

A total of 13 studies reported the funding source of their treatment programs. Table 1-6 summarizes the information. Four of 13 studies reviewed were from the U.S. Two of the programs were funded by public agencies and both were ABA-home-based. One program was funded by research grants and was hybrid-school-based. The last program was funded by both a medical assistance program and research grants, and was ABA clinic-based. Regarding the international studies, two of nine treatment programs were funded by public agencies/local educational authorities and both were ABA-home-based. Two programs were funded by state agencies. One was ABA-school-based and the other was Idiosyncratic-school-based. Three were funded by

national agencies and were delivered in diverse settings; all were ABA-based. One program was funded by research grants and was Idiosyncratic-school-based. One program was funded by either a local educational service or a private service provider (e.g., paid by parents themselves) and was ABA-home-based.

Table 1-6

Summary of Funding Sources by Study and Study Category

Funding Sources	Studies	Nation	Categorization
Public Agencies/ Local Educational Authorities	Cohen et al. (2006)	U.S.	ABA-home
	Howard et al. (2005)	U.S.	ABA-home
	Magiati et al. (2007)	UK	ABA-home
	Reed et al. (2007)	UK	ABA-home
State Agencies	Eikeseth et al. (2002)	Norway	ABA-school
	Jocelyn et al. (1998)	Canada	Idiosyncratic-school
National Agencies	Strauss et al. (2012)	Italy	ABA-home
	Zachor et al. (2010)	Israel	ABA-school
	Fava et al. (2011)	Italy	ABA-clinic
Research Grants	Strain & Bovey (2011)	U.S.	Hybrid-school
	Tsang et al. (2007)	China	Idiosyncratic-school
Mixed Sources	Remington et al. (2007)	UK	ABA-home
	Sallows et al. (2005)	U.S.	ABA-clinic

KQ 7. What evidence supports long-term outcomes that verify positive changes in developmental trajectory?

Of the selected studies, three pairs of studies were identified as original and longitudinal follow-up studies. Most studies with rigorous experimental designs reported no long-term follow-up data. Longitudinal follow-up studies do exist (e.g., Akshoomoff et al., 2010), but these did not meet our inclusion criteria because they did not have a control group or were non-experimental studies (e.g., retrospective study). Table 1-7 summarizes some elements of the original and follow-up studies. The study quality of all six was fair. Two pairs of studies were ABA-home-based programs and one pair was a hybrid-clinic-based program. The children's ages at the start of the programs in those studies are 2 to 4 years old (22-54 months).

There are some limitations of the longitudinal follow-up studies. As shown in table 1-7, the original study and follow-up did not consistently measure the same areas of outcome. In addition, Magiati et al. (2011) combined the experimental group (home-based EIBI) and control group (autism specific nursery school) in the original study (Magiati et al., 2007), and reported the follow-up outcome for the combined group. Therefore, they failed to provide the data of the original control group for comparison. It is impossible to tease out the follow-up outcome for the experimental group (home-based EIBI) from their data. With those limitations we analyzed two pairs of studies (i.e., Lovaas [1987] and McEachin et al. [1993]; and Kasari et al., [2006] and Kasari et al., [2012]) in order to find the evidence of long-term positive outcomes.

McEachin et al. (1993) conducted a follow-up of the Lovaas study (1987). They did not provide the exact period of the follow-up. The post-treatment assessment of the

original study had been conducted when the participant children were at the mean age of 7 years. The follow-up assessment in the McEachin et al. study was conducted when the participant children were at the mean age of 11.5 years (p.359; they also inconsistently reported the age as 13 years. p. 362). Therefore, based on their report, we estimated the period of the follow-up at approximately 5 to 6 years. The number of experimental and control group participants at follow-up was the same as the number in the original study. The original study program, described as EIBI, measured intellectual functioning (i.e., IQ) and educational placement. The follow-up study additionally measured adaptive behavior and psychological disturbance (e.g., anxiety, depression, hyperactivity and psychotic behavior), as well as intellectual functioning and educational placement. The original study verified that EIBI was effective for increasing intellectual functioning levels. The number of experimental group participants who were assessed in the normal range of intellectual functioning increased from 2 to 12. The number in the moderate-to-severe range of intellectual disability decreased from 10 to 3. However, the levels of intellectual functioning of the two control groups remained without change after treatment. At the follow-up, 5 or 6 years later, the experimental group displayed significantly higher levels of intellectual functioning than the control group; 11 participants (58%) in the experimental group attained an IQ of at least 80, while only three participants (17%) in the control group did. In terms of educational placement, nine out of 19 children (47%) were assigned to a regular public school classroom whereas none of the control group children were. The proportion of such outcomes for both groups in the earlier study did not change in the follow-up. Therefore the positive outcome of the experimental group on intellectual functioning and educational

placement was maintained up to 5 or 6 years after the post treatment evaluation. Additionally, at the follow-up, the experimental group exhibited more adaptive behaviors and less maladaptive behaviors compared to the control group. On the other hand, in terms of personality functioning, there was no significant difference between the experimental and control groups. However, these areas were not measured in the original study; therefore it is difficult to know if the outcomes had been maintained or changed at the time of the follow-up.

Kasari et al. (2012) conducted a 5-year follow-up evaluation of the earlier Kasari et al. study (2006). The follow-up study secured the three comparison groups of the original study, but the number of each group's participants in the follow-up was slightly less than the number in the original study. The original study implemented an early intensive program that targeted joint attention and play skills (social communication early intensive program) for 6 hours per day (The study did not provide how long the treatment was implemented.). The program comprised of ABA strategies (e.g., prompt hierarchy, positive reinforcement, imitation, one-on-one discrete trial teaching), developmental procedures (e.g., incidental teaching, following child's lead and interests), and milieu teaching. According to the results, the treatment program was significantly effective on improving joint attention and play skills compared to the control group. At the 5-year follow-up they examined the long-term effects of the social communication early intensive program on language and cognitive development. For this they implemented language and cognitive assessments that were not administered in the earlier study. This did not allow direct outcome comparisons of the same areas (joint attention and play skills) between the initial and follow-up studies. The results suggest

that most participants of treatment groups showed more useful, functional spoken language than the control group at the time of the follow-up. In addition, children who were able to engage in more functional play types displayed better cognitive outcomes. The results demonstrated evidence that early intensive programs targeting joint attention and play skills may produce positive changes in the developmental trajectory of language and cognitive areas. However, as mentioned earlier, these areas were not measured in the original study; therefore caution is needed to interpret the outcomes.

Table 1-7

Summary of Original and Follow-up Studies

ABA												
Categorization	Study Reference	Number of Subjects	Age at Start of Services	Treatment Areas								
				Communication/ Language	Adaptive Behavior	Problem Behavior	Social Area	Emotional Area	Cognitive Area	Severity of ASD	Others	
ABA-home	Lovaas (1987)	G1: 19 G2: 19 (control 1) G3: 21 (control 2)	G1: 35 months G2: 41 months							Evaluated		Evaluated
	McEachin et al. (1993)	G1: 19 G2: 19 (control 1) No control 2 group			Evaluated			Evaluated	Evaluated			Evaluated
ABA-home	Magiati et al. (2007)	44 G1: 28 G2: 16 (control)	22-54 months	Evaluated	Evaluated					Evaluated	Evaluated	Evaluated
	Magiati et al. (2011)	36 No control group		Evaluated	Evaluated					Evaluated	Evaluated	Evaluated

Hybrid (Behavioral + Developmental)											
Categor-ization	Study Referenc e	Number of Subject s	Age at Start of Service s	Treatment Areas							
				Communication / Language	Adaptive Behavior	Problem Behavior	Social Area	Emotiona l Area	Cognitiv e Area	Severit y of ASD	Others
Hybrid - clinic	Kasari et al. (2006)	58 G1 (joint attention): 20 G2 (symbolic play): 21 G3 (control): 17	G1: 43.2 months G2: 42.67 months G3: 41.94 months				Evaluate d				Evaluate d
	Kasari et al. (2012)	40 G1 (joint attention): 15 G2 (symbolic play): 14 G3 (control): 11		Evaluated					Evaluated		

Note.  Developmental areas evaluated in the study

Discussion

Key Findings

KQ 1. Effectiveness of the Comprehensive Programs

- Generally, of the four theoretical models (ABA, hybrid, developmental, and idiosyncratic) targeting comprehensive treatment for children diagnosed with ASD, the evidence supports the ABA-based model in terms of positive effectiveness across the largest number of developmental domains.
- ABA-based programs were effective on language, problem behavior, and cognitive areas. Developmental-based programs were effective on severity of ASD. Hybrid-based programs were effective on adaptive behavior and cognitive areas. Idiosyncratic-based programs were effective on adaptive and problem behavior areas.
- The effects of ABA-based programs on adaptive behavior and severity of ASD symptoms were inconclusive at this point in time. The effects of hybrid-based programs on language and social areas were inconclusive. The effects of idiosyncratic-based programs on language, social, and cognitive areas were also inconclusive.
- ABA-based programs were ineffective on social and emotional areas.
- Developmental-based programs were ineffective on language, adaptive behavior, social, and cognitive area, at this point in time. The total number of studies examining developmental based programs (five of 40 studies) is relatively smaller than the number in other programs (c.f., ABA [18]; hybrid [8]; Idiosyncratic [9]).

Therefore the results should be considered tentative until more relevant evidence has accumulated.

- Hybrid-based programs were ineffective on problem behavior and severity of ASD.
- Idiosyncratic-based programs were ineffective on the emotional area and severity of ASD.
- The developmental areas that benefit most from the comprehensive treatment program were both adaptive and cognitive behavior. Whereas the developmental area that benefits the least from the comprehensive treatment programs was the severity of ASD: High stability of ASD severity has been demonstrated by numerous previous studies.
- The most inconclusive or not evaluated areas, in terms of the effectiveness of comprehensive treatment programs, were the social and emotional areas.

KQ 2. Components of Comprehensive Treatment Programs

Across four categories (ABA, developmental, hybrid and idiosyncratic), we describe the overall trends for five treatment program components only from studies that reported effective outcomes for any of the measured dependent variables (and excluded studies without effective outcomes for all measured dependent variables): intervention strategies, developmental considerations, use of a manual or protocol, parent involvement and fidelity of implementation. Overall trends refer to whether 50% or more of the category reported the specific treatment program component.

It should be noted that it is not possible to draw firm conclusions about potential relations between positive study outcomes and specific, individual variables relating to treatment program components (i.e., intervention strategies; developmental

considerations; use of a manual or protocol; parent involvement; fidelity) as those variables were not isolated within the context of the reviewed studies pertaining to each of the models (ABA, developmental, hybrid, idiosyncratic) in a setting (i.e., home, school, or clinic).

Intervention Strategies

- We describe treatment program components for 15 ABA-based studies reporting significant results for any of the dependent variables measured (home - 8; school – 3; clinic – 4). ABA-based programs utilized strategies that are behavior analytic in nature (e.g., shaping, prompting, prompt fading, discrimination training, task analysis). The main format for teaching in ABA-based programs was through Discrete Trial Teaching (DTT) to teach progressively complex skills. As skills were mastered through DTT in the one-on-one setting, children also practiced skills in various settings and with different people to foster generalization of newly mastered skills. In order to foster generalization of newly mastered skills naturalistic teaching methods (e.g., incidental teaching, natural environment teaching) and practicing skills in various settings or with different people were utilized.
- We describe treatment program components for three developmental-based studies reporting significant results for any of the dependent variables measured (home - 1; school – 2; clinic - 0). Developmental-based programs focused primarily on play, communication, and social interactions. They followed the child's lead by observing the child's cues and responding to or expanding on any child-initiated communication.

- We describe treatment program components for seven hybrid-based studies reporting significant results for any of the dependent variables measured (home – 2; school – 3; clinic - 2). These programs based goals on developmental considerations using a mixture of structured (DTT) and semi-structured formats that emphasized relationship building or sensory needs (pivotal response training or milieu teaching) to teach and maintain new skills.
- We describe treatment program components for seven idiosyncratic studies reporting significant results for any of the dependent variables measured (home – 4; school – 2; clinic - 1). Idiosyncratic studies were not characterized by any one type of treatment strategy or focus. Three programs utilized principles of TEACCH (e.g., visual supports, structured learning environment). Four programs focused on parent training. These programs provided background information on autism, explanation of teaching strategies, and hands-on practice of these strategies with coaching, feedback and general supervision from therapists. Written resources were also provided to serve as reference materials.

Child Development

- ABA-, developmental-, and hybrid-based studies reference considering child development through the use of individualized programs based on the child's strengths and weaknesses. Out of 15 ABA-based studies, 10 reported this component (home – 3; school – 3; clinic – 4). Out of two developmental-based studies, two reported this component (home – 1, school – 1). All six hybrid-based studies reported this component (home – 2; school – 3; clinic – 1).

- Idiosyncratic-based programs did not individualize programs or base the program on any developmental curricula. Three of seven studies reported this component (home – 1; school – 1; clinic – 1).

Manuals

- ABA- and hybrid-based programs reported use of a manual that prescribed how to implement the treatment protocol. Out of 15 ABA-based studies, eight reported this component (home – 5; school – 2; clinic – 1). Out of six hybrid-based studies, four reported this component (home – 2; school – 1; clinic – 1).
- Few of the developmental- and idiosyncratic-based programs reported use of a manual. Neither of the two developmental studies reported this component. Out of seven idiosyncratic-based studies, two reported this component (home – 2).

Parents' Roles/Involvement

- Parents' roles ranged from attending informational sessions on autism, providing input on goals for goal setting, working alongside the therapists as a type of parent training and/or attending regular progress meetings. The majority of studies did not provide specific information regarding the number of hours allotted to these activities.
- Parent roles were represented across all categories. Out of 15 ABA-based studies, 14 reported this component (home – 7; school – 3; clinic – 4). In two ABA-based home, two school studies, and two clinic studies, parents attended informational workshops on core topics. In three ABA-based home studies and one school study,

parents served as therapists for maintenance and generalization programs. In three ABA-based home studies, parents provided input on priorities and goals for treatment programs. In two ABA-based home and two clinic studies, parents served as a co-therapist on their child's intervention team. In two ABA-based school and four clinic studies, parents participated in weekly progress meetings. Out of two developmental-based studies, two reported this component (home – 1; school – 1). In one developmental-based home and school study, parents attended a lecture style session on the basic concepts of the treatment program. In one developmental-based school study, parents also attended monthly treatment sessions in which therapists provided feedback to parents based on videotaped interactions between the parent and child. Out of six hybrid-based studies, three reported this component (home – 1; school – 2). In all three hybrid-based studies, parents attended parent trainings on autism and teaching strategies but were not required to commit any specific number of hours to implementation at home. Out of seven idiosyncratic-based studies, six reported this component (home – 4; school – 1; clinic – 1). In two idiosyncratic-based home studies, one school study, and one clinic study, parents provided input on setting goals. In two idiosyncratic-based home studies, parents agreed to conduct treatment at home. In two idiosyncratic-based home studies, one school study, and one clinic study, parents participated in a parent training workshop or educational seminar and learned strategies to use at home.

Fidelity

- Fidelity of implementation included checklists and using the treatment manual to ensure treatment was implemented with consistency.
- Developmental- and hybrid-based studies reported use of fidelity protocols. Out of two developmental-based studies, one reported this component (school – 1). Out of six hybrid-based studies, five reported this component (home – 1; school – 3; clinic – 1).
- ABA- and idiosyncratic-based programs did not report a general use of fidelity protocols. Out of 15 ABA-based studies, three reported this component (home – 1; school – 0; clinic – 2). Out of seven idiosyncratic-based studies, one reported this component (home – 1).

KQ3: Characteristics of Treatment Service Delivery

Across four theoretical models (ABA, developmental, hybrid and idiosyncratic), we describe the overall trends for nine components related to service delivery: intensity of treatment, duration of treatment, qualifications of therapists, qualifications of supervisors, activities related to training therapists, activities related to supervision, inclusion of multidisciplinary professionals, service model type (i.e., consultative, collaborative), and frequency of progress review to determine continuation of services.

We describe service delivery of treatment components for 15 ABA-based studies reporting significant results for any of the dependent variables measured (home - 8; school – 3; clinic – 4), three developmental-based studies reporting significant results for any of the dependent variables measured (home - 1; school – 2; clinic - 0), seven

hybrid-based studies reporting significant results for any of the dependent variables measured (home – 2; school – 3; clinic - 2) and seven idiosyncratic studies reporting significant results for any of the dependent variables measured (home – 4; school – 2; clinic - 1).

It should be noted it is not possible to draw firm conclusions about potential relations between positive study outcomes and specific, individual variables relating to the characteristics of treatment service delivery (e.g., intensity of treatment in hours; duration of treatment; qualifications of therapists and supervisors; training and supervision activities; service model type) as those variables were not isolated within the context of the reviewed studies pertaining to each of the models (ABA, developmental, hybrid, idiosyncratic) in a setting (i.e., home, school, or clinic).

Intensity of Treatment

- Intensity of treatment refers to the average number of treatment hours per week and range across the studies in the respective category.
- Out of eight ABA-based studies in the home setting, two studies differentiated treatment hours based on age in which children younger than 3 years of age received between 22.5 to 30 treatment hours (range 20 to 30 hours) per week and children older than 3 years of age received between 30.5 to 35.5 treatment hours (range 26 to 40 hours) per week. Of the remaining six ABA-based studies conducted in the home setting, the average number of treatment hours was 32.7 hours (range 18.4 to 40 hours) per week. The average number of treatment hours for three ABA-based studies in the school setting was 23 hours (range 15 to 37 hours) per week,

and for four ABA-based studies in the clinic setting was 30.65 hours (range 14 to 35 hours) per week.

- The average number of treatment hours for one developmental-based study in the home setting was 15.2 hours/week and for three developmental-based studies in the school setting was 8.6 hours (range 1 to 15 hours) per week. There were no developmental-based studies in the clinic setting.
- The average number of treatment hours for two hybrid-based studies in the home setting was 21.2 treatment hours (range 6.4 to 31.5 hours) per week, for three hybrid-based studies in the school setting was 8.6 hours (1 to 15 hours) per week, and for one hybrid-based study in the clinic setting was 2.5 hours/week.

Duration of Treatment

- Duration of treatment refers to how long the treatment lasted, reported in months and years.
- The average duration of eight ABA-based studies in the home setting was 20.6 to 22.1 months (range 9 to 36 months), of three ABA-based studies in the school setting was 18 months (range 12 to 36 months), and of four ABA-based studies in the clinic setting was 21 months (range 12 to 48 months).
- The average duration of one developmental-based study in the home setting was 3 months and one developmental-based study in the school setting was 12 months. There were no developmental-based studies in the clinic setting.
- The average duration of two hybrid-based studies in the home setting was 17 months (range 10 to 24 months), of three hybrid-based studies in the school setting

was 11 months (range 3 to 24 months), and of one hybrid-based study in the clinic setting was 5 to 6 weeks.

- The average duration of four idiosyncratic-based studies in the home setting was 5 months (range 1.5 to 11 months), of two idiosyncratic-based studies in the school setting was 7.5 months (range 3 to 12 months), and one idiosyncratic-based study in the clinic setting was 3 months.

Qualifications of Service Providers

Therapists

- The qualifications of therapists refers to the educational and professional backgrounds and related experiences reported for therapists.
- ABA-, developmental-, and hybrid-based studies reported qualifications of therapists. Out of 15 ABA-based studies, eight reported this component (home – 4; school – 3; clinic – 1). In two ABA-based home studies, the undergraduate therapists worked a minimum of 6 months under supervision prior to starting the program (Lovaas, 1987; McEachin et al., 1993). In two ABA-based home studies, therapists were required to pass a rigorous behavior observation assessment evaluating their accuracy or proficiency on conducting DTT, a competency knowledge test and for one of these studies, therapists also needed to receive favorable ratings from their supervisors. In three ABA-based school studies, therapists did not have any experience in ABA or EIBI. In one ABA-based clinic study, the therapist had to be at least 18 years old and have a minimum of one year in college. Out of two developmental-based studies, two reported this component (home – 1; school – 1; clinic – 0). In both studies, therapists attended a workshop prior to the start of the treatment. Out of seven

hybrid-based studies, four reported this component (home – 1; school – 2; clinic – 1).

In the one hybrid-based home study, therapists were required to have a baccalaureate degree. In the two hybrid-based school studies, therapists were graduate students who were experienced in intervention methods with children with autism or were preschool staff members with advanced degrees. In the hybrid-based clinic study, therapists were trained graduate students.

- Less than 50% of idiosyncratic-based studies reported qualifications of therapists. Out of seven idiosyncratic studies, three reported this component (home – 3; school – 0; clinic – 0).

Supervisors

- The qualification of supervisors refers to the educational and professional backgrounds and related experiences reported for supervisors.
- ABA-based studies reported qualifications of supervisors. Out of 15 ABA-based studies, 11 reported this component (home – 6; school – 3; clinic – 2). In three ABA-based home studies, supervisors were Board Certified Behavior Analysts (BCBA) or master teacher-level Comprehensive Application of Behavior Analysis to Schooling (CABAs), some with a Ph.D. In two ABA-based home studies, the supervisors were graduate students in behavior analysis or master's level clinicians with two or more years of experience in providing EIBT. In one ABA-based home study, the supervisors were senior student therapists with a minimum of 1500 hours of one-to-one treatment experience at the UCLA Young Autism Project, who demonstrated mastery of research pertaining to ABA treatment, had satisfactory scores during behavior observation of skill at designing and implementing treatment plans and

satisfactory ratings from other supervisors. In one ABA-based school study, the supervisor qualification was a minimum of 1500 hours experience implementing the UCLA treatment. In one ABA-based school study supervisors were professional behavior analysts with extensive research and clinical experience with the UCLA model. In one ABA-based school study, the supervisors had to have a minimum of a bachelor's degree in psychology or pedagogy, although half had a master's degree in psychology or speech pathology and one supervisor had a BCBA. In one ABA-based clinic study, the supervisor qualification consisted of a Bachelor of Arts degree in psychology, one-year of experience as a therapist, two full years of full-time experience as a senior therapist and completion of a 9-month internship at UCLA. In one ABA-based clinic study, the supervisor was the director of the clinic.

- Few of the developmental-, hybrid- and idiosyncratic-based studies reported qualifications of supervisors. Neither of two developmental-based studies reported this component. Out of seven hybrid-based studies, one reported this component (home -1; school – 0; clinic – 0). Out of seven idiosyncratic studies, one reported this component (home – 1; school – 0; clinic – 0).

Activities Related to Training Therapists

- Activities related to training of therapists refer to the strategies and activities used to teach therapists to conduct therapy.
- Developmental-based studies reported activities related to training therapists. Out of two studies, both reported this component (home – 1; school – 1; clinic – 0). In one developmental-based home study, therapist training lasted 1.5 hours and included the use of modeling by the trainer, asking parent trainees to independently

demonstrate the same skill, and the trainer coaching or providing feedback about their performance. In the second study, the supervisor reviewed videotaped interactions between the therapist (parent) and child, and discussed changes to the parent interaction and communication responses. These were recorded in a written program and given to the parents to use at home.

- Less than 50% of ABA-, hybrid-, and idiosyncratic-based studies reported activities related to training therapists. Out of 15 ABA-based studies, three reported this component (home – 0; school – 1; clinic – 2). Out of seven hybrid-based studies, three reported this component (home – 1; school – 1; clinic – 1). Out of seven idiosyncratic studies, three reported this component (home – 3; school – 0; clinic – 0).

Supervision Activities

- The supervision activities refer to specific activities the supervisors conducted during the treatment in order to monitor therapists' performances and the child's programming.
- One of two developmental-based studies reported supervision activities (50% or more of studies in the theoretical model). Out of two studies, one reported this component (home – 1; school – 0; clinic – 0). Supervision consisted of the supervisor following up with families at the end of the first month. The supervisor used modeling and coaching feedback to improve parents' performance with their children. Goals, methods and techniques of the home program were also refined during this time to maximize the child's progress.

- Less than 50% of studies for each of three theoretical models (ABA-, hybrid-, and idiosyncratic-based studies) reported supervision activities. Out of 15 ABA-based studies, six reported this component (home – 2; school – 3; clinic – 1). Out of seven hybrid-based studies, one reported this component (home – 0; school – 0; clinic – 1). Out of seven idiosyncratic studies, two reported this component (home – 1; school – 0; clinic – 1).

Inclusion of Multidisciplinary Professionals

- The multidisciplinary approach refers to the inclusion of professionals from different professional specializations who consulted for or worked with children in the program.
- Less than 50% of each of the theoretical models (ABA-, developmental-, hybrid-, and idiosyncratic-based studies) reported the inclusion of multidisciplinary professionals. Out of 15 ABA-based studies, one reported this component (home – 0; school – 0; clinic – 1). Neither of two developmental-based studies reported this component. Out of seven hybrid-based studies, two reported this component (home – 2; school – 0; clinic – 0). Out of seven idiosyncratic studies, two reported this component (home – 1; school – 1; clinic – 0).

Service Model Type - Consultative or Collaborative

- ABA-, developmental-, and idiosyncratic-based studies reported a service delivery model. Out of 15 ABA-based studies, nine reported this component (home – 2; school – 3; clinic – 4). In seven studies, authors reported a consultative model in which supervisors, therapists, and parents attended team meetings on a regular basis (weekly up to every 2 months), supervisors advised therapists and parents and

were available through phone or email to provide additional clinical supervision. In the two collaborative studies, parents and therapists worked together to provide therapy across school and home environments. Out of two developmental-based studies, two reported this component (home – 1; school – 1; clinic – 0). The two studies followed a consultative format. Out of seven idiosyncratic based studies, four reported this component (home – 2; school – 1; clinic – 1). In two idiosyncratic-based home studies, a collaborative model for designing and implementing programs was reported. In one idiosyncratic-based school study, a consultative model between the behavior therapist and school staff was reported. In one idiosyncratic-based clinic study, a consultative model between therapists and parents was reported.

- Few of the hybrid-based studies reported a service delivery model. Out of seven hybrid-based studies, three reported this component (home – 2; school – 1; clinic – 3).
- None of the studies reported information regarding the frequency of progress review to determine continuation of services.

KQ4. Specific Characteristics of Children and Families

Across four categories (ABA, developmental, hybrid and idiosyncratic), we describe the overall trends for family and child characteristics. Family characteristics describe reported race/ethnicity and SES. Child characteristics describe diagnosis and age at start of treatment.

It should be noted it is not possible to draw firm conclusions about potential relations between positive study outcomes and specific, individual variables relating to

family and child characteristics (i.e., race/ethnicity; SES; age at start of treatment; diagnosis and/or severity) as those variables were not isolated within the context of the reviewed studies pertaining to each of the models (ABA, developmental, hybrid, idiosyncratic) in a setting (i.e., home, school, or clinic).

Family Characteristics

- ABA-, developmental-, hybrid- and idiosyncratic-based studies did not report race/ethnicity or SES.

Child Characteristics

- ABA-, developmental, hybrid- and idiosyncratic-based studies reported child characteristics. Fourteen of 15 ABA-based studies included children with a diagnosis of Autistic disorder or PDD-NOS and did not include children with other major medical conditions (e.g., Down syndrome, seizures, and deafness). The average starting age across the 15 studies was 40.1 to 49.1 months (range 22 to 84 months). Although this is a large range, there are some trends based on the setting of the treatment. In home-based programs, the average starting age was approximately 39.6 months (range 32 to 48 months). In school-based programs, the average starting ages were 40.3 to 81.3 (range 25 to 84 months). In clinic-based programs, the average starting ages were 41 to 44 months (range 22 to 81 months). Of two developmental-based studies, both included children with a clinical diagnosis of autistic disorder but excluded children whose parents were diagnosed with a known psychiatric or physical illness. The average starting age across both studies was 24 to 71.5 months (range 24 to 72 months). Five of six hybrid-based studies required an independent diagnosis of autism or PDD-NOS and excluded children if they had a

neurodevelopmental disorder of a known etiology (e.g., fragile X syndrome) or any other major physical problems. The starting age was 38.6 to 42.6 months (range 28.6 to 60 months). Four of seven idiosyncratic-based studies specified an independent diagnosis of autistic disorder or PDD-NOS. The starting age of treatment was 44 to 59.7 months (range 36 to 63.4 months).

KQ 5. Best Practices for Inclusion of Treatment Services in an Educational Setting

- Based on the existing evidence, school-based programs from the ABA theoretical model were supported by more studies that produced positive outcomes across language, adaptive behavior, problem behavior, and cognitive areas than school-based programs from other theoretical models. Consequently we summarized the major components related to service delivery and treatment modality of ABA school-based treatment as the best practice for inclusion of effective treatment services in a school setting at this point in time.
- The average of treatment hours was 23 hours (range 15-37 hours) per week.
- The average of treatment duration was 18 months (range 12 to 36 months).
- The average age at the start of the treatment services was 4 years old (range 3 years 11 months to 7 years 4 months).
- The treatment providers were trained therapists, teachers, and educational paraprofessionals.
- Supervisors need appropriate qualifications to train the therapists. The recommended qualifications for supervisors can be master's degrees in psychology or special education, becoming BCBA's or highly skilled ABA therapists.

- Training and supervising therapists are more important than the therapists' background.
- The programs should use a treatment protocol or manuals so that the therapists can implement as originally intended with high fidelity.
- Consultants or a multidisciplinary service model is recommended for inclusion of treatment services at school.
- Characteristics of children who benefit the most from ABA-school-based treatment program: Age at intake may not be a critical factor for positive treatment outcome.
- Parents' active involvement was recommended to promote generalization of obtained skills into natural environments.
- Treatment goals should be tailored to the individuals' needs within the typical child development sequence.
- There is no data related to these programs' effectiveness on social and emotional areas, thus the recommendations listed above may have limited effectiveness in improving those areas.

KQ 6. Funding Options for Treatment Services

- Four of 13 studies reported funding sources were from the U.S.
- The funding sources reported were public agencies, research grants, and mixture of both a medical assistance program and research grants.
- According to the studies' reports, none of programs from the U.S shared the cost of the treatment services with families.

KQ 7. Evidence of Long-term Outcomes that Verify Positive Changes in Developmental Trajectory

- Positive outcomes produced by early intensive programs were maintained up to 5 or 6 years after the post treatment evaluation.
- The 5 to 6 year follow-up studies demonstrated that the control group, who received no program or different programs (e.g., less intensive treatment), showed significantly different outcomes from the treatment group. The results imply that if the participant does not receive the intensive programs at an early age (3-4 years old) they might not make the same level of improvement in their development trajectory after 5 or 6 years. The follow-up results may support that early intensive programs contribute to positive changes in later developmental trajectories.
- Even though the follow-up studies provide evidence of positive changes in later developmental trajectories, it is too soon to conclude that early intensive programs such as ABA-home or hybrid-clinic-based programs produce positive changes in later developmental trajectories, because the body of evidence is insufficient. Therefore this conclusion should be considered tentative pending further supporting data.

Section Two

Review of DARS Data

The Department of Assistive and Rehabilitative Services (DARS) Autism Program has provided Applied Behavior Analysis (ABA) services to children in Texas ages 3-8 with a diagnosis of Autism Spectrum Disorders (ASD) since 2008. Services are provided through seven grant contractors which are local community agencies and organizations under contract to DARS to provide autism services: Any Baby Can (ABC; ABC was a contractor but not currently.); Autism Treatment Center (ATC); Center for Autism and Related Disorders (CARD); Child Study Center (CSC); Easter Seals North Texas (ESNTX); Mental Health and Mental Retardation Authority of Harris County (MHMRA); Texana Center (TEXANA).

Treatment Hours

Figure 2-1 presents the average of the reported treatment hours/month and the approximate treatment hours/week provided by each contractor. The total average of treatment hours/month was 59.9 hours (approximately 15 hours/week) across seven contractors. The average range of treatment hours/month was 42.8 to 109.4 hours. The intervention hours/week data for each contractor were not available; therefore the hours/week data are approximations that were calculated by dividing the average of reported treatment hours/month by four.

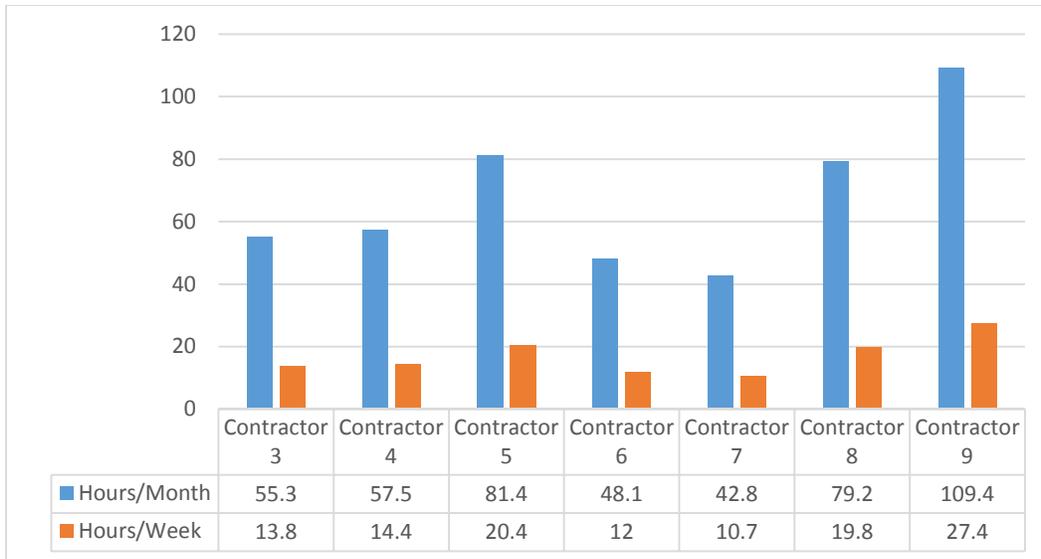


Figure 2-1. Average of Treatment Hours in Each Contractor.

Treatment Duration

Figure 2-2 summarizes the average of the reported treatment duration across seven contractors. The duration ranges reflect the total number of months a child was enrolled in the program rather than time of actual treatment service. For example, it is possible a child was enrolled in the program for 12 months, but only received services for 11 of those months because one month was dedicated to family vacation. The total average of treatment duration was 15 months. The overall range of treatment duration was from 1 to 27 months. The duration ranges for each contractor are as follows: contractor 3 (1-22 months), contractor 4 (1-28 months), contractor 5 (1-26 months), contractor 6 (1-27 months), contractor 7 (1-25 months), contractor 8 (1-33 months), and contractor 9 (2-9 months; this contractor was offering services for a shorter time).



Figure 2-2. Average of Treatment Duration in Each Contractor.

Age at Start of Services

Table 2-1 presents ages at start of services and the correspondent percentage and the number of children served by each contractor. Overall, the most common age at start of services was 4 (29.3%), followed by 5 (21.4%) and then 3 (19.7%). The age of the child at the start of services varied by contractor. For example, for contractor 3, most common was 3 (23.3%), followed by 4 (20.0%), 6 (20.0%), then 5 (16.7%). For contractor 4, the most common age at start of services was 5 (29.0%), followed by 3 (25.8%), then 4 (19.4%).

Table 2-1

Age at Start of Services for Each Contractor

Contractor	Age at Start						Total
	3	4	5	6	7	8	
Contractor 3	23.3%(7)	20.0%(6)	16.7%(5)	20.0%(6)	13.3%(4)	6.7%(2)	30
Contractor 4	25.8%(16)	19.4%(12)	29.0%(18)	16.1%(10)	6.5%(4)	3.2%(2)	62
Contractor 5	31.7%(20)	27.0%(17)	19.0%(12)	9.5%(6)	7.9%(5)	4.8%(3)	63
Contractor 6	14.7%(10)	35.3%(24)	29.4%(20)	13.2%(9)	5.9%(4)	1.5%(1)	68
Contractor 7	9.2%(11)	31.1%(37)	17.6%(21)	16.8%(20)	17.6%(21)	7.6%(9)	119
Contractor 8	29.3%(14)	33.3%(16)	16.7%(8)	10.4%(5)	8.3%(4)	2.1%(1)	48
Contractor 9	12.5%(2)	43.8%(7)	18.8%(3)	6.3%(1)	6.3%(1)	12.5%(2)	16
Total	19.7%(80)	29.3%(119)	21.4%(87)	14.0%(57)	10.6%(43)	4.9%(20)	406

Outcomes Analysis

The DARS autism program employed a pre- and post-test method to evaluate the effectiveness of the program. Each contractor administered two assessment tools (i.e., Pervasive Development Disorders Behavior Inventory [PDDBI], Psychoeducational Profile - third edition [PEP-3]) with each child served prior to the initiation of programming. They also administered the assessment tools when programming was completed for those children who did not drop out of the program. There are significant limitations inherent in pre- and post-test methodologies that prevent analyses of the data that allow for conclusions to be drawn regarding the effectiveness of the program. Specifically, these limitations prevent inferences of causality in terms of gains from pre to post-test and the program. Limitations include our inability to rule out the influence of

factors outside of the program in positive changes reflected in the pre- and post-test assessments. Potential factors that might influence the results that cannot be ruled out using pre- and post-test methods include natural maturation, history effects (e.g., learning that occurs as a result of variables outside the program), testing (i.e., exposure to the test itself can influence performance on the test), attrition (i.e., children dropping out of the program; e.g., attrition can influence scores as children who remain may be more successful in the program than those who dropped out would have been), and interactions between these various factors. Said another way, pre- and post-test methods cannot rule out threats to internal validity (i.e., the extent to which positive results indicated by the test, or assessment, can be attributed to the program). An additional factor complicating our ability to analyze the results included the manner in which the pre and post-tests were administered. Specifically, personnel from the respective contractors administered the pre and post-tests for the children who were served at those contractors. The recommendations for augmenting the methodology to increase internal validity and the ability to infer levels of effectiveness of the program are included in section three under program evaluation.

Section Three

Options for Service Delivery Treatment Modality

In order to identify the key elements associated with effective ASD treatments we conducted a systematic literature review by focusing on the following key questions.

The key questions were developed based on the elements requested by DARS.

KQ 1. How effective are the comprehensive programs?

KQ 2. What components of treatment programs are related to effective outcomes?

KQ 3. What characteristics of treatment service delivery are related to effective outcomes?

KQ 4. What specific characteristics of children and families are related to effective outcomes?

KQ 5. What are the best practices for inclusion of treatment services in an educational setting?

KQ 6. What are the funding options for treatment services?

KQ 7. What evidence supports long-term outcomes that verify positive changes in developmental trajectory?

The following were the methods we employed in conducting the systematic review of the literature.

Methods

Literature Search Process

The relevant literature was selected through a systematic search protocol we developed as shown in the left flow of the chart depicted in Figure 1-1(see below). Our

search consisted of database searches and manual searches (to identify additional studies not identified via electronic searches). Through these processes we obtained an initial pool of studies. We then identified studies with high-relevance through the systematic application of the inclusion criteria.

Database searches. We conducted electronic literature searches in September, 2013. In order to identify and retrieve studies, we utilized five databases: PsycINFO, Medline, ERIC, Education Source, and Academic Search Complete via EBSCOhost Research Databases service at the University of Texas libraries. We limited the search to peer-reviewed studies from 1969 to 2013. The electronic search retrieved/yielded 1,188 articles.

Manual searches. We conducted hand searches by tracking references from six meta-analysis reviews (i.e., Eldevik et al., 2009; Makrygianni & Reed, 2010; Peters-Scheffer, Didden, Korzilius, & Sturmey, 2010; Reichow, 2012; Virués-Ortega, 2010; Warren et al., 2011) found in the database searches. A total of eight studies were identified from the meta-analysis studies (i.e., not database searches). We also searched the most current program evaluation reports from representative comprehensive programs. For this we contacted 10 comprehensive programs evaluated by the National Research Council (2001) by email or phone. In addition, we checked other resources (e.g., Autism Speaks) for additional current comprehensive programs developed after the NRC report was published. As a result we identified two more programs and subsequently contacted those programs. Six of the 12 programs provided us with publications and/or descriptions related to their program evaluation. Most of the studies the programs provided were already found in our database searches. As a

result, the number of included studies identified by contacting comprehensive programs was two.

A total of ten studies were identified through manual search (studies from meta-analysis reviews [N= 8], studies from contacting comprehensive programs [N = 2]). Therefore the total number of articles initially selected through electronic and manual searches was 1,198.

Inclusion and exclusion criteria. To select appropriate studies for establishing criteria for program evaluation, we developed inclusion/ exclusion criteria for our systematic literature review. The criteria are summarized in Table 1-1 below. In order to identify high quality criteria for program evaluation, studies that employed rigorous experimental designs for evaluating effectiveness were chosen. The experimental designs included randomized controlled trials and pre/post-tests with a control group (non-randomized). Studies that evaluated effectiveness using pre- and post-tests without a control group, single-subject designs, and individual case reports were excluded. The initially selected articles (N=1,198) were screened against the inclusion/exclusion criteria. As a result, a total of 40 studies were selected/identified for inclusion.

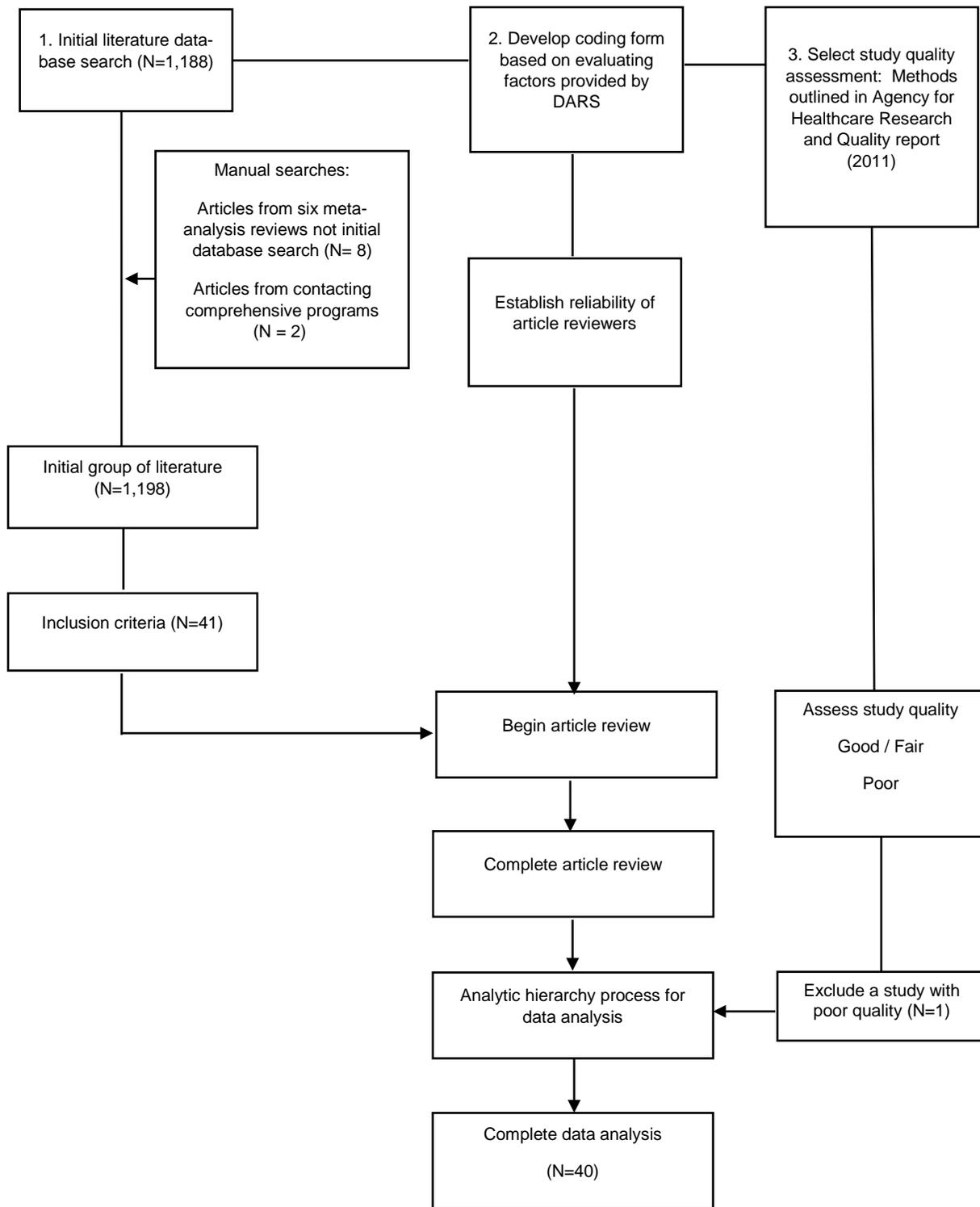


Figure 1-1. Process of Literature Review.

Table 1-1

Summary of Inclusion Criteria

8. All participants diagnosed with Autism Spectrum Disorders
 9. Participants under the age of 10
 10. Comprehensive programs/interventions that address multiple developmental areas including those representing the core features of autism spectrum disorder (i.e., social interaction, communication, atypical behaviors)
 11. Group research designs suitable for determining effectiveness of a program/intervention:
 - a. Randomized controlled trials
 - b. Pre/post-tests with control group (non-randomized)
 - c. The total number of participants ≥ 10
 12. Reports quantitative data
 13. Peer reviewed journals
 14. In English
-

Data Collection System

We utilized two coding procedures to extract relevant information from the selected/identified studies: coding for program evaluation criteria and coding for assessing quality of individual studies.

Coding for program evaluation criteria. A coding form was developed to extract data corresponding to the evaluation factors provided by DARS. This coding

form comprised 1) general information, 2) service delivery, 3) treatment modalities, 4) assessments, 5) outcomes, and 6) funding options.

Assessing quality of studies. A second coding form was developed to assess the quality of selected individual studies. To identify useful quality criteria for program evaluation, it is essential that the evaluation criteria be established from the information drawn from acceptable quality (e.g., good or fair) studies. For this purpose, we employed the quality assessing methods used by Warren et al. (2011); originally outlined in the EPC Methods Guide for Effectiveness and Comparative Effectiveness Reviews. We chose this method because it provides clear and specific assessment components, and a scoring system to assess the quality of individual studies based on the described protocol.

Reliability of review. Reliability of review refers to the consistency and dependability of the review procedures such that high reliability encourages confidence in the validity of the results. In order to review the selected articles with a high degree of reliability, two reviewers met and established consensus on coding methods and two coding forms. One coding form was used to summarize the articles based on program evaluation criteria and a second coding form to evaluate the study quality. Reviewers then independently coded two pilot articles with both coding forms and calculated inter-observer agreement (IOA). The IOA coding form for program evaluation criteria was 89% and the IOA for assessing study quality was 83.3%. An acceptable level of agreement is over 80% (NAC, 2009).

Analytic Hierarchy Process for Data Analysis

To identify useful quality criteria related to effective outcome, we employed an analytic hierarchy process for data analysis. We analyzed the treatment programs of the selected studies using three criteria: categorization of treatments, study quality, and effectiveness. For categorization of treatments, we first designated two standards of categorization: the program theoretical model (i.e., ABA, developmental, hybrid, and idiosyncratic models) and main treatment location (i.e., home, school, or clinic). Table 1-2 summarizes the programs included and the definition of each theoretical model. The categorization of treatment programs was made by combining the two standards, and the selected studies were organized into the following combined categories (e.g., ABA – Home, ABA – School, ABA – Clinic, Developmental – Home, Developmental – School, Developmental – Clinic).

Table 1-2

Summary of the Programs and Characteristics in Each Theoretical Model

Categorization	Program Name	Definition
ABA Model	<ul style="list-style-type: none"> ▪ Lovaas-model approach ▪ Early Intensive Behavioral Intervention (EIBI) ▪ Intensive behavior analytic based on Lovaas model 	Behavioral oriented approach based on ABA principles and strategies such as reinforcement, shaping, chaining, prompting, modeling, fading, discrimination learning, and task analysis using teaching formats such as discrete trial teaching (DTT).
Developmental Model	<ul style="list-style-type: none"> ▪ DIR/Floortime ▪ Focused Playtime Intervention (FPI) ▪ Hanen's More Than Words (HMTW) ▪ Scottish Early Intervention Program ▪ Social Communication Intervention 	Developmental oriented approach based on cognitive development theory and interpersonal development via social communication, social interactions, or play process.

Categorization	Program Name	Definition
Hybrid Model	<ul style="list-style-type: none"> ▪ Early Start Denver Model (ESDM) ▪ Learning Experiences and Alternative Program for preschoolers and their parents (LEAP) ▪ Barnet Early Autism Model (BEAM) ▪ Joint Attention Symbolic Play Engagement and Regulation (JASPER) ▪ Intervention for Interpersonal Synchrony (IS) 	Both behavioral and developmental oriented approach that influences intervention goals, procedures, and evaluation. For example, using behavioral analytic teaching strategies (e.g., reinforcement, shaping, chaining, prompting, and modeling) based on developmental oriented goals and curriculum within a mix of teaching formats and methods such as DTT (clinician-led) and naturalistic teaching (child-led).
Idiosyncratic Model	<ul style="list-style-type: none"> ▪ Treatment and Education of Autistic and Related Handicapped Children (TEACCH) ▪ Keyhole Intervention Program ▪ Treatment , Research and Education for Autism and Developmental Disorders (TRE-ADD) ▪ Management Intervention for Problem Behavior 	Use varied approaches that are difficult to classify as one of the three theoretical models above. For example, TEACCH is based on several approaches such as social learning theory, developmental, and behavioral approach (Odom. et al., 2010).

Next, we considered study quality. Specifically, we arranged the studies in each category based on their evaluated quality (i.e., good/fair or poor). Therefore, when the aforementioned grouped studies were analyzed, we discriminated information data in the good/fair studies from those in the poor and dropped the poor quality study.

Last, we considered the effectiveness of the treatment. To identify useful criteria to be utilized for program evaluation, we endeavored to differentiate data in the grouped studies related to effective outcomes from those with non-effective outcomes. Since the programs of the selected studies produced different outcomes of effectiveness across

different developmental areas, we provided a summary of effectiveness across developmental areas in each category (e.g., ABA – Home, ABA – School, ABA – Clinic or ABA, hybrid, developmental category) addressing key question number one. Related to the summary of effectiveness, the rest of the key questions were addressed in each category. We analyzed the collected data through the analytic hierarchy process; the outcomes of the analysis and recommendations are presented in the following section.

DARS requested public comment on potential changes to the Autism Program from January 15, 2014 through February 10, 2014. Fifteen respondents submitted a total of 68 written comments. Respondents included parents, providers, medical professionals, advocates for services for individuals with autism, and a state legislator. In addition, the Autism Program hosted three public meetings in various locations to gain public input regarding potential modifications to the program. Public meetings were held in El Paso, Dallas, and San Antonio. Thirty-four people attended the public hearings and a total of 30 comments were received from attendees including parents, medical professionals, advocates, legislative staff and providers. The written comments and the comments made at the public hearing are provided after the relevant recommendations from the literature review in the following section.

Recommended Modifications to the DARS Autism Program

Of the four theoretical models (ABA, hybrid, developmental, and idiosyncratic) targeting comprehensive treatment for children diagnosed with Autism Spectrum Disorders (ASD), the evidence supports the ABA-based model in terms of positive effectiveness across the largest number of developmental domains. Although there were some positive outcomes with other theoretical models, the evidence is not sufficient to recommend a change in model from the current DARS autism program. Specifically, the ABA model positively impacted three areas: language (8 of 10 studies), problem behavior (4 of 5 studies), and cognitive (10 of 15 studies) domains. The effects of the ABA model were also inconclusive in two areas: adaptive behavior (7 of 16 studies) and the severity of ASD (5 of 9 studies). The developmental model positively impacted the severity of ASD (2 of 3 studies) only. The hybrid model positively impacted two areas: adaptive behavior (2 of 3 studies) and cognitive (2 of 3 studies) domains. The effects of the hybrid model were also inconclusive in two areas: language (4 of 7 studies) and social (2 of 4 studies) domains. The idiosyncratic model positively impacted adaptive behavior (2 of 3 studies) and problem behaviors (1 of 1 study). The effects of the idiosyncratic model were also inconclusive in three areas: language (2 of 4 studies), social (2 of 4 studies), and cognitive domains (1 of 2 studies). The above results showed that the largest amount of research consists of ABA-based studies, providing the most, in terms of robust evidence base from which to draw conclusions relative to the other theoretical models.

Recommendations: Based on the evidence yielded by the review of the literature pertaining to models for comprehensive treatments of children with ASD, we

recommend the ABA-based model be the central approach taken by the DARS Autism Program.

Public Comments: Comments supported using ABA treatment and indicated that the research has proven that ABA is the most effective intervention for children with autism.

The remaining section identifies recommendations for the components of effective comprehensive ABA-based programs found in the literature to enhance services. In addition, we describe an effective, evidence-based alternative treatment modality that consists of targeted, or focused treatments (see the Evidence-based Effective Alternative Treatment Modality section below).

Evidence-based Effective Alternative Treatment Modality

Numerous ABA-based, empirically supported techniques and procedures exist that have been demonstrated to be effective in the decrease of behaviors of concern (e.g., problem behavior); and improvement in behavior deficits (e.g., language and communication; self-help skills; social skills). These include empirically supported assessment and intervention procedures such as function-based approaches to problem behavior including functional behavioral assessment (FBA), functional analysis (FA), functional communication training (FCT), reinforcement-based treatments (e.g., differential reinforcement of alternative behaviors; differential reinforcement of other behaviors; differential reinforcement of compliance; noncontingent reinforcement [NCR]); and procedures for assessing and teaching skills such as task analysis, discrete trial training, and other reinforcement-based skill teaching programs. These techniques and

procedures have been demonstrated to be effective across a wide variety of settings (e.g., schools, home, vocational, outpatient) and ages in the behavioral literature.

These empirically supported techniques and procedures are distinct from comprehensive treatment programs in that they target prioritized, specific behaviors of concern (e.g., problem behavior) and specific skill deficits (e.g., language and communication; self-help; social skills) rather than broad-based functioning across general domains. These techniques and procedures can be conducive to a variety of service delivery modalities including consultation following initial assessment and treatment evaluations and relatively short, intense treatment implementation; approaches that emphasize caregiver (e.g., parents, teachers) training and on-going support, teaching, and feedback regarding the implementation of assessment and intervention procedures; and other relatively novel delivery methods such as telehealth and online communication systems (e.g., Skype; FaceTime).

ABA-based Comprehensive Program Characteristics

Treatment Intensity and Duration

Across 15 ABA-based studies of comprehensive treatment programs that demonstrated effectiveness, the treatment intensity averaged approximately 29 hours (range 14 to 40 hours) per week. In six of eight studies conducted in the home setting, treatment intensity averaged 32.7 hours (range 18.4 to 40 hours). Two additional studies, conducted in the home, differentiated treatment hours based on age. Children younger than 3 years of age received between 22.5 to 30 treatment hours (range 20 to 30 hours) per week and children older than 3 years of age received between 30.5 to 35.5 treatment hours (range 26 to 40 hours) per week. In three studies conducted in

the school setting, the treatment intensity averaged 23 treatment hours (range 15 to 37 hours) per week. In four studies conducted in the clinical setting, the treatment intensity averaged 30.65 hours (range 14 to 35 hours) per week.

Across the 15 ABA-based studies that demonstrated effectiveness, treatment duration averaged approximately 20 months of intervention (range 9 to 48 months). In eight studies conducted in the home setting, the average treatment duration was 20.6 to 22.1 months (range 9 to 36 months). In three studies conducted in the school setting, the average treatment duration was 18 months (range 12 to 36 months). In four studies conducted in the clinical setting, the average treatment duration is 21 months (range 12 to 48 months).

Recommendations: Based on the evidence yielded in the review of the literature pertaining to intensity of ABA programming, we recommend that at least 14 hours of treatment per week be provided. We recommend that higher levels of intensity (e.g., 20 – 30 hours/week) are implemented when duration of treatment is anticipated to be relatively shorter and/or when an individual's needs are deemed relatively higher. Additionally, we recommend that level of intensity should be determined and adjusted based on individual needs evidenced by progress (or lack of progress) as identified via on-going progress monitoring.

Additionally, based on the evidence yielded in the review of the literature pertaining to duration ABA programming, we recommend that the treatment period consist of at least 9 months. We recommend that longer durations (e.g., approximately 2 years) be applied and used when intensity of treatment is relatively lower; and based

on individual needs as evidenced by progress or lack of progress as identified via on-going progress monitoring.

Public Comments: Individuals provided comments regarding the establishment of criteria for the intensity of services allowed or required in the program.

- a) Parents indicated that they tried an ABA program but it was for a short duration and with only two hours of therapy a week. The parents indicated that the lack of intensity did not adequately address their child's sensory issues or speech delays.
- b) Medical professionals indicated that the National Research Council recommends more intensive service, defined as: intensive (15-25 hours/week, high adult to pupil ratio), and early (18 months to 5 years of age at service initiation) intervention that addresses the comprehensive needs of children with ASD.
- c) Providers indicated that since there is not a way to predict how a child with autism might respond to behavioral intervention, it would be difficult to establish criteria for treatment intensity (these criteria, in essence, would not be based on existing empirical evidence). The providers recommended that all children be admitted to the program at maximum treatment intensity for the first six months and subsequently, each child's individual rate of progress in various domains (e.g., motor imitation, matching pictures and objects, listener skills, speaker skills, problem behavior, number of reinforcers) during the first six months be used to determine treatment intensity for subsequent months.
- d) Providers suggested permitting them to base the number of service hours per week on the needs of the child and family, but establish minimum and maximum hours.

e) Individual advocates indicated that the DARS Autism Program should explore ways to use empirically-developed behavioral interventions so more children in Texas will benefit and to look at the intense need for effective services in the underserved areas of Texas.

In addition, individuals expressed support to expand the length of time for eligibility and recommended extending the length of time for eligibility to three years.

Service Provider Qualifications

Therapists. Therapists' backgrounds were diverse; however the evidence from ABA-based studies that demonstrated effectiveness suggested that consistent and rigorous training and supervision of therapists were more important than the therapists' backgrounds. Out of the eight ABA-based studies that were conducted in the home, therapists included college students (four studies), tutors (three studies) and recruited from the community (one study). Four of eight ABA-based studies conducted in the home provided information on therapist qualifications. In two studies, the undergraduate therapists worked a minimum of 6 months under supervision. In two studies, therapists were required to pass a rigorous behavior observation assessment evaluating their accuracy or proficiency on conducting DTT, and a competency knowledge test. One study in addition, also required therapists to receive favorable ratings from their supervisors. Out of the three ABA-based studies conducted in the school setting, the therapists were aides and teachers who did not have any ABA or EIBI experience. In three of four ABA-based studies conducted in the clinic setting, the therapists were clinic staff members and in one study, were at least 18 years of age with at least a year of college experience. A second clinic-based study described therapists as skilled

behavior therapists, although they did not report what qualifications were required for this title. In addition, two of the four clinic-based studies included parents as co-therapists, but did not provide any recommendations for qualifications to participate. Three studies (home – 1; clinic -2) also suggested that parents may serve as program co-therapists, but they should be willing to commit at least 5 hours/week observing sessions conducted by therapists, learn how to use behavioral strategies, and implement programs under supervision and with feedback from the therapists. The extent to which it is necessary for parents to serve as co-therapists as related to effective outcomes is discussed further in the section “Parent involvement”.

Recommendations: Although the evidence yielded by the review of the literature was highly variable in terms of therapist qualifications, a relatively consistent component in the reviewed studies was the meeting of minimal standards of training based on established criteria (as evidenced either by written assessment or assessment based on direct supervision). However the evidence suggested that training and supervision were more crucial components than therapist qualifications. Therefore, therapist-focused recommendations will center on training and supervision (see below).

Public Comments: Comments supported that the guidelines of the Behavior Analysis Certification Board (BACB) are widely accepted and propose adopting their guidelines with respect to education, training and experience requirement. The providers further commented that if DARS decides to require autism technicians to be registered behavior technicians that the required training and the subsequent credentialing process could take several months to complete.

Supervisors. Supervisors should have extensive training and experience in treating children with ASD. Eleven of 15 ABA-based studies that demonstrated effectiveness (home – 6; school - 3, clinic - 2) reported that supervisors were often senior therapists with at least 1500 hours or 2 years of experience (home – 2; school – 3; clinic - 1); and/or college degreed clinicians (bachelor’s, master’s, or PhD; home – 3; school – 1); demonstrated competency in development and implementation of treatment programs (home – 1); director of the clinic (clinic – 1); or were certified as a Board Certified Behavior Analyst (BCBA; home - 3). It should be noted that credentials for BCBA’s require 225 hours of graduate level courses and at least 1500 hours of supervised experience, although this experience does not necessarily have to be with individuals with ASD.

Recommendations: Given that some insurance companies are now requiring treatment programs to be developed and supervised by BCBA’s and given that the BACB certification (i.e., BCBA) indicates a minimum standard of supervision of clinical hours practicing and designing ABA programming and understanding of behavioral principles and ABA, we recommend the minimum supervisor qualification should be a BCBA credential with experience working with children with ASD.

Public Comments: a) Individuals commented that because “the Autism Program model provides comprehensive Applied Behavior Analysis treatment services,” clinical supervisors must be Board Certified Behavior Analysts. b) “Regarding the potential change that those supervising staff must be a BCBA or BCBA-D, currently, we have our BA-Is (Bachelor level staff mostly not certified) also supervising our staff and conducting training with them in coordination with the BA-II’s (BCBA’s or Master level staff). All staff

get training from the BA-IIIs as well but we would prefer to also have the flexibility to allow our BA-Is to conduct training as well due to the skill level required for that position and our training methods.”

Consistent Treatment Implementation

Therapist training. Three of 15 ABA-based studies that demonstrated effectiveness reported therapist training activities (school – 1; clinic – 2). In one study, training consisted of an apprenticeship format in which supervisors set up the children’s programs and the therapists implemented them, but received in-vivo feedback from supervisors. Therapists also received hands-on training during weekly meetings. The second study described several components. Therapists and parents serving as co-therapists underwent a theoretical workshop lasting one week (15 hours), followed by one week of treatment observations in play rooms (6 hours) and videoed observations of one-to-one sessions under supervision (6 hours), and concluded with one week of participation in supervised one-to-one sessions (5 hours) and direct treatment application (10 hours). The third study described therapist training generally as 30 hours of training, which included a minimum of 10 hours of one-to-one training and feedback while working with their assigned child. The initial therapist training (i.e., workshop) was conducted before starting the treatment and continued on a regular basis (weekly or biweekly), utilizing team meetings to review or practice difficult strategies (see “supervision activities”).

Recommendations: Although the evidence yielded by the review of the literature was highly variable in terms of therapist training, a relatively consistent component in

the reviewed studies was the meeting of minimum standards of understanding of principles of ABA and accuracy of implementation of ABA procedures (as evidenced by written assessment or assessment based on direct supervision). We recommend that all therapists undergo formalized training (i.e., didactic instruction; workshops; readings; observation of modeling of techniques by supervisors; role-play with supervisors; in-situ training in which supervisors provide specific feedback and additional training as needed) by supervisors on methods for data collection, procedures for implementing DTT, prompting procedures, behavior management strategies for addressing problem behavior, other program specific methods, and other ABA techniques. In addition, we recommend that the effectiveness of formalized training be assessed via written exams (with criteria established to determine mastery) and direct observation of therapists by supervisors as they work directly with clients (with fidelity checklists used to assess accuracy of use of procedures and criteria for determining mastery) to ensure individual acquisition of the skills necessary to accurately implement ABA treatments.

Public Comments: Individuals suggested that DARS explore the use of technology (distance-training) as a training and coaching tool for staff for facilities in some of the underserved areas.

Supervision activities. Nine of 15 ABA-based studies that demonstrated effectiveness (home – 2; school – 3; clinic – 4) reported the use of supervision activities; however only six provided descriptions of the activities. Based on the evidence, supervision included a focus on the treatment program goals as well as implementation of the treatment programs. For supervision of the treatment programs goals, the literature suggested regular (weekly or biweekly) progress monitoring meetings lasting 1

to 2 hours, which included the therapists, supervisors, and parents. During these meetings, program data were reviewed, goals adjusted, mastery criterion set for new skills, therapists trained, if needed. Supervision of the implementation of the treatment programs included regular monitoring through observation of sessions in person or through videotaped interactions, 1-2 hours/week. Supervisors provided both positive and critical feedback on the therapist's abilities to implement strategies and collected ongoing data. Supervisors were additionally responsible for developing teaching programs and training novice therapists.

Recommendations: We recommend that regular supervision procedures be established (i.e., weekly or biweekly; 1-2 hours/week) and followed that include direct observation of ABA programming (in-person and/or via video recordings) to assess accuracy of implementation of procedures by the therapist, to inform the supervisor on the potential need to adjust teaching procedures based on individual characteristics and needs, and/or to adjust behavior management strategies as needed. Data from ABA programs and pertaining to problem behavior should be reviewed on an on-going basis (e.g., daily; 2-3 times per week). Supervisory meetings that include supervisors, therapists, and parents should be conducted at least bi-weekly for the purpose of data review, program adjustment and planning, and training.

Public Comments: a) Comments supported that it would be good to set minimum standards with respect to staff supervision and that at the very least autism technicians must meet face-to-face with a BCBA to discuss a child's clinical data approximately 50% of the days in which the child receives therapy. b) Comments also supported that more

information is needed to make an assessment regarding the requirement for supervising staff to have knowledge of typical child development for 3-8 year olds.

Use of manuals. Eight of 15 ABA-based studies that demonstrated effectiveness (home – 5; school – 2; clinic -1) reported use of a manual. Five studies reported that they referenced manuals used in the comprehensive program developed by Ivar Lovaas (commonly referred to as the “Lovaas method”). However the studies did not provide specific content of the manual as an Appendix.

Recommendations: Based on the reviewed evidence, providers should utilize a manual or common protocol to maintain consistency of treatment implementation. For example, providers should consider utilizing the manuals used by Lovaas when applicable based on the component of the program used.

Fidelity evaluation. Three of 15 ABA-based studies that demonstrated effectiveness (home – 1; clinic – 2) reported implementing fidelity evaluation protocols; but did not report results. These evaluations were conducted by external raters who assessed how the therapists collected data, utilized general behavioral strategies, and carried out the teaching components of the child’s individual skills program. These observations were conducted in person or using videotaped treatment sessions. A supervisor then reviewed the results of the fidelity evaluations with the therapists and discussed ways to improve the therapists’ service delivery.

Recommendations: We recommend that assessments of fidelity be conducted on an on-going basis during training (see above comments pertaining to recommendations for training); and following successful training (i.e., mastery achieved based on

observations and use of behavioral fidelity checklists developed by supervisors) assessments of fidelity should be conducted on an established, regular basis (e.g., accuracy of implementation of each ABA program procedure and behavior management strategy procedures assessed at least once per month using a fidelity checklist). These evaluations should be conducted with anyone conducting therapy with the child (including parent-implemented therapy).

Parent Involvement

Parent involvement roles. The preponderance of evidence (14 of 15 ABA-based studies that demonstrated effectiveness) suggested that parents should be involved in their child's program. However, existing evidence related to parent involvement roles is not sufficient to identify the specific roles that are linked to more effective outcomes. The following describes the various parent roles.

In the least intensive role described in six ABA-based studies (home – 2; school – 2; clinic – 2), parents participated in informational sessions or workshops to increase their understanding of ASD and general behavioral strategies that can be used on a daily basis. For example, learning about the functions of problem behavior empowered parents to differentiate between reinforcing appropriate behaviors and inadvertently reinforcing problem behaviors. In nine ABA-based studies (home – 3; school – 2; clinic – 4), parents were also included as a member of the child's team of stakeholders.

In a more intensive parent role described in four ABA-based studies (home – 3; school – 1), parents learned the intervention strategies to the extent that he/she actively encouraged opportunities for generalization at home and in community settings. Last, in

three ABA-based studies (home – 1; clinic -2), parents participated by becoming co-therapists who conducted intervention sessions outside of scheduled treatment sessions. The role of co-therapist was the most intensive, requiring hours of session observation, teaching, ongoing supervision and feedback. Although parents can be effective co-therapists who can help contribute to positive child outcomes, it was unclear whether this level of intensity was necessary to gain significant outcomes.

Recommendations: We recommend that parent input should be solicited during the planning stages in order to help individualize the child’s treatment program. Parents should be asked and encouraged to help prioritize skills to target, select functional targets and goals that fit the family’s lifestyle, needs, and/or culture. As mentioned previously (see supervision recommendations), we recommend that parents participate in regular supervision meetings in which data are reviewed, programs are adjusted and planned, and training is conducted.

Public Comments: Comments supported having parents as active participants in the program. The provider suggested that parents be required to come in for training at least 1 hour every two weeks, and to track progress (i.e., collect data) at home.

Program components for parent training. In six ABA-based studies that demonstrated effectiveness (home – 2; school – 2; clinic – 2), parent training consisted of 12-18 hours training workshops across 2-3 days. These workshops provided an introduction to ASD, basic behavioral principles (reinforcement, functions of problem behavior), and teaching strategies (prompting, promoting functional communication, generalization). Thereafter, parents were trained on how to generalize their child’s newly acquired skills at home and in community settings during weekly training sessions

or were given weekly instructions for home treatment. In three ABA-based studies (home – 1; clinic -2) in which the parent was a co-therapist, they were trained with the same intensity as the therapists' training. For example, following a one-week (15 hours) theoretical workshop, the parent participated in one week of treatment observation (6 hours), video observations of one-to-one sessions (6 hours) and concluded with one week of supervised hands-on application of treatment strategies (10-hours total, with 5-hours in clinic).

Recommendations: The existing evidence related to parent training components is not sufficient to identify the amount and type of training that are linked to more effective outcomes. However, there were several common elements pertaining to parent training. As such, we recommend an approach to training parents that incorporates formal workshops that focus on basic behavioral principles, teaching strategies, behavior management strategies, and information pertaining to ASD. These workshops should be offered prior to or early on in terms of initiation of ABA treatment. Workshops should include didactic instruction, role-play, modeling, in-situ training, on-going feedback, and additional training as needed. Written assessments and fidelity checklists should be utilized to assess mastery of skills and inform supervisors on the effectiveness of the workshops in providing training to parents. Initial parent training should consist of at least 10 hours of total training. Regular follow-up sessions should be conducted to assess parent understanding and fidelity (via direct observation of parent/child interactions; e.g., during weekly or bi-weekly supervision meetings; see above).

Public Comments: Individuals commented regarding a possible increase in requirements for parent training.

- a) Parents indicated they supported parent training.
- b) Providers indicated that requiring parent training once a week would be very challenging from a scheduling standpoint for BCBA's to complete. Instead, the providers support group parent training and stated they are currently providing this. The instructor presents a topic and in subsequent weeks the parents work with the instructor on how to utilize the information received on the topic. The parents develop a support system with each other. In this group parent training model, the child is not present.
- c) Providers suggested requiring a minimum number of hours of parent training. For example, require parents to participate in training for 10-15 hours (total) during each 3-month period of service. Parents should be offered weekly training sessions if they desire more hours.
- d) Advocates suggested that DARS:
 - explore expanding effective ways to train parents to use effective behavioral intervention, and coach or supervise to ensure fidelity of the interventions; and
 - explore the use of technology (distance-training) as a training and coaching tool for families for facilities in some of the underserved areas.

Review of Child's Progress

None of the ABA-based studies reported information regarding the frequency of progress review to continue services.

Recommendations: Although sufficient evidence does not exist on which to base specific, formal recommendations pertaining to continuation or ceasing of services, the recommended regular supervision meetings (see above) can serve as a format for continued evaluation of progress and determinations about continued services and future plans in this regard should be discussed within the context of the progress (or lack of progress) as evidenced in the regularly reviewed data; and parents should play a primary role in those discussions.

Significance of Child Development

Understanding of typical child development was not always explicitly targeted but most, if not all, programs were individualized based on the child's strengths and needs gathered from ongoing evaluations using a mixture of standardized assessments and direct observational measurement. These assessments were often developmental in nature (e.g., Vineland Adaptive Behavior Scales). Ten of 15 ABA-based studies reported this component (home – 3; school – 3; clinic – 4). Four of the 10 studies specifically reported the use of typical child development sequences to guide individualization of programs, although they did not report the methods or materials for doing so.

Recommendations: We recommend utilizing an individualized program based on typical child development sequences. For this we advocate administering assessments to identify the child's strengths and needs using a mixture of standardized assessments and direct observational measurements. Based on the identified strengths and needs, individualized goals should be developed and prioritized based on typical child

development sequences. The modification of the programs should be based on review of the child's progress (or lack of progress) as evidenced in the regularly reviewed data.

Service Delivery Approach

Multidisciplinary approach. The reviewed literature of ABA programs that demonstrated effectiveness suggested that including a multidisciplinary group of professionals is not as important as individualizing the child's program based on strengths and needs. In only one of 15 ABA-based studies that demonstrated effectiveness, a speech-language pathologist, occupational therapist, and preschool special education teacher contributed recommendations for treatment in their specific areas.

Recommendations: Although the reviewed evidence related to utilizing multidisciplinary, consultative, or collaborative service delivery approaches is not strong, we recommend that consideration be given to the utilization of multi-disciplinary (transdisciplinary) and consultative service delivery approaches in which professionals from different disciplines work together (e.g., for input from multiple sources of expertise regarding such issues as speech pathology; to avoid fracturing services along disciplinary lines).

Consultative or collaborative approach. Seven of 15 ABA-based studies that demonstrated effectiveness utilized a consultative approach and two of 15 ABA-based studies utilized a collaborative approach. In the consultative approach, a qualified supervisor (and multidisciplinary professionals, if they were involved) provided feedback to therapists and/or parents through regularly scheduled meetings and supervision. In

the collaborative approach, the therapist and parent worked together as co-therapists (see “parent involvement roles”).

Recommendations: Although a majority of studies did not report using either a consultative or collaborative approach, collectively, the two models support the use of ongoing feedback and supervision between a trained supervisor and therapist or parent.

Public Comments: Providers supported providing services in another location to reach more children and families. The providers indicated that therapy could be provided using a consultative model where a BCBA works with a family in their home and in their community over the course of a week. During that week, the BCBA would model the appropriate techniques and then allow the parents and others involved with the child to practice while the BCBA provided feedback. The BCBA would continue to maintain contact with the family through emails, phone calls, and videos.

Characteristics of Children and Families

Age at start of treatment. Across 15 ABA-based studies that demonstrated effectiveness, the ages for children who entered into treatment services ranged between 22 to 84 months (just under 2 to 7 years). Although this is a large range, there were some trends based on the setting of the treatment. In home-based programs, the average starting age was approximately 39.6 months (range 32 to 48 months). In school-based programs, the average starting age was between 40.3 to 81.3 months (range 25 to 84 months). In clinic-based programs, the average starting age was between 41 to 44 months (range 22 to 81 months).

Recommendations: The existing evidence is not sufficient to identify the specific ages that are linked to more effective outcomes. However, based on the evidence yielded by the review of the literature, we recommend that treatment begin as early as reasonably possible (e.g., approximately 36 months of age) as dictated by the identification of ASD in the individual, at least by 80 months of age. This recommendation is also based on follow-up results that suggested a potential relation between age at start of program and level of long-term improvement. Specifically, follow-up results implied that when participants do not receive programming at an early age (3-4 years old), it may negatively affect developmental trajectory after 6 years.

Public Comments: Individuals commented regarding a potential change to program age limits. All were in support of expanding the age limits from as early as 18 months in age to children older than nine years, the current age cap.

Diagnosis and severity of autism. Most studies required an independent diagnosis of autistic disorder or pervasive developmental delay not otherwise specified and did not include children who had any other major medical conditions (e.g., Down syndrome, seizures, Attention-Deficit/Hyperactivity Disorder, and deafness).

In a regression analysis from one study, more gains were made with individuals who had a higher severity of autism. The relationship between the treatment program and gains for children with less severe autism was less clear. There may be some pretreatment variables linked to significant outcomes. Those who responded well had higher scores on IQ, mental age, Vineland adaptive composite, communication and social skills scores, more behavior problems and autistic symptoms as reported on the Developmental Behavior Checklist as compared to the children who did not respond as

well to treatment. However, currently, the existing evidence is not sufficient to draw firm conclusions regarding child characteristics that are linked to more effective outcomes.

Recommendations: The existing evidence is not sufficient to identify relations between diagnosis and severity of autism and more effective outcomes. We recommend that assessment and treatment practices be individualized with a focus on those deficits and skills pertaining to the core characteristics of the ASD diagnosis (e.g., communication deficits; social interactions, focus on repetitive or restricted behaviors) for the purpose of program treatment planning. The modification of the programs should be based on review of the child's progress (or lack of progress) as evidenced in the regularly reviewed data.

Public Comments: Commenters indicated that changes to determine treatment based on severity level are dangerous. The commenters also indicated awareness of the DSM-5 definition and the levels that are associated with the new definition of ASD; however, they do not believe that these levels were ever meant to filter the higher functioning children out from treatments and felt that this is exactly what these proposed changes will do. The commenters felt that taking treatment away from children that are deemed less severe is taking valuable opportunities away from a child that can learn to overcome some of the challenges of being a person with autism thus robbing our society of another functioning citizen.

Family characteristics. Most studies did not report socioeconomic status (SES). Of those that reported ethnicity and race, most families were Caucasian. However the existing evidence related to family characteristics is not sufficient to identify the characteristics that are linked to more effective outcomes.

Benefits and Risks of Implementation

There is convincing evidence to support several benefits to ABA-based programs. Highly-intensive ABA programs can be effective for children with severe difficulties in intellectual, educational, and adaptive behavioral functioning. There are also potentially long term benefits from comprehensive ABA treatment based on the Lovaas model. In one study of a 6-year follow-up conducted after a two-year comprehensive ABA program, children maintained the improvements in their level of intellectual functioning measured at post-treatment. The follow-up results imply that if the participant does not receive the programs at an early age (3-4 years old) they might not make the same level of improvement in their developmental trajectory after 6 years. Even though the follow-up study provided evidence of positive changes in later developmental trajectories, there was only one ABA based longitudinal study. Thus the strength of evidence is insufficient to draw firm conclusions about which early ABA programs produce positive changes in later developmental trajectories. Therefore this suggestion should be tentative until enough follow-up data support the suggestion.

We did not identify evidence suggesting risks of the implementation of ABA based programs for the children. However, there are some concerns to be considered. There is a relatively high cost (annually \$45,575-\$69,050) to provide such intensive services (Institute of Education Sciences, 2010); however, one should also consider that it costs more than \$1.4 million to provide supported lifelong care (Autism Speaks, 2012) in the U.S. With such intensive services, there are limits to how many children may be served at a given time. While there are many interventions available that may require fewer resources or that could be provided to a larger number of children with existing

resources, many are unfounded in their effectiveness. It seems prudent to support treatment programs that have demonstrated effectiveness until other programs that may require less resources are determined effective.

ABA-based Focused Treatment Techniques

This section describes empirically supported ABA-based techniques and procedures, or focused treatments. These treatments target prioritized, specific behaviors of concern and/or specific skill deficits across core and secondary areas of ASD (i.e., language and communication; social skills; challenging behavior; and adaptive behavior). To summarize empirically supported behavioral techniques and procedures, we examined studies in which systematic reviews of the behavioral literature were conducted pertaining to treatments for one (or more) of the core, or secondary areas of ASD.

Literature Search Process

We conducted electronic literature searches using five databases: Academic Search Complete, Education Full Text, ERIC, PsycINFO, Psychology and Behavioral Sciences Collection and via EBSCOhost Research Databases Service at the University of Texas libraries. The search terms employed were as follows: “autis*”, “social skills”, “adaptive behavior”, “challenging behavior”, “repetitive behavior”, “communication” or “language”, and “review”. We selected the three latest literature review studies in each target area (i.e., language and communication; social skills; challenging behavior; and adaptive behavior) between 2009 and 2014. If we could not find three review studies within the designated time period, we extended the year limitation an additional five years. The following sections describe empirically-based, behavioral treatment

strategies reviewed in the identified literature review studies. Table 3-1 summarizes the treatment strategies. It should be noted that the described strategies have been empirically evaluated in studies that have appeared in peer-reviewed journals. We did not conduct a systematic review of individual studies to evaluate effectiveness as we did in the previous sections on comprehensive treatment models. Additionally, the list of described strategies in this section should be considered non-exhaustive in terms of ABA-focused treatments.

Language and Communication

The three most recent studies that reviewed ABA-based treatments for language and communication deficits included Brunner and Seung (2009); Kim and Utley (2009); and Ogletree, Oren, and Fischer (2007). Communication and language is defined as the “ability to express wants, needs, choices, feelings, or ideas” (Wong, Odom, Hume...Schultz, 2014, p. 19). In the studies reviewed in the literature reviews, communication and language skills involved spoken language, gestures, and the ability to initiate or maintain conversations. Effective ABA-based techniques for increasing communication skills as indicated by the literature reviews included Functional Communication Training (FCT), Augmentative and Alternative Communication (AAC), modeling/video modeling, and time delay. These techniques and procedures are typically implemented in combination with reinforcement and various prompting procedures.

FCT. FCT is used primarily with individuals who engage in challenging behaviors (e.g., tantrums, self-injury, aggression, and property destruction). The therapist first determines the motivation, or function of the challenging behavior (e.g., via Functional

Analysis [FA] or other Functional Behavioral Assessment [FBA] methods). The individual is then taught an appropriate communicative behavior (e.g., voice output device, sign language, picture card exchange, and tablet-based communication) to replace challenging behavior in the individual's repertoire. This is achieved by providing the functional reinforcer (e.g., escape from non-preferred activities; access to preferred activities; and attention) following instances of the target appropriate communication.

AAC. AAC approaches utilize non-verbal methods of communication that are often visually based (e.g., Picture Exchange Communication Systems [PECS], sign language, and picture and symbol communication boards and devices). For example, PECS is a behavioral intervention system that involves teaching the individual to utilize visual-graphic symbols to communicate wants, needs, and thoughts. AAC approaches can also involve the use of digital-based communication systems (e.g., tablet-based communication applications).

Modeling/video modeling. Modeling is a specific type of prompting procedure used to facilitate correct responding through real-time demonstrations of target language/communication behaviors. Video modeling is a specific type of modeling in which video-based models (i.e., peers or adults engaging in the target language/communication behavior) are presented to individuals and they are encouraged to imitate the video. Reinforcement strategies are typically used in conjunction with modeling strategies (i.e. reinforcement is immediately provided in the form of praise and/or delivery of requested items contingent on the individual's use of language/communication).

Time delay. Time delay is also known as “expectant waiting”. The therapist arranges the environment to occasion communication opportunities; or delivers a prompt to promote the target language/communication behavior. Reinforcement is immediately provided in the form of praise and/or delivery of requested items contingent on the individual’s use of language/communication. This strategy is used in conjunction with a hierarchal prompting system (e.g., least to most prompting or most to least prompting) that typically includes vocal and gestural/model prompts.

Reinforcement. Reinforcement is the presentation of a consequence(s) following target language/communication behaviors that increases the probability that the behavior will occur in the future when opportunities emerge under similar conditions. Both positive reinforcement (i.e., the provision of consequences such as preferred activities or attention following behavior) and negative reinforcement (i.e., the contingent removal of non-preferred activities) are used to strengthen target language/communication behaviors.

Prompting. Prompting entails the presentation of stimuli to increase the probability with which the individual will emit the target language/communication behavior. Prompting procedures can entail vocal, physical, or visual cues and are generally presented in a hierarchal sequence (e.g., least to most prompting or most to least prompting). For example, a vocal prompt may be presented and if the individual does not emit a language/communication behavior, a visual cue or a physical prompt is presented to facilitate the desired response. Reinforcement strategies are typically used in conjunction with prompting.

Social Skills

The three most recent studies that reviewed ABA-based treatments for social skills deficits included Flynn and Healy (2012); Matson, Matson, and Rivet (2007); and Scattone (2007). Social skills refer to “interpersonal responses with specific operational definitions that allow the child to adapt to the environment through verbal and nonverbal communication” (Matson et al., 2007, p.683). In the reviewed studies, social skills involved social initiation, contingent response, securing attention, eye contact, voice volume, turn taking, perspective taking, maintaining interactions, play, and friendship. Effective ABA-based techniques for teaching and promoting social skills as indicated by the literature reviews included video modeling, social scripts and script fading procedures, self-management, and peer mediated intervention. These techniques and procedures are typically implemented in combination with reinforcement and various prompting procedures.

Video modeling. Video modeling is a modeling procedure in which pre-developed video-based models (i.e., peers or adults engaging in the target social skills) are presented to individuals and they are encouraged to imitate the video. Reinforcement is typically provided contingent on successful demonstration of the modeled social skills.

Social scripts and script fading procedures. Social scripts and script fading procedures initially entail the use of specific structured scripts related to the target social skill (i.e., the scripts serve as prompts for the individual). The individual repeatedly practices the skill through the use of the script. As the individual demonstrates success,

the scripts are gradually faded in a stepwise manner until all written prompting is removed.

Self-management. Self-management procedures involve teaching individuals to independently regulate their own behavior by discriminating between appropriate and inappropriate target social skills. Individuals are taught to monitor and record data on their performance in using target social skills; and self-reinforce for correct performance.

Peer mediated intervention. Peer mediated intervention involves the incorporation of peers into social skills teaching programs. Peer mediated interventions can be implemented with pairs or small groups; and can include the individual and typically developing peers. Peers are typically trained to serve as the intervention agents to promote the individual's use a target social skill, social interactions, and acquisition of social skills.

Positive reinforcement. Positive reinforcement entails the provision of preferred stimuli contingent on engagement in target social skills. Positive reinforcement is often used in conjunction with other social skills training procedures to facilitate the use of, and acquisition of social skills.

Prompting. Prompting entails the presentation of stimuli to increase the probability with which the individual will emit the target social skills. Prompting procedures can entail vocal, physical, or visual cues and are generally presented in a hierarchal sequence (e.g., least to most prompting or most to least prompting). Reinforcement strategies are typically used in conjunction with prompting to promote the use of, and acquisition of social skills.

Challenging Behavior

The three most recent studies that reviewed ABA-based treatments for challenging behavior included Boyd, McDonough, and Bodfish (2012); Brosnan and Healy (2011); and Patterson, Smith, and Jelen (2010). Challenging behavior is defined as “any behavior that is destructive, harmful, disruptive or otherwise unacceptable and that occurs with sufficient frequency or severity to be of major concern” (Sigafoos, Arthur, & O’Reilly, 2003). In the reviewed studies, challenging behavior included self-injury, aggression, noncompliance, and repetitive/restricted behaviors (i.e., restrictive interests and/or inflexible adherence to nonfunctional routines or rituals). Although challenging behaviors such as aggression and self-injury are not considered core characteristics of ASD (i.e., they are not part of the diagnostic criteria), many individuals with ASD exhibit challenging behaviors that produce various complications (i.e., tissue damage to self and others; social isolation; and increased deficits in academic, social, and vocational functioning). Effective ABA-based techniques for treating challenging behavior as indicated by the literature reviews included FA and FBA techniques, response interruption/blocking, response cost, skill enrichment strategies, differential reinforcement, FCT, noncontingent reinforcement (NCR), extinction, and interspersed requests.

FA and FBA. FA and other FBA procedures are used to identify the motivation, or function of challenging behavior. An FA consists of directly manipulating antecedents and consequences to systematically assess the conditions in which challenging behavior is more or less likely to occur. Other FBA procedures are less direct and can include descriptive assessment (e.g., observations of individuals in natural

environments; data collection on antecedent and consequences that appear to be associated with challenging behavior), interviews with care providers, record review, and rating scales. The identification of the function(s) of challenging behavior should facilitate the generation of effective, function-based treatments for challenging behavior (e.g., FCT, NCR, and extinction).

Response interruption and redirection. Response interruption and redirection entails the therapist physically blocking, or preventing the individual from engagement in the behavior and re-directs the individual to an alternative activity (e.g., academic tasks).

Response cost. Response cost is a procedure in which the individual's access to reinforcing activities is restricted contingent on engagement in challenging behavior. This inhibitory procedure decreases the likelihood that individuals will engage in challenging behavior in the future.

Skill enrichment strategies. Skill enrichment strategies involve teaching the individual appropriate adaptive skills to offset the motivation to engage in the challenging behavior. For example, teaching a child various ways to play with a car (e.g., rolling it down the ramp, making cars crash) can result in the child's engagement with the play skill which, in turn, competes with engagement in repetitive behavior.

Differential reinforcement. Differential reinforcement procedures (e.g., Differential Reinforcement of Alternative behaviors [DRA]; Differential Reinforcement of Other behaviors [DRO]; and Differential Reinforcement of Incompatible behaviors [DRI]) entail the provision of reinforcement based on specific environmental contingencies. For example, DRA involves the delivery of reinforcement contingent on specific, target

behaviors (e.g., vocal requests; compliance). DRO involves the delivery of reinforcement contingent on the absence of challenging behavior.

FCT. As described above, the motivation, or function of the challenging behavior is first identified (e.g., via FA or other FBA methods). The individual is then taught an appropriate communicative behavior (e.g., voice output device, sign language, picture card exchange, and tablet-based communication) to replace challenging behavior in the individual's repertoire.

NCR. With NCR, the motivation, or function of the challenging behavior is often first identified via FA or FBA methods. The functional reinforcer previously shown to maintain challenging behavior is provided to the individual on a time-based schedule regardless of the presence or absence of challenging behavior.

NCR can also involve the delivery of preferred activities on time-based schedules (or via continued access) for the purpose of providing stimuli that might compete with the engagement in challenging behavior.

Extinction. Extinction consists of the withholding of functional reinforcers (i.e., reinforcers previously shown to maintain challenging behavior) following occurrences of challenging behavior. Extinction is typically used in conjunction with other function-based treatments for challenging behavior; and is rarely recommended in alone.

Interspersed requests. With interspersed requests, during instructional trials, efforts are made to increase compliance through the strategic use of high probability requests (e.g., simple directions that have a high probability of the individual complying with) prior to the presentation of more difficult tasks.

Adaptive Behavior

The three most recent studies that reviewed ABA-based treatments for adaptive behavior deficits were Flynn and Healy (2012); Matson, Hattier, and Belva (2012); and Palmen, Didden, and Lang (2012). Adaptive behavior is defined as “skills required in everyday independent living and will often be referred to as independent living skills or daily living skills” (Flynn & Healy, 2012, p.432). In the reviewed studies, adaptive behavior involved self-help/self-care (e.g., feeding, getting dresses, and toilet training), independent living (e.g., doing laundry, making bed, and setting the table), vocational skill, academic skill, and leisure. Effective ABA-based techniques for promoting adaptive behavior as indicated by the literature reviews included modeling/video modeling, task-analysis and chaining, graduated guidance, response interruption and redirection, and self-management. These techniques and procedures are typically implemented in combination with reinforcement and various prompting procedures.

Modeling/video modeling. With modeling, the individual observes a model’s real-time demonstration of a target adaptive behavior and they are encouraged to imitate the target adaptive behavior. With video modeling, the individual observes a pre-developed video in which the target adaptive behavior is demonstrated (by an adult or peer) and the individual is encouraged to imitate the skill.

Task-analysis and chaining. In a task analysis, a complex target adaptive behavior is broken into more manageable sub-steps. Each sub-step consists of a single and teachable smaller component skill. The individual is taught to master sub-steps and link the steps as he/she masters the sub-steps (i.e., chaining) until he/she successfully demonstrates the total target adaptive skill.

Graduated guidance. Graduated guidance is a variation of most-to-least prompting involving physical prompts. With the graduated guidance procedure, the therapist shadows the individual's movement and uses the amount and level of prompts needed to help the individual complete the target adaptive behavior without error. This procedure differs from other prompting procedures because this process requires many moment-to-moment decisions about when to apply and fade the prompts based on the individual's responding during the intervention session.

Response interruption and redirection. When the individual is about to make an error, the therapist interrupts or blocks the incorrect response and presents the instruction again with physical guidance or some other prompt (i.e., redirection) to ensure that the correct target adaptive behavior occurs.

Self-management. Self-management procedures involve teaching individuals to independently regulate their own behavior by discriminating between appropriate and inappropriate target adaptive behaviors. Individuals are taught to monitor and record data on their performance in using target adaptive skills; and self-reinforce for correct performance.

Positive reinforcement. Positive reinforcement entails the provision of preferred stimuli contingent on engagement in target adaptive behaviors. Positive reinforcement is often used in conjunction with other adaptive behavior training procedures to facilitate the use of, and acquisition of adaptive behaviors.

Prompting. Prompting entails the presentation of stimuli to increase the probability of that the individual will emit the target adaptive behaviors. Prompting

procedures can entail vocal, physical, or visual cues and are generally presented in a hierarchical sequence (e.g., least to most prompting or most to least prompting).

Reinforcement strategies are typically used in conjunction with prompting to promote the use of, and acquisition of adaptive behaviors.

Table 3-1

Strategies Utilized in ABA-based Focused Treatments

Language and Communication	Social Skills	Challenging Behavior	Adaptive Behavior
<ul style="list-style-type: none"> ▪ Functional Communication Training (FCT) ▪ Augmentative and Alternative Communication (AAC) ▪ Modeling/video modeling ▪ Time delay ▪ Reinforcement ▪ Prompting 	<ul style="list-style-type: none"> ▪ Video modeling ▪ Social scripts and script fading procedures ▪ Self-management ▪ Peer-mediated intervention ▪ Positive reinforcement ▪ Prompting 	<ul style="list-style-type: none"> ▪ Functional Analysis (FA) and Functional Behavior Assessment (FBA) ▪ Response interruption and redirection ▪ Response cost ▪ Skill enrichment strategies ▪ Differential reinforcement ▪ Functional Communication Training (FCT) ▪ Noncontingent reinforcement (NCR) ▪ Extinction ▪ Interspersed requests 	<ul style="list-style-type: none"> ▪ Modeling/video modeling ▪ Task-analysis and chaining ▪ Graduated guidance ▪ Response interruption and redirection ▪ Self-management ▪ Positive reinforcement ▪ Prompting

Program Evaluation

The DARS autism program employed a pre- and post-test method to evaluate the effectiveness of the program. Each contractor administered two assessment tools (i.e., Pervasive Development Disorders Behavior Inventory [PDDBI], Psychoeducational Profile - third edition [PEP-3]) with each child served prior to the initiation of programming and when programming was completed. There are significant limitations inherent in pre- and post-test methodologies that prevent analyses of the data that allow for conclusions to be drawn regarding the effectiveness of the program. Specifically, these limitations prevent inferences of causality between gains suggested by pre and post-test rendered data and the program. Limitations include our inability to rule out the influence of factors outside of the program in positive changes reflected in the pre- and post-test assessments. Factors that cannot be ruled out using pre- and post-test methods include natural maturation, history effects (e.g., learning that occurs as a result of variables outside the program), testing (i.e., exposure to the test itself can influence performance on the test), attrition (i.e., children dropping out of the program; e.g., attrition can influence scores as children who remain may be more successful in the program than those who dropped out would have been), and interactions between these various factors. Said another way, pre- and post-test methods cannot rule out threats to internal validity (i.e., the extent to which the results of the test, or assessment, can be attributed to the program. An additional factor complicating our ability to analyze the results included the manner in which the pre and post-tests were administered. Specifically, personnel from the respective agencies administered the pre and post-tests for the children served at the same agencies.

Recommendations: To increase internal validity and the ability to infer levels of effectiveness of the program during program evaluation we are recommending two modifications of the current procedures. We recommend that to the extent possible, control groups be incorporated into the methods to allow for comparisons with assessment scores obtained with children who receive comprehensive interventions. For example, an interest list control group method allowing for an interest list comparison would allow for comparisons of pre- and post-test assessment scores and an enhanced ability to conduct statistical analyses in a way that would minimize threats to internal validity relative to the previous methods (i.e., pre and post-test without a control group). We also recommend that pre and post-assessments be administered by individuals who are not affiliated with the contractors that provide the interventions. In other words those who administer the tests are blind (to the maximum extent possible) to the condition (experimental or interest list control) and phase (pretest or posttest) of the child.

Section Four

Assessments

This section describes various assessment instruments that were used in ABA-based comprehensive programs and may also be used in ABA-based focused treatments, across core areas of ASD. For each area (ABA-based comprehensive programs and focused treatments), we describe our literature search procedures and the results.

Table 4-1 summarizes the assessment instruments for ABA-based comprehensive programs and focused treatments.

ABA-based Comprehensive Programs

Literature Search Process

We conducted electronic literature searches to identify evidence-based comprehensive treatment approaches for ASD. To identify and retrieve studies, we utilized five databases: PsycINFO, Medline, ERIC, Education Source, and Academic Search Complete via EBSCOhost Research Databases service at the University of Texas libraries. The search terms employed in the database searches were as follows: “autism”, “pervasive developmental disorder”, “early”, “toddler or preschool”, “effectiveness”, “evaluation”, “behavior*”, “program”, “treatment”, “intervention”, NOT “pharmacology or drug”. We limited the search to peer-reviewed studies from 1969 to 2013. The year limitation was determined based on the oldest and latest years available via the electronic search. The electronic search retrieved/yielded 1,188 articles. In addition we conducted hand searches by tracking references from six meta-analysis reviews (i.e., Eldevik et al., 2009; Makrygianni & Reed, 2010; Peters-Scheffer, Didden, Korzilius, & Sturmey, 2010; Reichow, 2012; Virués-Ortega, 2010; Warren et al., 2011)

found in the database searches. We also searched the most current program evaluation reports from representative comprehensive programs (see Section 1 for more detailed information regarding manual searches). A total of ten studies were identified through manual search (studies from meta-analysis reviews [N= 8], studies from contacting comprehensive programs [N = 2]). Therefore the total number of articles initially selected through electronic and manual searches was 1,198. The initially selected articles (N=1,198) were screened against the inclusion/exclusion criteria (see Section 1 regarding the inclusion/exclusion criteria). As a result, a total of 40 studies were selected/identified for review.

The total number of studies that evaluated comprehensive ABA-based programs was 19; one study was excluded because the quality was poor. Therefore, 18 studies (45%) were reviewed to evaluate the assessment tools in comprehensive ABA-based programs.

Assessment Instruments

Language and Communication

Eight ABA-based studies evaluated language and communication skills (Cohen et al., 2006; Eikeseth et al., 2002; Howard et al., 2005; Magiati et al., 2007; Remington et al., 2007; Sallows et al., 2005; Smith et al., 2000; Strauss et al., 2012). The assessment tools used in evaluating language and communication in the studies were British Picture Vocabulary Scale –II (BPVS-2); Communication Developmental Inventories (CDI); Clinical Evaluation of Language Fundamentals, third edition (CELF-III); Expressive One-Word Picture Vocabulary Test (EOWPVT); Early Social

Communication Scales (ESCS); Infant-Toddler Developmental Assessment (IDA); Preschool Language Scale, third edition (PLS-3); Peabody Picture Vocabulary Test, third edition (PPVT- III); Reynell Developmental Language Scales (RDLS; RDLS-III); Receptive-expressive Emergent Language Scales-2 and 3 (REEL 2; REEL 3); Rossetti Infant-Toddler Language Scale; Receptive One-word Picture Vocabulary Test (ROWPVT); and Sequenced Inventory of Communication Development – Revised edition (SICD-R).

BPVS-II/BPVS-III. One of eight ABA-based studies used the BPVS-II (Magiati et al., 2007). BPVS-II (Dunn, Dunn, Whetton, & Burley, 1997a) is an assessment of receptive vocabulary that can be used as an initial screening tool or a baseline measure. It does not require any reading or writing response from the child. Because it only requires a gestural or pointing response (or some other agreed response), it is suitable for children with language, reading or writing difficulties. The age range is 3 to 15 years of age. The administration time ranges from 5 to 8 minutes. It does not require any formal training to administer. (<http://www.moray.gov.uk/downloads/file81582.pdf>). The third edition is the most current edition of this assessment (BPVS-III). The age range is 3 to 16 years of age. The administration time is approximately 10 minutes. It does not require any formal training to administer. (<http://www.gla.ac.uk/assessment.co.uk/products/british-picture-vocabulary-scale-third-edition>).

CDI. One of eight ABA-based studies used the CDI (Strauss et al., 2012). The CDI (Fenson, Pethick, Renda, & Cox, 2000) is an assessment of language and communication skills and development. Strauss et al. (2012) utilized the short form version of this assessment. The toddler short form consists of two parallel versions

(forms A and B) for repeated administrations. Each contains a 100-word vocabulary production checklist. Parents are asked whether their child has begun to use specific words and whether the child combines words. The age range is between 16 to 30 months, but it may also be useful with developmentally delayed children beyond the specified age ranges (Fenson, Pethick, Renda, Cox, Dale, & Reznick, 2000). It generally takes 20 to 40 minutes to complete and 10 to 15 minutes to score. It may be completed by parents or caregivers or through an interview by a professional (<http://www.brookespublishing.com/resource-center/screening-and-assessment/cdi/>).

CELF-III/CELF-4. One of eight ABA-based studies used the CELF-III (Sallows et al., 2005). The CELF-III (Semel, Wiig, & Secord, 1995) is a standardized test designed to assess receptive language (e.g., sentence structure, concepts and directions, recalling sentences) and expressive language (e.g., sentence assembly, word structure, formulated sentences). The age range is between 6 and 21 years of age. The administration time ranges from 30 to 45 minutes. Information regarding administrator qualifications was not available (<http://depts.washington.edu/soccomm/tests/celf.html>). The most current version is the fourth edition (CELF-4). CELF-4 is a comprehensive communication and language assessment with multiple subtests (e.g., receptive language, expressive language, language content, language memory, phonological awareness) used to identify the nature of the language disorder and a student's strengths and weaknesses. The age range is between 5 and 21 years of age. The administration time ranges from 30 to 60 minutes. Administration qualifications include a) a master's degree in psychology, education, occupational therapy, social work, or in a related field and formal training in ethical administration, scoring and interpretation of

clinical assessments or b) certification by or full active membership in a professional organization that requires training and experience in assessments or c) a degree or license to practice in the healthcare field or d) formal, supervised mental health, speech/language, and/or educational training specific to assessment of children or child development and formal training in ethical administration, scoring and interpretation of clinical assessments

(<http://www.pearsonclinical.com/language/products/100000442/clinical-evaluation-of-language-fundamentals-fourth-edition-celf4.html?Pid=015-8037-200>).

EOWPVT/EOWPVT-4. One of eight ABA-based studies used the EOWPVT (Howard et al., 2005). No current information could be found about the EOWPVT (Brownell, 2000a). The most current version is the fourth edition (EOWPVT-4). EOWPVT-4 is an individually administered, norm-referenced assessment for expressive vocabulary of objects, actions, or concepts. It consists of 190 items presented in a developmental sequence. It is co-normed with the receptive language assessment version (ROWPVT-4). The age ranges is 2 to 80 years of age. The administration time is approximately 20 minutes.

(<http://www.proedinc.com/customer/productView.aspx?ID=2166>). This assessment may be administered and interpreted by professionals familiar with vocabulary and cognitive function disorders (e.g., speech-language pathologists, psychologists, occupational therapists, rehabilitation specialists, counselors; <http://www.linguisystems.com/products/product/display?itemid=10665>).

ESCS. One of eight ABA-based studies used the ESCS (Remington et al., 2007). The ESCS (Mundy, P., Delgado, C., Block, J., Venezia, M., Hogan, A., & Seibert, J.,

2003) is a semi-structured observational instrument designed to measure early social-communicative behaviors (e.g., joint attention behaviors, nonverbal behaviors, social interaction behaviors) in an ecologically valid context. It consists of 25 eliciting tasks with a variety of toys to encourage interaction between an adult and child. The age range is between 8 and 20 months of age, but it may also be used with children with developmental delays whose verbal age fall within this range. The administration time is between 15 to 25 minutes. Information regarding administrator qualifications was not available.

IDA. One of eight ABA-based studies used the IDA (Howard et al., 2005). The IDA (Provence, Eriksen, Vater, & Palmeri, 1985) is a developmental assessment designed to identify children who are developmentally at risk. The age range for the IDA is between birth to 3 years of age. The administration time may be varied. There are no administration qualifications, but includes six distinct phases: referral and pre-interview data gathering, parent interview, health review, developmental observation and assessment with the Provence Profile, integration and synthesis of information, and reporting findings. (<http://www.proedinc.com/customer/productView.aspx?ID=4513>).

PLS-3/PLS-5. One of eight ABA-based studies used the PLS-3 (Howard et al., 2005). No current information could be found on the PLS-3 (Zimmerman, Steiner, & Pond, 1992). The most current edition is the fifth edition. The PLS-5 (Zimmerman, Steiner, & Pond, 2011) is a play-based assessment with items ranging from pre-verbal, interaction-based skills to emerging language and early literacy. The age range for this assessment is birth to 7 years, 11 months. The administration time is between 45 to 60 minutes. Administration qualifications include a) a master's degree in psychology,

education, occupational therapy, social work, or in a related field and formal training in ethical administration, scoring and interpretation of clinical assessments or b) certification by or full active membership in a professional organization that requires training and experience in assessments or c) a degree or license to practice in the healthcare field or d) formal, supervised mental health, speech/language, and/or educational training specific to assessment of children or child development and formal training in ethical administration, scoring and interpretation of clinical assessments (<http://www.pearsonclinical.com/language/products/100000233/preschool-language-scales-fifth-edition-pls-5.html#tab-details>).

PPVT- III/PPVT- 4. One of eight ABA-based studies used the PPVT – III (Howard et al., 2005). PPVT – III (Dunn & Dunn, 1997) is a norm-referenced instrument that measures receptive vocabulary and is a screening test of verbal ability. There are two parallel forms, IIIA and IIIB, which may be used for reliable testing and retesting. Each form contains 204 items. The age range is 2 to 90 years of age. The administration time ranges from 10 to 15 minutes. Information regarding administrator qualifications was not available (<http://www.pearsonclinical.com/language/products/100000081/peabody-picture-vocabulary-test-third-edition-ppvt-iii.html#tab-details>). The fifth edition is the most current edition. It has been co-normed with the Expressive Vocabulary Test, second edition (EVT-2) for easy comparison of receptive and expressive vocabulary. Similar to the previous edition, there are two parallel versions that may be used for testing and retesting. The age range is 2 to 90 years of age. The administration time ranges from 10 to 15 minutes. Administration qualifications include a) a master's degree in psychology, education, occupational therapy, social work, or in a related field and

formal training in ethical administration, scoring and interpretation of clinical assessments or b) certification by or full active membership in a professional organization that requires training and experience in assessments or c) a degree or license to practice in the healthcare field or d) formal, supervised mental health, speech/language, and/or educational training specific to assessment of children or child development and formal training in ethical administration, scoring and interpretation of clinical assessments

(<http://www.pearsonclinical.com/language/products/100000501/peabody-picture-vocabulary-test-fourth-edition-ppvt4.html?Pid=PAa30700#tab-details>).

RDLS/NRDLs. Six of eight ABA-based studies used a version of the RDLS (Cohen et al., 2006; Howard et al., 2005; Remington et al., 2007; Smith et al., 2000; Eikeseth et al., 2002; Sallows et al., 2005). The American version, RDLS (Reynell & Gruber, 1990), was used by five studies (Cohen et al., 2006; Eikeseth et al., 2002; Howard et al., 2005; Sallows et al., 2005; Smith et al., 2000). One study (Remington et al., 2007) utilized the Reynell Developmental Language Scales – third edition (RDLS-III; Edwards et al., 1997), which is the United Kingdom version. The RDLS and RDLS-III are norm-referenced tests made up of two scales: verbal comprehension and expressive language. The age range for RDLS is from 1 to 6 years old. A new version, New Reynell Developmental Language Scales (NRDLs, 2011) is available in the United Kingdom. The age range for the NRDLs is 3 to 7 years and 6 months. Information regarding time to administer and administrator qualifications for either assessment were not available (<http://www.springerreference.com/docs/html/chapterdbid/334465.html>).

REEL-2; REEL-3. One of eight ABA-based studies used the REEL-2 (Howard et

al., 2005). No current information could be found on the REEL-2 (Bzoch & League, 1991). The most current edition is the REEL, third edition (REEL-3; Bzoch, League). REEL-3 is intended to identify infants and toddlers who may require language or communication interventions, but may also be used to develop intervention goals. It consists of two core subtests (receptive and expressive language) and a supplementary subtest (inventory of vocabulary words). It is appropriate for children up to 3 years of age. The administration time is approximately 20 minutes. A professional who has a Master's degree in psychology, speech-language pathology, occupational therapy, social work, special education or related field should administer it. It can also be administered by a person with a bachelor's degree in the aforementioned fields with an additional license or certification from an agency that requires training and experience in assessment (<http://www.wpspublish.com/store/p/2937/receptive-expressive-emergent-language-test-third-edition-reel-3>).

Rossetti Infant-Toddler Language Scale. One of eight ABA-based studies used the Rossetti Infant-Toddler Language Scale (Howard et al., 2005). The Rossetti Infant-Toddler Language Scale (Rossetti, 2006) is a comprehensive tool used to assess preverbal and verbal aspects of communication and interactions. This criterion-referenced assessment can be completed through parent/teacher interview, observation of the child or directly elicited from the child. There are nine subscales on interaction attachment, pragmatics, gesture, play, language comprehension, and language expression. This assessment is suitable for birth to 3 years of age. The administration time may be varied. Information regarding administrator qualifications was not available.

ROWPVT/ROWPVT-4. One of eight ABA-based studies used the EOWPVT

(Howard et al., 2005). No current information could be found about the ROWPVT (Brownell, 2000b). The most current version is the fourth edition (ROWPVT-4). ROWPVT-4 is an individually administered, norm-referenced assessment for receptive vocabulary of objects, actions, or concepts. It consists of 190 items presented in a developmental sequence. It is co-normed with the expressive language assessment version (EOWPVT-4) to provide a comprehensive assessment of expressive and receptive vocabulary. The age ranges is 2 to over 80 years of age. The administration time is approximately 20 minutes

(<http://www.proedinc.com/customer/productView.aspx?ID=2699>). This assessment may be administered and interpreted by professionals familiar with vocabulary and cognitive function disorders (e.g., speech-language pathologists, psychologists, occupational therapists, rehabilitation specialists, counselors; <http://www.linguisystems.com/products/product/display?itemid=10666>).

SICD-R. One of eight ABA-based studies used the SICD-R (Howard et al., 2005). SICD-R (Hedrick, Prather, & Tobin, 1975) assesses communication skills of two areas: receptive and expressive communication. The receptive section tests understanding language, speech discrimination, and awareness skills. The expressive section tests initiation, responding, and imitation skills. Results from this assessment may also be used to guide the planning of individualized treatment programs. The age range is 4 to 48 months of age. The administration time ranges between 30 and 75 minutes. A professional who has a Master's degree in psychology, speech-language pathology, occupational therapy, social work, special education or related field should administer it. It may also be administered by a person with a bachelor's degree in the aforementioned

fields with an additional license or certification from an agency that requires training and experience in assessment (<http://www.wpspublish.com/store/p/2970/sequenced-inventory-of-communication-development-revised-sicd-r>).

Social Skills

Three ABA-based studies evaluated the effects on social skills (Sallows et al., 2005; Smith et al., 2000; Zachor et al., 2007). The assessment tools used in evaluating social skill improvement in the studies were Autism Diagnostic Interview-Revised (ADI-R); Autism Diagnostic Observation Schedule (ADOS); and Child Behavior Checklist (CBCL).

ADI-R. One out of three studies used the ADI-R (Sallows et al., 2005) to evaluate the improvement of social skills. The ADI-R (Wirt, Lachar, Klinedinst, & Seat, 1977) is a standardized assessment tool that is used for diagnosis of ASD through a comprehensive parent interview. The ADI-R provides categorical results for three domains: Language/Communication, Reciprocal Social Interactions, and Repetitive Behaviors/Interests. The age range for the ADI-R is from 18 months to adult. The administration time ranges from 90 to 150 minutes, including additional time to score results. It requires the administrator to be qualified with specialized training to conduct this assessment (Ozonoff, Goodlin-Jones, & Solomon, 2005). The most current version is the ADI-R (Rutter et al., 2003). The age range is between children and adults with a mental age above 2.0 years. The administration time ranges from 90 to 150 minutes, including scoring. Administration qualifications include a) a master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) a bachelor's degree in

fields listed above, and c) a license or certification from an agency/organization that requires training and experience in assessment

<http://www.wpspublish.com/store/p/2645/autism-diagnostic-interview-revised-adi-r>

ADOS/ADOS-2. One out of three studies used the ADOS (Zachor et al., 2007). The ADOS (Lord, Rutter, DiLavore, & Risi, 1999) is a semi-structured, standardized assessment via direct testing of communication, social interaction, play, and restricted and repetitive behaviors in individuals who may have an ASD. The assessment involves a variety of social situations and 'presses' designed to elicit behaviors relevant to the diagnosis of ASD. The most current version is the ADOS-2 (2012). There are five different modules. The individual being evaluated is given only one module, selected on the basis of his or her expressive language level and chronological age. The Toddler Module is for children between 12 and 30 months of age who do not consistently use phrase speech. Module 1 is for children 31 months and older who do not consistently use phrase speech. Module 2 is for children of any age who use phrase speech but are not verbally fluent. Module 3 is for verbally fluent children and young adolescents. Module 4 is for verbally fluent older adolescents and adults. The age range for the ADOS-2 is between 12 months through adulthood. The administration time for each module ranges from 40 to 60 minutes. Administration qualifications include a) a master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) a bachelor's degree in fields listed above, and c) a license or certification from an agency/organization that requires training and experience in assessment

<http://www.wpspublish.com/store/p/2647/autism-diagnostic-observation-schedule-ados>

CBCL/CBCL/1.5-5 and CBCL/6-18. One out of three studies used the CBCL (Smith et al., 2000). The CBCL (Achenbach, 1991) is completed by parents and teachers regarding children's competencies and behavioral/emotional problems. The most current versions are the CBCL/1.5-5 and CBCL/6-18. The CBCL/1.5-5 includes 99 items that describe specific kinds of behavioral, emotional, and social problems that characterize preschool children. There are also open-ended questions for describing additional problems. The target population is children between the ages of 1.5 and 5 years. The administration time ranges from 10 to 20 minutes. Information regarding administrator qualifications was not available (<http://www.aseba.org/preschool.html>). The CBCL/6-18 has 118 items that describe specific behavioral and emotional problems, plus two open-ended questions for reporting additional problems. The target population is children between the ages of 6 and 18 years. The administration time is approximately 15 minutes. Information regarding administrator qualifications was not available (<http://www.aseba.org/schoolage.html>).

Challenging Behavior

Five ABA-based studies evaluated the effects on challenging behavior (Eikeseth et al., 2007, 2012; Reed et al., 2007; Remington et al., 2007; Strauss et al., 2012). The assessment tools used in evaluating challenging behavior in the studies were Autism Spectrum Disorder-Behaviors Problems for Children Scales (ASD-BPC); CBCL; Conners' Rating Scales Revised (CRS-R); Developmental Behavior Checklist (DBC); Nisonger Child Behavior Rating Form (NCBRF); and Vineland Adaptive Behavior Scales (VABS).

ASD-BPC. One out of five studies used the ASD-BPC (Strauss et al., 2012). The ASD-BPC (Matson, Gonzalez, & Rivet, 2008) is an informant-based assessment scale designed to survey behavior problems in individuals with ASD. It is part of a comprehensive instrument to assess ASD symptoms, comorbid psychopathology, and behavior problems for children with ASD. Information regarding age ranges and administration time were not available. The ASD-BPC is completed by parents and teachers (Matson et al., 2008).

CBCL/CBCL/1.5-5 and CBCL/6-18. One out of five studies used the CBCL (Eikeseth et al., 2007). The CBCL (Achenbach, 1991) is completed by parents and teachers regarding children's competencies and behavioral/emotional problems. The most current versions are the CBCL/1.5-5 and CBCL/6-18. The CBCL/1.5-5 includes 99 items that describe specific kinds of behavioral, emotional, and social problems that characterize preschool children. There are also open-ended questions for describing additional problems. The target population is children between the ages of 1.5 and 5 years. The administration time ranges between 10 to 20 minutes. Information regarding administrator qualifications was not available (<http://www.aseba.org/preschool.html>). The CBCL/6-18 has 118 items that describe specific behavioral and emotional problems, plus two open-ended questions for reporting additional problems. The target population is children between the ages of 6 and 18 years. The administration time is approximately 15 minutes. Information regarding administrator qualifications was not available.

(<http://www.aseba.org/schoolage.html>).

CRS-R/Conners CBRS. One out of five studies used the CRS-R (Reed et al., 2007). The CRS-R (Conners, 1997) assesses children for behavioral problems, emotions, and Attention Deficit/Hyperactivity Disorder (ADHD). The short version of the CRS-R is comprised of 28 items. There are four subscales of the instrument: a) Oppositional Behavior—indicative of rule breaking, authority problems, and ease of anger; b) Cognitive Problems—indexing inattention, difficulty in organizing work, or concentrating for sustained periods; c) Hyperactivity—suggesting difficulties in sitting still, restlessness, and impulsivity; and the d) ADHD index—identifying children likely to suffer from ADHD. The age range for the CRS-R is between 3 and 17 years. The administration time of the short version ranges between 5 to 10 minutes (Reed et al., 2007). The most current version is the Conners CBRS. It assesses behaviors, emotions, academics, and social problems. The age range is between 6 and 18 years for teacher forms and parent forms, and between 8 and 18 years for self-report forms. The administration time is approximately 20 minutes. The Conners CBRS is available in parent, teacher, and self-report forms.

<http://www.mhs.com/product.aspx?gr=edu&id=overview&prod=cbrs>.

DBC. One out of five studies used the DBC (Remington et al., 2007). The DBC (Einfeld & Tonge, 2002a) is a behavior rating questionnaire providing a total behavior score, indexing the severity of behavior problems. There are five subscales derived from factor analysis: Disruptive/Anti-social Behavior; Self-absorbed; Communication Disturbance; Anxiety; and Social Relating. The age range for the DBC is between 4 and 18 years. The administration time requires approximately 15 minutes. The DBC is

completed by parents or teachers.

<http://www.med.monash.edu.au/spppm/research/devpsych/dbc.html>).

NCBRF. Remington et al. also used the NCBRF to evaluate challenging behavior as well as the DBC. The NCBRF (Aman, Tasse, Rojahn, & Hammer, 1996) is a standardized instrument for assessing child and adolescent behavior. Two "levels" of the NCBRF (one for children with intellectual and developmental disabilities and one for normally developing children) are available. The first level is simply called the NCBRF and was derived for children with developmental disabilities, specifically those with intellectual disability and/or ASD. Parent and teacher rating versions are available. It is standardized on parents of children aged 3 to 16 years of age. Information regarding administration time and administrator qualifications were not available.

<http://psychmed.osu.edu/ncbrf.htm>).

VABS/Vineland-II. One out of five studies used the VABS to evaluate challenging behavior (Fennell et al., 2011). The VABS (Sparrow, Balla, & Cicchetti, 1984) includes four domains: communication, daily living skills, socialization, and motor skills (for children under age 5). The age range for the VABS is from birth to 18 years. The administration time ranges between 20 to 60 minutes. The VABS is completed through an interview with a parent or teacher (Ozonoff, Goodlin-Jones, & Solomon, 2005). The most current version is the Vineland-II. It includes five domains: communication, daily living skills, socialization, motor skills, and maladaptive behavior index (optional) domains. The age range is between birth and 90 years. The administration time ranges from 20 to 60 minutes for the Survey Interview and Parent/Caregiver Rating Forms; 25 to 90 minutes for the Expanded Interview Form; and 20 minutes for the Teacher Rating

Form. Administration qualifications include a) a master's degree in psychology, education, occupational therapy, social work, or in a field closely related to the intended use of the assessment, and formal training in the ethical administration, scoring, and interpretation of clinical assessments; b) certification by or full active membership in a professional organization (such as ASHA, AOTA, AERA, ACA, AMA, CEC, AEA, AAA, EAA, NAEYC, NBCC) that requires training and experience in the relevant area of assessment; c) a degree or license to practice in the healthcare or allied healthcare field; and d) formal, supervised mental health, speech/language, and/or educational training specific to assessing children, or in infant and child development, and formal training in the ethical administration, scoring, and interpretation of clinical assessments (<http://www.pearsonclinical.com/psychology/products/100000668/vineland-adaptive-behavior-scales-second-edition-vineland-ii-vinelandii.html?Pid=Vineland-II>).

Adaptive Behavior

Sixteen ABA-based studies evaluated the effects on adaptive behavior (Cohen et al., 2006; Eikeseth et al., 2002, 2007, 2012; Fava et al., 2011; Fernell et al., 2011; Howard et al., 2005; Magiati et al., 2007; McEachin, 1993; Reed et al., 2007; Reed & Osborne, 2012; Remington et al., 2007; Sallows et al., 2005; Smith et al., 2000; Strauss et al., 2012; Zachor et al., 2007). All of the studies used the VABS to evaluate the improvement in adaptive behavior.

VABS/Vineland-II. The VABS is the most commonly used assessment to assess children's day-to-day adaptive functioning. It includes four domains: communication, daily living skills, socialization, and motor skills (for children under age 5). The age range for the VABS is from birth to 18 years. The administration time ranges between

20 to 60 minutes. The VABS is completed through an interview with a parent or teacher (Ozonoff, Goodlin-Jones, & Solomon, 2005). The most current version is the Vineland-II. It includes five domains: communication, daily living skills, socialization, motor skills, and maladaptive behavior index (optional) domains. The age range is between birth and 90 years. The administration time ranges from 20 to 60 minutes for the Survey Interview and Parent/Caregiver Rating Forms; 25 to 90 minutes for the Expanded Interview Form; and 20 minutes for the Teacher Rating Form. Administration qualifications include a) a master's degree in psychology, education, occupational therapy, social work, or in a field closely related to the intended use of the assessment, and formal training in the ethical administration, scoring, and interpretation of clinical assessments; b) certification by or full active membership in a professional organization (such as ASHA, AOTA, AERA, ACA, AMA, CEC, AEA, AAA, EAA, NAEYC, NBCC) that requires training and experience in the relevant area of assessment; c) a degree or license to practice in the healthcare or allied healthcare field; and d) formal, supervised mental health, speech/language, and/or educational training specific to assessing children, or in infant and child development, and formal training in the ethical administration, scoring, and interpretation of clinical assessments

(<http://www.pearsonclinical.com/psychology/products/100000668/vineland-adaptive-behavior-scales-second-edition-vineland-ii-vinelandii.html?Pid=Vineland-II>)

Autistic Symptomatology

Ten ABA-based studies evaluated autism symptomatology (Eikeseth et al., 2012; Fava et al., 2011; Fernell et al., 2011; Magiati et al., 2007; Magiati et al., 2011; Reed et al., 2007; Reed & Osborne, 2012; Strauss et al., 2012; Zachor et al., 2007; Zachor et al.,

2010). The assessment tools used in evaluating autism symptomatology in the studies included the Autistic Behavior Checklist (ABC); Autism Diagnostic Interview (ADI/ADI-R); Autism Diagnostic Observation Scale (ADOS); Childhood Autism Rating Scale (CARS); Diagnosis of Social and Communication Disorders (DISCO; Gilliam Autism Rating Scales (GARS);

ABC/ASIEP-3. One of ten studies used the ABC (Fennell et al., 2011). The ABC assesses autism symptomatology using a subset scale of the ASIEP-3 (Krug, Arick, Almond, 2008). The ASIEP-3 assesses five components: autism symptomatology, spontaneous speech, social responding, educational assessment, and prognosis of learning rate. The age range is between 2 to 13 years and 11 months. The administration time is varied. The administration qualifications include a bachelor's degree (BA, BS) in psychology, school counseling, occupational therapy, speech–language pathology, social work, education, special education, or related field (<http://www.wpspublish.com/store/p/2665/autism-screening-instrument-for-educational-planning-asiep-3>)

ADI/ADI-R. Three of ten studies used the ADI or revised version (ADI-R) (Magiati et al., 2007; Magiati et al., 2011; Zachor et al., 2007). The ADI-R (Wirt, Lachar, Klinedinst, & Seat, 1977) is a standardized assessment tool that is used for diagnosis of ASD through a comprehensive parent interview. The ADI-R provides categorical results for three domains: Language/Communication, Reciprocal Social Interactions, and Repetitive Behaviors/Interests. The age range for the ADI-R is from 18 months to adult. The administration time ranges from 90 to 150 minutes, including additional time to score results. It requires the administrator to be qualified with specialized training to

conduct this assessment (Ozonoff, Goodlin-Jones, & Solomon, 2005). The most current version is the ADI-R (Rutter et al., 2003). The age range is between children and adults with a mental age above 2.0 years. The administration time ranges from 90 to 150 minutes, including scoring. Administration qualifications include a) a master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) a bachelor's degree in fields listed above, and c) a license or certification from an agency/organization that requires training and experience in assessment

<http://www.wpspublish.com/store/p/2645/autism-diagnostic-interview-revised-adi-r>

ADOS/ADOS-2. Four of ten studies used the ADOS (Fava et al., 2011; Strauss et al., 2012; Zachor et al., 2007; Zachor et al., 2010). The ADOS (Lord, Rutter, DiLavore, & Risi, 1999) is a semi-structured, standardized assessment via direct testing of communication, social interaction, play, and restricted and repetitive behaviors in individuals who may have an ASD. The assessment involves a variety of social situations and 'presses' designed to elicit behaviors relevant to the diagnosis of ASD. The most current version is the ADOS-2 (2012). There are five different modules. The individual being evaluated is given only one module, selected on the basis of his or her expressive language level and chronological age. The Toddler Module is for children between 12 and 30 months of age who do not consistently use phrase speech. Module 1 is for children 31 months and older who do not consistently use phrase speech. Module 2 is for children of any age who use phrase speech but are not verbally fluent. Module 3 is for verbally fluent children and young adolescents. Module 4 is for verbally fluent older adolescents and adults. The age range for the ADOS-2 is between 12

months through adulthood. The administration time for each module ranges from 40 to 60 minutes. Administration qualifications include a) a master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) a bachelor's degree in fields listed above, and c) a license or certification from an agency/organization that requires training and experience in assessment

(<http://www.wpspublish.com/store/p/2647/autism-diagnostic-observation-schedule-ados>).

CARS/CARS-2. One of ten studies used the CARS (Eikeseth et al., 2012). The CARS (Schopler, Reichler, & Renner, 1988) is an observational rating scale to identify children with ASD and determine symptom severity. The most current version is the CARS-2. It consists of two 15-item rating scales completed by the examiner (each designed for a different population); and an unscored Parent/Caregiver Questionnaire. The age range for the CARS-2 is 2 years and up. The administration time ranges between 5 to 10 minutes after the information needed to make the ratings has been collected. Administration qualifications include a) a master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) a bachelor's degree in fields listed above, and c) a license or certification from an agency/organization that requires training and experience in assessment

(<http://www.wpspublish.com/store/p/2696/childhood-autism-rating-scale-second-edition-cars-2>).

DISCO. One of ten studies used the Swedish version of the DISCO (Fernell et al., 2011). The DISCO (Wing, Leekham, Libby, Gould, & Larcombe, 2002) is a semi-

structured parent interview used to assess language and communication of individuals with autism. It is a 300-question structured interview designed to facilitate understanding of the whole picture of an individual's development and behavior from infancy onward. For clinical uses some sections on family, medical history and information on the child's first 2-years of life may be omitted. Items address topics such as social imagination, social communication and social interactions with others. There is no age restriction for this assessment (<http://www.autism.org.uk/our-services/diagnosing-complex-needs/the-diagnostic-interview-for-social-and-communication-disorders-disco.aspx>). The approximate administration time for the full assessment interview is 2-3 hours, however it may be modified depending on what sections (e.g., family history, first 2-years developmental history) are omitted. Specific information regarding administrator qualifications was not available, however an extensive 5-day training is available (http://www.autismrpphub.com/sites/default/files/resources/disco_encyclopedia.pdf)

GARS/GARS-3. Two of ten studies used the GARS (Reed et al., 2007; Reed & Osborne, 2012). The most current edition is the third edition and is based on the new DSM-5 definition of autism. The GARS-3 is a 56-item assessment divided into six subscales: restrictive, repetitive behaviors, social interaction, social communication, emotional responses, cognitive style, and maladaptive speech. It is designed to identify autism in individuals and estimate its severity. The age range for the GARS-3 is between 3 to 22 years of age. The administration time is between 5 to 10 minutes. The administration qualifications include a) a degree from an accredited 4-yr college or university in psychology, counseling, or closely related field and satisfactory completion of coursework in test interpretation, psychometrics and measurement theory,

educational statistics, or a closely related area or b) license or certification from an agency that requires appropriate training and experience in the ethical and competent use of psychological tests

<http://www4.parinc.com/products/Product.aspx?ProductID=GARS-3>).

ABA-Based Focused Treatments

Literature Search Process

We conducted electronic literature searches using five databases: Academic Search Complete, Education Full Text, ERIC, PsycINFO, Psychology and Behavioral Sciences Collection and via EBSCOhost Research Databases Service at the University of Texas libraries. The search terms employed were as follows: “assessment”, “autis*”, “social”, “communication”, “language”, “adaptive”, “challenging behavior”, and “problematic behavior”. We selected the review studies in each target area: language and communication (Matson & Neal, 2010); social skills (Matson & Wilkins, 2007); challenging behavior (Matson & Nebel-Schwalm, 2007); and adaptive behavior (Ozonoff, Goodlin-Jones, & Solomon, 2005). We did not select any date restrictions. The following sections describe assessment instruments provided in the selected articles. It should be noted that the selected studies did not conduct a systematic review of behavioral treatment studies in which the tools were used to evaluate treatment outcomes. These studies descriptively reported existing assessment instruments available in the described target area. It should be noted that we did not systematically review individual studies to evaluate assessment tools used in the ABA-based focused treatments. Therefore the following list of assessments is not comprehensive. It was not possible to

determine how commonly these assessment tools are used for evaluation purposes in ABA-based focused treatment practices.

Assessment Instruments

Language and Communication

Matson and Neal (2010) identified three tools for the assessment of language and communication: Children's Communication Checklist (CCC); Communicative Developmental Inventories (CDI); and Diagnostic Interview for Social and Communication disorders (DISCO).

CCC/CCC-2. The CCC (Bishop, 1998) is a 70-item parent/teacher checklist tool that assesses pragmatic aspects of communicative difficulties. There are nine scales, two of which address social relationships and restricted interests. The other seven scales include pragmatic use of language, speech production, word-finding, comprehension of discourse, use of stereotyped language, and failure to use context in comprehending utterances (Bishop, 1998; Matson & Neal, 2010). Information regarding age range, administration time, and administrator qualifications were not available. The most current edition is the second edition (CCC-2). The CCC-2 U.S. edition is a norm-referenced 70-item parent/caregiver rating scale addressing two major domains: language (i.e., speech, syntax, semantics, and coherence) and pragmatics (i.e., initiation, scripted language, context, nonverbal communication, social relations, and interests). The age range is between 4 years and 16 years, 11 months of age. The approximate administration time is between 5 and 10 minutes. Administration qualifications include a) a master's degree in psychology, education, occupational

therapy, social work, or in a related field and formal training in ethical administration, scoring and interpretation of clinical assessments or b) certification by or full active membership in a professional organization that requires training and experience in assessments or c) a degree or license to practice in the healthcare field or d) formal, supervised mental health, speech/language, and/or educational training specific to assessment of children or child development and formal training in ethical administration, scoring and interpretation of clinical assessments
<http://www.pearsonclinical.com/language/products/100000193/childrens-communication-checklist2-us-edition-ccc-2.html#tab-pricing>).

CDI. The CDI (Fenson et al., 1993) is a parent report used to assess early comprehension and production of words, phrases, gesture use and early use of grammar. The assessment is administered by asking parents to recognize sample information from given choices rather than recall specific examples. After scores are obtained, they are compared to normative sample ranges to give a level of communicative ability. For example, at 18 months in word production, a child could have 86 words, falling within the 50th percentile or 24 words (15th percentile) or lower range and still be within normal developmental limits. It is available for three age groups: children between 8 and 18 months, 16 and 30 months, or 30 to 37 months. It generally takes 20 to 40 minutes to complete and 10 to 15 minutes to score. It may be completed by parents or caregivers or through an interview by a professional
<http://www.brookespublishing.com/resource-center/screening-and-assessment/cdi/>).

DISCO. The DISCO (Wing, Leekham, Libby, Gould, & Larcombe, 2002) is a semi-structured parent interview used to assess language and communication of

individuals with autism. It is a 300-question structured interview designed to facilitate understanding of the whole picture of an individual's development and behavior from infancy onward. For clinical uses some sections on family, medical history and information on the child's first 2-years of life may be omitted. Items address topics such as social imagination, social communication and social interactions with others. There is no age restriction for this assessment (<http://www.autism.org.uk/our-services/diagnosing-complex-needs/the-diagnostic-interview-for-social-and-communication-disorders-disco.aspx>). The approximate administration time for the full assessment interview is 2-3 hours, however it may be modified depending on what sections (e.g., family history, first 2-years developmental history) are omitted. Specific information regarding administrator qualifications was not available, however an extensive 5-day training is available (http://www.autismrpphub.com/sites/default/files/resources/disco_encyclopedia.pdf).

Social Skills

Matson and Wilkins (2007) described four instruments to consider when measuring social skills: Childhood Autism Rating Scale (CARS); Children's Social Behavior Questionnaire (CSBQ); Matson Evaluation of Social Skills with Youngsters (MESSY); and Social Responsiveness Scale (SRS).

CARS/CARS-2. The CARS (Schopler, Reichler, & Renner, 1988) is an observational rating scale to identify children with ASD and determine symptom severity. The most current version is the CARS™-2. It consists of two 15-item rating scales completed by the examiner (each designed for a different population); and an unscored Parent/Caregiver Questionnaire. The age range for the CARS-2 is 2 years and up. The

administration time ranges between 5 to 10 minutes after the information needed to make the ratings has been collected. Administration qualifications include a) a master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) a bachelor's degree in fields listed above, and c) a license or certification from an agency/organization that requires training and experience in assessment (<http://www.wpspublish.com/store/p/2696/childhood-autism-rating-scale-second-edition-cars-2>).

CSBQ. The CSBQ (Luteijn, Jackson, Volkmar, & Minderaa, 1998) assesses social behavior problems in ASD. The CSBQ has 49 items with six subscales (i.e., contact, stereotyped, changes, understanding, orientation, and not tuned). The age range for the CSBQ is between 4 and 18 years. Information regarding administration time was not available. The CSBQ is completed by parents or other caregivers (de Bildt, Mulder, Hoekstra, Minderaa, & Hartman, 2009; Matson & Wilkins, 2007).

MESSY. The MESSY (Matson, Macklin, & Helsel, 1985) has been recommended for children with ADHD but can also be used for children with ASD. The MESSY is a 64 item inventory of social behaviors that yields two factors: Factor 1- Inappropriate Assertiveness/Impulsiveness, and Factor 2- Appropriate Social Skills. Information regarding age range and administration time were not available. The MESSY is completed through an interview with a caregiver or teacher (e.g., the items are read to the parent and the examiner marks his/her responses on the form; Matson, Stabinsky-Compton, & Sevin, 2007).

SRS/SRS-2. The SRS (Constantino et al., 2003) is a rating scale designed to identify the presence and severity of social impairment within the autism spectrum and differentiates it from that which occurs in other disorders. This instrument has five treatment subscales. The age range for the SRS is from 2.5 to 18 years. The administration time ranges between 15 to 20 minutes. It is completed by parents or teachers. The most current version is the SRS-2. The age range is from 2.5 through adulthood. The administration time ranges from 15 to 20 minutes. Administration qualifications include a) a master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) a bachelor's degree in fields listed above, and c) a license or certification from an agency/organization that requires training and experience in assessment (<http://www.wpspublish.com/store/p/2994/social-responsiveness-scale-second-edition-srs-2>)

Challenging Behavior

Matson & Nebel-Schwalm (2007) described three instruments to consider when measuring challenging behavior: Behavior Problems Inventory (BPI); Overt Aggression Scale (OAS); and PDD Behavior Inventory (PDDBI).

BPI/BPI-01and BPI-S. The BPI (Rojahn, Matson, Lott, & Esbensen, & Smalls, 2001) is a 52-item respondent-based behavior rating instrument for self-injurious, stereotypic, and aggressive/destructive behavior in intellectual disability and other developmental disabilities. Items are rated on a frequency scale and a severity scale. The age range for the BPI is from 14 to 91 years. The administration time ranges

between 2 to 5 minutes. The BPI is completed through an interview with a caregiver. The most current versions are BPI-01 and the BPI-S (Rojahn et al., 2001).

OAS. The OAS (Yudofsky, Silver, Jackson, Endicott, & Williams, 1986) is an objective and prospective recording and rating instrument. The OAS divides recording of aggressions into four subtypes: 1) verbal aggression; 2) physical aggression against others; 3) physical aggression against property or objects; and 4) physical aggression against self (self-injurious behavior). The OAS is completed by parents or teachers. This assessment is appropriate for individuals 9 years or older (<http://vinst.umdj.edu/VAID/TestReport.asp?Code=OAS>). Information regarding administration time and administrator qualifications were not available.

PDDBI. The PDDBI (Cohen, Schmidt-Lackner, Romanczyk, & Sudhalter, 2003) can be used for assisting in diagnosis and treatment recommendation and for assessing change over time. It has five domains: Repetitive, Ritualistic, and Pragmatic Problem Behaviors (REPRIT); Approach/Withdrawal Problems (AWP); Expressive Social Communication Abilities (EXSCA); Receptive/Expressive Social Communication Abilities (REXSCA); and Autism (AUTISM). The REPRIT composite score indicates the severity in a variety of domains (e.g., Sensory/Perceptual Approach Behaviors, Ritualisms/Resistance to Change, and Social Pragmatic Problems) associated with ASD. The AWP composite score indicates severe problems in many different domains (e.g., Sensory/Perceptual Approach Behaviors, Semantic/Pragmatic Problems, Arousal Regulation Problems, Specific Fears, and Aggressiveness). The EXSCA composite score indicates relatively sophisticated use of non-vocal and vocal social communication skills. The REXSCA composite score indicates sophisticated use of both

receptive and expressive social communication skills. The AUTISM composite score indicates the severity of ASD in which those persons with ASD possess little to no meaningful communication or social skills, but high levels of repetitive behaviors. The age range for PDDBI is between 2 and 12 years. The administration time ranges between 20 to 30 minutes for standard forms and 30 to 45 minutes for extended forms. It is completed by parents or teachers. Administration qualifications include a degree, certificate, or license to practice in a health care profession or occupation, including (but not limited to) the following: clinical psychology, medicine, neurology, neuropsychology, nursing, occupational therapy and other allied health care professions, physicians' assistants, psychiatry, school psychology, social work, speech-language pathology; plus appropriate training and experience in the ethical administration, scoring, and interpretation of clinical behavioral assessment instruments (<http://www4.parinc.com/Products/Product.aspx?ProductID=PDDBI#>).

Adaptive Behavior

Ozonoff et al. (2005) reported the VABS as the instrument used for measuring adaptive behavior.

VABS/Vineland-II. The VABS is the most commonly used assessment of adaptive skills and includes four domains: communication, daily living skills, socialization, and motor skills (for children under age 5). The age range for the VABS is from birth to 18 years. The administration time requires 20 to 60 minutes. The VABS is completed through an interview with a parent or teacher (Ozonoff, Goodlin-Jones, & Solomon, 2005). The most current version is the Vineland-II. It includes five domains: communication, daily living skills, socialization, motor skills, and maladaptive behavior

index (optional) domains. The age range is between birth and 90 years. The administration time ranges from 20 to 60 minutes for the Survey Interview and Parent/Caregiver Rating Forms; 25 to 90 minutes for the Expanded Interview Form; and 20 minutes for the Teacher Rating Form. Administration qualifications include a) a master's degree in psychology, education, occupational therapy, social work, or in a field closely related to the intended use of the assessment, and formal training in the ethical administration, scoring, and interpretation of clinical assessments; b) certification by or full active membership in a professional organization (such as ASHA, AOTA, AERA, ACA, AMA, CEC, AEA, AAA, EAA, NAEYC, NBCC) that requires training and experience in the relevant area of assessment; c) a degree or license to practice in the healthcare or allied healthcare field; and d) formal, supervised mental health, speech/language, and/or educational training specific to assessing children, or in infant and child development, and formal training in the ethical administration, scoring, and interpretation of clinical assessments

(<http://www.pearsonclinical.com/psychology/products/100000668/vineland-adaptive-behavior-scales-second-edition-vineland-ii-vinelandii.html?Pid=Vineland-II>).

Assessment Instruments Recommendations

The team from the Autism Institute at the Meadows Center for Preventing Educational Risk (MCPER) met to make recommendations on assessment tools. The team, made up of four PhD level Board Certified Behavior Analysts (BCBA-D), reviewed the DARS proposal, and extensive review of literature on comprehensive ABA interventions. The following assessments are based on the needs identified from the DARS proposal (e.g., age ranges, purpose of assessments, administration times and

qualifications), research literature, and many collective years of clinical experience working with individuals with ASD.

ABA-based Comprehensive Program Assessments

We recommend administering the following assessments prior to beginning treatment and at the end of treatment.

Language and Communication

In the area of language and communication, we recommend the Peabody Picture Vocabulary Test, fourth edition (PPVT-4), which tests receptive language. In addition, we also suggest the Expressive Vocabulary Test, second edition (EVT – 2), which tests expressive language. Since these assessments are co-normed with each other, together they provide a comprehensive system for comparing receptive and expressive language performance. Each assessment includes parallel versions (A and B) that are equal and provide different targets for pretest and posttest purposes. Both also include a Growth Scale Value (GSV) for measuring incremental vocabulary growth over time. They are suitable for assessing individuals 2 years and 6 months to 90 years of age, and can each be administered in 10 to 15 minutes.

Social Skills

In the area of social skills, we recommend the Autism Diagnostic Interview, Revised (ADI-R). This assessment focuses on three functional domains including language/communication; reciprocal social interactions; and restricted, repetitive, and stereotyped behaviors and interests. It is widely used for both clinical and research purposes, including formal diagnosis as well as treatment and educational planning. It

consists of 93 items that are administered to an informant familiar with the individual's background (e.g., family, education, previous diagnoses, and medications), developmental history and current behaviors. This comprehensive standardized interview requires 90 to 150 minutes for administration and scoring. Training is strongly recommended prior to administration and may be completed through a comprehensive DVD training series.

Challenging behavior

In the area of challenging or problematic behavior, we recommend the maladaptive behavior index section of the Vineland Scales, second edition (Vineland-II). The Vineland-II is used to support individuals with intellectual and developmental disabilities, including autism spectrum disorder. It is widely used for both clinical and research purposes, including diagnosis, progress reporting, and developing educational treatment programs. It is a semi-structured interview that is conducted with the caregiver, suitable for assessment of individuals from birth to 90 years of age, and requires an administration time of 20 to 60 minutes.

Adaptive Behavior

In the area of adaptive behavior, we recommend the Vineland Scales, second edition (Vineland-II). This assessment tests adaptive or functional skills needed for everyday living and includes five domains: communication, daily living skills, socialization, motor skills and an optional maladaptive behavior index. It is used to support individuals with intellectual and developmental disabilities, including autism spectrum disorder. It is widely used for both clinical and research purposes, including

diagnosis, progress reporting, and developing educational treatment programs. It is a semi-structured interview that is conducted with the caregiver, suitable for assessment of individuals from birth to 90 years of age, and requires an administration time of 20 to 60 minutes.

Autistic Symptomology

In the area of autistic symptomology, we recommend the Autism Diagnostic Interview, Revised (ADI-R). This assessment focuses on three functional domains including language/communication; reciprocal social interactions; and restricted, repetitive, and stereotyped behaviors and interests. It is widely used for both clinical and research purposes, including formal diagnosis as well as treatment and educational planning. It consists of 93 items that are administered to an informant familiar with the individual's background (e.g., family, education, previous diagnoses, and medications), developmental history and current behaviors. This comprehensive standardized interview requires 90 to 150 minutes for administration and scoring. Training is strongly recommended prior to administration and may be completed through a comprehensive DVD training series.

ABA-based Focused Treatment Assessments

In addition to individualized data collection to track an individual's progress, we recommend that all individuals in the focused ABA program also have two additional assessments conducted prior to entering treatment: Childhood Autism Rating Scale, second edition (CARS-2) and Vineland Scales, second edition (Vineland-II). The descriptions of these assessments are provided in the previous section. These

assessments may provide additional information of general functioning that may be used to direct treatment goals. Additional assessments of specific areas (e.g., communication, social skills) may be administered at the discretion of the clinician.

Table 4-1

Assessment Instruments for ABA-based Comprehensive Programs and Focused Treatments

ABA-based Comprehensive Programs					
Language and Communication					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
BPVS-III	3-16 years	10 minutes	No formal training	Receptive vocabulary	Not available for purchase in US (UK based)in UK
CDI	8-37 months (chronological or verbal age)	20-40 minutes	Parents, caregiver report	Language and communication skills	\$122/Complete set (manual, three assessments according to different ages) \$60/user's guide and technical manual \$20/ booklet of 25 CDI-III (ages 30-37 months)

Note. BPVS-III = British Picture Vocabulary Scale; CDI = Communication Developmental Inventories; CELF-4 Clinical Evaluation of Language Fundamentals, 4th edition

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
CELF-4	5-21 years	30-60 minutes	a) Master's degree in related field with formal training in assessment methods or b) Certification by or membership in professional organization requiring assessment training or c) Degree or license to practice in healthcare or d) Formal, supervised training in clinical assessment and formal training in ethical assessment practices	Comprehensive communication and language	\$535/kit (Includes Examiner's Manual; set of 2 Stimulus Books, Record Forms 1 and 2 package of 10 each, observational rating scale (ORS) Forms pad of 50; CELF-4 luggage tag) \$200/Examiner's manual \$77/CELF-4 record form 1 (ages 5-8), 25 forms \$58.75/ORS forms pad of 50
EOWPVT-4	2-80 years	20 minutes	Professionals familiar with vocabulary and cognitive function disorders	Expressive vocabulary	\$175/kit (<i>Examiner's Manual, Test Plates, and 25 Record Forms</i>) \$55/examiner's manual \$80/test plate \$40/25 record forms
ESCS	8-20 months (chronological or verbal age)	15-25 minutes	Unknown	Early social-communicative behaviors	Free (online)

Note. EOWPVT- 4 = Expressive One-Word Picture Vocabulary Test, 4th edition; ESCS = Early Social Communication Scales; EVT-2 = Expressive Vocabulary Test, 2nd edition

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
EVT-2	6-90+ years	10-20 Minutes	a) Master's degree in related field with formal training in assessment methods or b) Certification by or membership in professional organization requiring assessment training or c) Degree or license to practice in healthcare or d) Formal, supervised training in clinical assessment and formal training in ethical assessment practices	Expressive vocabulary and word retrieval	\$441.65/ EVT-2 Complete Kit (A & B) \$185.65/EVT-2 Record Form A (Pkg of 100) \$185.65/EVT-2 Record Form B (Pkg of 100)
IDA	Birth to 3 years	varied	No formal training	Identifies children developmentally at risk	\$700/kit; \$100/administration manual
NRDLS	3 years to 7 years, 6 months	Unknown	Unknown	Language and communication skills	Not available for purchase in US (UK based)

Assessment	Age range	Admini- stration time	Qualification of assessors	Areas tested	Approximate Cost
PLS-5	Birth to 7 years, 11 months	45 to 60 minutes	a) Master's degree in related field with formal training in assessment methods or b) Certification by or membership in professional organization requiring assessment training or c) Degree or license to practice in healthcare or d) Formal, supervised training in clinical assessment and formal training in ethical assessment practices	Pre-verbal, interaction-based skills to emerging language to early literacy	<p>\$350/PLS-5 Complete Kit (Examiner's Manual, Administration Scoring Manual, Picture Manual, Record Forms (15), Home Communication Questionnaire (25), and Complete Manipulatives Kit)</p> <p>\$59/ examiner's manual</p> <p>\$111/ administration and scoring manual</p> <p>\$166.25/record forms (pkg of 50)</p> <p>\$62/record forms (pkg of 15)</p> <p>\$10.50/home communication questionnaire</p> <p>\$175/picture manual</p> <p>\$136/complete manipulative kit</p>

Note. IDA = Infant-Toddler Developmental Assessment; NRDLs = New Reynell Developmental Language Scales

PLS-5 = Preschool Language Scale, 5th edition

Assessment	Age range	Administr- ation time	Qualification of assessors	Areas tested	Approximate Cost
PPVT- 4	2 years, 6 months to 90 years	10-15 minutes	a) Master's degree in related field with formal training in assessment methods or b) Certification by or membership in professional organization requiring assessment training or c) Degree or license to practice in healthcare or d) Formal, supervised training in clinical assessment and formal training in ethical assessment practices	Receptive vocabulary and verbal ability	<p>\$238.70/kit for Form A (Includes: A Easel, Manual, A Record Forms (25), and Carrying Case)</p> <p>\$85.45/manual</p> <p>\$48.15/Record Form A (pkg of 25)</p> <p>\$168.30/Record Form A (pkg of 100)</p> <p>\$238.70/kit for Form B (Includes: B Easel, Manual, B Record Forms (25), and Carrying Case)</p> <p>\$48.15/Record form B (pkg of 25)</p> <p>\$168.30/Record Form B (pkg of 100)</p>
REEL-3	Birth to 3 years	20 minutes	Master's degree in related field; Bachelor's degree with additional training	Receptive and expressive language	\$72/manual

Note. PPVT-4 = Peabody Picture Vocabulary Test, 4th edition

Assessment	Age range	Administr- ation time	Qualification of assessors	Areas tested	Approximate Cost
Rossetti Infant-Toddler Language Scale	Birth to 3 years	varied	Knowledge of child development and language	Preverbal and verbal areas of communication and interaction	\$100/kit
ROWPVT-4	2-80+ years	20 minutes	Professionals familiar with vocabulary and cognitive function disorders	Receptive vocabulary	\$175/kit (<i>Examiner's Manual, Test Plates, and 25 Record Forms</i>) \$55/examiner's manual \$80/test plate \$40/25 record forms
SICD-R	4-48 months	30-75 minutes	Master's degree or Bachelors with additional license/certification from agency requiring experience in assessment	Communication skills (receptive and expressive)	\$486/kit (Includes: 50 Record Booklet/Profiles; Instruction Manual; Test Manual, carrying case) \$40/testing manual \$40/instruction manual \$62/record booklet/profile form (pkg of 25)

Note. REEL-3 = Receptive-expressive Emergent Language Scales, 3rd edition; ROWPVT-4 = Receptive One-word Picture Vocabulary Test, 4th edition; SICD-R = Sequenced Inventory of Communication Development, Revised edition

Social Skills					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
ADI-R	Children and adults with a mental age above 2.0 years	90-150 minutes, including scoring	a) Master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) Bachelor's degree in fields listed above, and c) License or certified from an agency/organization that requires training and experience in assessment.	Language/communication Reciprocal social interactions Repetitive behaviors/interests	\$237/kit (10 Interview Booklets; 10 Comprehensive Algorithm Forms; Manual) \$74/manual \$85/ADI-R Interview Booklet (Pack of 5) \$15/ADI-R Comprehensive Algorithm Form (Pack of 10) \$823/ADI-R Training Package \$164.50/ADI-R Set of Interview Booklets and Comprehensive Algorithm Forms for Training

Assessment	Age range	Administr- ation time	Qualification of assessors	Areas tested	Approximate Cost
ADOS-2	12 months through adulthood	40 to 60 minutes	a) Master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) Bachelor's degree in fields listed above, and c) License or certified from an agency/organization that requires training and experience in assessment	Communication Social interaction Play Restricted and repetitive behaviors	\$1,995/ ADOS-2 Hand-scored Kit (Manual; 50 Protocol Booklets (10 per Module); Test Materials (100+ stimulus items); all in a durable plastic container with handles and wheels) \$2,095/ ADOS-2 Software Kit \$99/ ADOS-2 Manual \$51/ each ADOS Toddler Module, Module 1, 2, 3, and 4 Observation/ Coding Booklet (Pack of 10) \$999/ADOS-2 DVD Training Package \$99/ ADOS-2 Training DVD Guidebook

Note. ADI-R = Autism Diagnostic Interview, Revised ; ADOS-2 = Autism Diagnostic Observation Schedule, 2nd edition

Assessment	Age range	Administr- ation time	Qualification of assessors	Areas tested	Approximate Cost
CBCL/1½-5	1½ - 5 years	10 to 20 minutes	Parents Teachers	Behavioral problems Emotional problems Social problems	\$415/ Preschool computer scoring starter kit (50 CBCL/1½-5 -LDS forms, 50 C-TRF forms, ADM Ages 1½-5 Module with Multicultural Options, new Stress Problems Scale, Manual for the ASEBA Preschool Forms & Profiles and the Multicultural Supplement to the Manual for the ASEBA Preschool Forms & Profiles) \$25/ Package of 50
CBCL/6-18	6 -18 years	15 minutes	Parents Teachers	Behavioral problems Emotional problems Social problems	\$485/ School-Age computer-scoring starter kit (50 CBCL/6-18 forms, 50 TRF/6-18 forms, 50 YSR Forms, ADM Ages 6-18 Module with Multicultural Options and 2007 Scales, the Manual for the ASEBA School-Age Forms & Profiles, and the Multicultural Supplement for the School-Age Manual \$25/ Package of 50

Note. CBCL/1½-5 = Child Behavior Checklist for ages 1½-5; CBCL/6-18 = Child Behavior Checklist for ages 6-18

Challenging Behavior					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
ASD-BPC	Unknown	Unknown	Parents Teachers	ASD symptoms Comorbid psychopathology Behavior problems	Unknown
CBCL/1½-5	1½ - 5 years	10 to 20 minutes	Parents Teachers	Behavioral problems Emotional problems Social problems	\$415/ Preschool computer scoring starter kit (50 CBCL/1½-5 -LDS forms, 50 C-TRF forms, ADM Ages 1½-5 Module with Multicultural Options, new Stress Problems Scale, Manual for the ASEBA Preschool Forms & Profiles and the Multicultural Supplement to the Manual for the ASEBA Preschool Forms & Profiles) \$25/ Package of 50

Note. ASD-BPC = Autism Spectrum Disorder-Behaviors Problems for Children Scales; CBCL/1½-5 = Child Behavior Checklist for ages 1½-5; CBCL/6-18 = Child Behavior Checklist for ages 6-18

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
CBCL/6-18	6 -18 years	15 minutes	Parents Teachers	Behavioral problems Emotional problems Social problems	\$485/ School-Age computer-scoring starter kit (50 CBCL/6-18 forms, 50 TRF/6-18 forms, 50 YSR Forms, ADM Ages 6-18 Module with Multicultural Options and 2007 Scales, the Manual for the ASEBA School-Age Forms & Profiles, and the Multicultural Supplement for the School-Age Manual \$25/ Package of 50
Conners CBRS	6 -18 years (Parent and teacher forms) 8-18 years (Self-report)	Full-length: 20 minutes Short: 10 minutes	Parents (P) Teachers (T) Youth (self-report: SR)	Behaviors Emotions Academic Social problems	\$689/ Software Kit (Manual, Unlimited-Use Scoring Program, 25 Item Booklets for each of Conners CBRS-P, Conners CBRS-T, and Conners CBRS-SR) \$104/Conners CBRS Manual \$60/each Conners CBRS-P, T, SR Response Booklet Eng (25/pkg) \$440/Conners CBRS Scoring Software Program

Note. Conners CBRS = Conners Comprehensive Behavior Rating Scales; DBC = Developmental Behavior Checklist

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
DBC	4-18 years	15minutes	Parents Teachers	Disruptive/Anti-social Behavior Self-absorbed Communication disturbance Anxiety Social Relating	Not yet established (http://www.med.monash.edu.au/spppm/research/devpsych/dbc.html)
NCBRF	3-16 years	Unknown	Parents Teachers	Child and adolescent behavior	Free (online)

Note. NCBRF = Nisonger Child Behavior Rating Form

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
Vineland-II	Birth-90 years	20-90minutes	a) Master's degree in psychology, education, occupational therapy, social work, or in a field closely related to the intended use of the assessment, and formal training in the ethical administration, scoring, and interpretation of clinical assessments; b) Certification by or full active membership in a professional organization (such as ASHA, AOTA, AERA, ACA, AMA, CEC, AEA, AAA, EAA, NAEYC, NBCC) that requires training and experience in the relevant area of assessment; c) Degree or license to practice in the healthcare or allied healthcare field; and d) Formal, supervised mental health, speech/language, and/or educational training specific to assessing children, or in infant and child development, and formal training in the ethical administration, scoring, and interpretation of clinical assessments.	Communication Daily living skills Socialization Motor skills Maladaptive behavior index (optional)	\$420/ Vineland-II complete Starter Kit (Includes Survey Forms, Expanded Form and Teacher Rating Form Includes all components in each individual starter kit) \$198.50/Expanded Interview Starter Kit (Includes 10 Expanded Interview Record Booklets, 10 Report to Parents, and 1 Manual) \$94.25/Expanded interview manual \$80.70/Expanded Interview Record Booklets (pkg of 25) \$34.80/Expanded interview Report to Parents (pkg of 25) \$34.80/Expanded Form Report to Caregivers \$118/training CD

Adaptive Behavior					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
Vineland-II	Birth-90 years	20-90minutes	a) Master's degree in psychology, education, occupational therapy, social work, or in a field closely related to the intended use of the assessment, and formal training in the ethical administration, scoring, and interpretation of clinical assessments; b) Certification by or full active membership in a professional organization (such as ASHA, AOTA, AERA, ACA, AMA, CEC, AEA, AAA, EAA, NAEYC, NBCC) that requires training and experience in the relevant area of assessment; c) Degree or license to practice in the healthcare or allied healthcare field; and d) Formal, supervised mental health, speech/language, and/or educational training specific to assessing children, or in infant and child development, and formal training in the ethical administration, scoring, and interpretation of clinical assessments.	<p>Communication</p> <p>Daily living skills</p> <p>Socialization</p> <p>Motor skills</p> <p>Maladaptive behavior index (optional)</p>	<p>\$420/ Vineland-II complete Starter Kit (Includes Survey Forms, Expanded Form and Teacher Rating Form Includes all components in each individual starter kit)</p> <p>\$198.50/Expanded Interview Starter Kit (Includes 10 Expanded Interview Record Booklets, 10 Report to Parents, and 1 Manual)</p> <p>\$94.25/Expanded interview manual</p> <p>\$80.70/Expanded Interview Record Booklets (pkg of 25)</p> <p>\$34.80/Expanded interview Report to Parents (pkg of 25)</p> <p>\$34.80/Expanded Form Report to Caregivers</p> <p>\$118/training CD</p>

Autistic Symptomatology					
Assessment	Age range	Administr- ation time	Qualification of assessors	Areas tested	Approximate Cost
ABC /ASEIP-3	2 to 13 years, 11 months	Varies	A bachelor's degree (BA, BS) in psychology, school counseling, occupational therapy, speech–language pathology, social work, education, special education, or related field	ASEIP-3 has five standardized components: ABC (autism symptomology); Sample of vocal behavior (spontaneous speech); interaction assessment (social responding); educational assessment; prognosis of learning rate (child's acquisition learning rate)	<p>\$282/kit (<i>Examiner's Manual, 25 Autism Behavior Checklist Record Forms, 25 Sample of Vocal Behavior Record Forms, 25 Interaction Assessment Record Forms, 25 Educational Assessment Record Forms, 25 Prognosis of Learning Rate Record Forms, an Audio CD, and a set of Toys/manipulatives, all in a sturdy storage box</i>)</p> <p>\$72/examiner's manual</p> <p>\$29/ABC record forms (pack of 25)</p> <p>\$29/Sample of vocal behavior record forms (pack of 25)</p> <p>\$29/Interaction Assessment Record forms (pack of 25)</p> <p>\$29/Educational Assessment Record forms (pack of 25)</p> <p>\$29/ Prognosis of Learning Rate Record Forms</p> <p>\$23/audio cd</p> <p>\$67/toys and manipulatives</p>

Note. ABC = Autism Behavior Checklist; ASEIP-3 = Autism Screening Instrument for Educational Planning, 3rd edition

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
ADI-R	Children and adults with a mental age above 2.0 years	90-150 minutes, including scoring	a) Master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) Bachelor's degree in fields listed above, and c) License or certified from an agency/organization that requires training and experience in assessment.	Language/communication Reciprocal social interactions Repetitive behaviors/interests	\$237/kit (10 Interview Booklets; 10 Comprehensive Algorithm Forms; Manual) \$74/manual \$85/ADI-R Interview Booklet (Pack of 5) \$15/ADI-R Comprehensive Algorithm Form (Pack of 10) \$823/ADI-R Training Package \$164.50/ADI-R Set of Interview Booklets and Comprehensive Algorithm Forms for Training

Note. ADI-R = Autism Diagnostic Interview, revised edition; ADOS-2 = Autism Diagnostic Observation Schedule, 2nd edition

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
ADOS-2	12 months through adulthood	40 to 60 minutes	a) Master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) Bachelor's degree in fields listed above, and c) License or certified from an agency/organization that requires training and experience in assessment	Communication Social interaction Play Restricted and repetitive behaviors	\$1,995/ ADOS-2 Hand-scored Kit (Manual; 50 Protocol Booklets (10 per Module); Test Materials (100+ stimulus items); all in a durable plastic container with handles and wheels) \$2,095/ ADOS-2 Software Kit \$99/ ADOS-2 Manual \$51/ each ADOS Toddler Module, Module 1, 2, 3, and 4 Observation/ Coding Booklet (Pack of 10) \$999/ADOS-2 DVD Training Package \$99/ ADOS-2 Training DVD Guidebook

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
CARS-2	2 years and up	5 to 10 minutes (after the information needed to make the ratings has been collected)	a) Master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) Bachelor's degree in fields listed above, and c) License or certified from an agency/organization that requires training and experience in assessment	Autism symptom severity	CARS-2 Kit (25 Standard Version Rating Booklets (CARS2-ST); 25 High-Functioning Version Rating Booklets (CARS2-HF); 25 Questionnaires for Parents or Caregivers (CARS2-QPC); and a Manual = \$175 Manual = \$80 High functioning version (25 rating booklets) = \$42 Standard Version (25 rating booklets) = \$42 Questionnaire version for parents and caregivers (25 booklets)
DISCO	No age restrictions	2-3 hours for full assessment	Unknown, training is available	Comprehensive assessment of core symptoms of autism, including verbal and nonverbal communication and social interaction with peers and adults	unknown

Note. CARS-2 = Childhood Autism Rating Scale, 2nd edition

Note. DISCO = Diagnostic Interview for Social and Communication disorders; GARS-3 = Gilliam Autism Rating Scale, 3rd edition

Assessment	Age range	Administr- ation time	Qualification of assessors	Areas tested	Approximate Cost
GARS-3	3 to 22	5-10 minutes	A degree from an accredited 4-year college or university in psychology, counseling, or a closely related field PLUS satisfactory completion of coursework in test interpretation, psychometrics and measurement theory, educational statistics, or a closely related area; OR license or certification from an agency that requires appropriate training and experience in the ethical and competent use of psychological tests	Restrictive, repetitive behaviors, social interaction, social communication, emotional responses, cognitive style, and maladaptive speech	\$163/GARS kit (<i>Examiner's Manual, 50 Summary/Response Forms, and the Instructional Objectives manual, sturdy storage box</i>) \$73/Examiner's manual \$35/instructive objectives manual \$59/ 50 summary/response forms

ABA-based Focused Treatments					
Language and Communication					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
CCC-2	4-16 years, 11 months	5-10 minutes	a) Master's degree in related field with formal training in assessment methods or b) Certification by or membership in professional organization requiring assessment training or c) Degree or license to practice in healthcare or d) formal, supervised training in clinical assessment and formal training in ethical assessment practices	Language and pragmatics	\$189/kit (Includes Manual, 25 Caregiver Response Forms, 25 Scoring Worksheets, and Scoring CD) \$72/manual \$26/scoring worksheets (pkg of 25) \$45/caregiver response forms (pkg of 25)

Note. CCC-2 = Children's Communication Checklist, 2nd edition; CDI = Communicative Developmental Inventories

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
CDI	8-37 months (chronological or verbal age)	20-40 minutes	Parents, caregiver report	Language and communication skills	\$122/Complete set (manual, three assessments according to different ages) \$60/user's guide and technical manual \$20/ booklet of 25 CDI-III (ages 30-37 months)
DISCO	No age restrictions	2-3 hours for full assessment	Unknown, training is available	Comprehensive assessment of core symptoms of autism, including verbal and nonverbal communication and social interaction with peers and adults	unknown

Note. DISCO = Diagnostic Interview for Social and Communication disorders; CARS-2 = Childhood Autism Rating Scale, 2nd edition

Social Skills					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
CARS-2	2 years and up	5 to 10 minutes (after the information needed to make the ratings has been collected)	a) Master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) Bachelor's degree in fields listed above, and c) License or certified from an agency/organization that requires training and experience in assessment	Autism symptom severity	CARS-2 Kit (25 Standard Version Rating Booklets (CARS2-ST); 25 High-Functioning Version Rating Booklets (CARS2-HF); 25 Questionnaires for Parents or Caregivers (CARS2-QPC); and a Manual = \$175 Manual = \$80 High functioning version (25 rating booklets) = \$42 Standard Version (25 rating booklets) = \$42 Questionnaire version for parents and caregivers (25 booklets)
CSBQ	4 to 18 years	Unknown	Parents Caregivers	Social behavior problems	Unknown

Assessment	Age range	Admini- stration time	Qualification of assessors	Areas tested	Approximate Cost
MESSY	Unknown	Unknown	Unknown	Inappropriate Assertiveness/Impulsi veness Appropriate Social Skills	Unknown

Note. CSBQ = Children's Social Behavior Questionnaire; MESSY = Matson Evaluation of Social Skills with Youngsters; SRS-2 = Social Responsiveness Scale, 2nd edition

Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
SRS-2	2.5 through adulthood	15 to 20 minutes	a) Master's degree in psychology, school counseling, occupational therapy, speech-language pathology, social work, education, special education, or related field or b) Bachelor's degree in fields listed above, and c) License or certified from an agency/organization that requires training and experience in assessment	Presence and severity of social impairment	<p>\$247/SRS-2 Hand-Scored Kit (25 School-Age AutoScore Forms; 25 Preschool AutoScore Forms; 25 Adult AutoScore Forms; 25 Adult Self-Report AutoScore Forms; Manual)</p> <p>\$350/SRS-2 Software Kit (25 School-Age AutoScore Forms; 25 Preschool AutoScore Forms; 25 Adult AutoScore Forms; 25 Adult Self-Report AutoScore Forms; Manual; Unlimited-Use Scoring CD)</p> <p>\$165/SRS-2 Child/Adolescent Hand-Scored Kit (5 School-Age AutoScore Forms; 25 Preschool AutoScore Forms; Manual)</p> <p>\$268/SRS-2 Child/Adolescent Software Kit (25 School-Age AutoScore Forms; 25 Preschool AutoScore Forms; Manual; Unlimited-Use Scoring CD)</p> <p>\$84.50/SRS-2 Manual</p> <p>\$50/SRS-2 School-Age AutoScore™ Form, for each ages 4-18 Years, and ages 2.5-4.5 Years (Pack of 25)</p>

Challenging Behavior					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
BPI-01	14 to 91 years	2 to 5 minutes	Parents Caregivers	Problem behaviors such as self-injurious, stereotypic, and aggressive/destructive behavior	Unknown
OAS	9 years and older	Unknown	Unknown	Aggressions into four subtypes: a) verbal aggression; b) physical aggression against others; c) physical aggression against property or objects; and d) physical aggression against self (self-injurious behavior)	Free (online)

Note. BPI = Behavior Problems Inventory; OAS = Overt Aggression Scale

Assessment	Age range	Administr- ation time	Qualification of assessors	Areas tested	Approximate Cost
PDDBI	2 to 12 years	20 to 30 minutes for standard forms 30 to 45 minutes for extended forms	Degree, certificate, or license to practice in a health care profession or occupation, including (but not limited to) the following: clinical psychology, medicine, neurology, neuropsychology, nursing, occupational therapy and other allied health care professions, physicians' assistants, psychiatry, school psychology, social work, speech-language pathology; plus appropriate training and experience in the ethical administration, scoring, and interpretation of clinical behavioral assessment instruments	Repetitive, Ritualistic, and Pragmatic Problem Behaviors (REPRIT) Approach/Withdrawal Problems (AWP) Expressive Social Communication Abilities (EXSCA) Receptive/Expressive Social Communication Abilities (REXSCA) Autism (AUTISM).	\$285/PDDBI Introductory Kit (PDDBI Professional Manual, 25 Parent Rating Forms, 25 Teacher Rating Forms, 25 Parent Score Summary Sheets, 25 Teacher Score Summary Sheets, and 50 Profile Forms) \$270/ PDDBI-SP-CD-ROM \$90/PDDBI Professional Manual \$76/PDDBI Parent /Teacher Rating Forms (pkg/25)

Note. PDDBI = PDD Behavior Inventory

Adaptive Behavior					
Assessment	Age range	Administration time	Qualification of assessors	Areas tested	Approximate Cost
Vineland-II	Birth-90 years	20-60minutes	Parents Teachers	Communication Daily living skills Socialization Motor skills Maladaptive behavior index (optional)	\$420/ Vineland-II complete Starter Kit (Includes Survey Forms, Expanded Form and Teacher Rating Form Includes all components in each individual starter kit) \$198.50/Expanded Interview Starter Kit (Includes 10 Expanded Interview Record Booklets, 10 Report to Parents, and 1 Manual) \$94.25/Expanded interview manual \$80.70/Expanded Interview Record Booklets (pkg of 25) \$34.80/Expanded interview Report to Parents (pkg of 25) \$34.80/Expanded Form Report to Caregivers \$118/training CD

Appendix A. Summary of results of ABA-based programs across settings.

Language	Home	School	Clinic	Total
Effective	3 (60%)	1(100%)	4 (100%)	8 (80%)
Ineffective	2 (40%)	0 (0%)	0 (0%)	2 (20%)
Not Measured	4	4	0	8
Total	9	5	4	18

Adaptive	Home	School	Clinic	Total
Effective	3 (37.5%)	3 (60%)	1 (33%)	7 (44%)
Ineffective	5 (62.5%)	2 (40%)	2 (67%)	9 (56%)
Not Measured	1	0	1	2
Total	9	5	4	18

Problem Behavior	Home	School	Clinic	Total
Effective	1 (50%)	2 (100%)	1(100%)	4 (80%)
Ineffective	1 (50%)	0 (0%)	0 (0%)	1 (20%)
Not Measured	7	3	3	13
Total	10	5	4	18

Social	Home	School	Clinic	Total
Effective	1(50%)	0 (0%)	1(50%)	2 (50%)
Ineffective	1(50%)	0 (0%)	1(50%)	2 (50%)
Not Measured	7	5	2	14
Total	9	5	4	18

Emotion	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	2 (100%)	0 (0%)	0 (0%)	2 (100%)
Not Measured	7	5	4	16
Total	9	5	4	18

Cognitive	Home	School	Clinic	Total
Effective	7 (78%)	2 (67%)	1 (33%)	10 (67%)
Ineffective	2 (22%)	1 (33%)	2 (67%)	5 (33%)
Not Measured	0	2	1	3
Total	9	5	4	18

Severity of ASD symptoms	Home	School	Clinic	Total
Effective	1 (50%)	1 (33%)	3 (100%)	5 (56%)
Ineffective	2 (50%)	2 (67%)	0 (0%)	4 (44%)
Not Measured	6	2	1	9
Total	9	5	4	18

Table 2. Summary of results of developmental-based programs across settings.

Language	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	1(33%)	1 (25%)
Ineffective	1(100%)	0 (0%)	2(67%)	3 (75%)
Not Measured	1	0	0	1
Total	2	0	3	5

Adaptive	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	1(33%)	1 (33%)
Ineffective	0 (0%)	0 (0%)	2(67%)	2 (67%)
Not Measured	2	0	0	2
Total	2	0	3	5

Problem Behavior	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not Measured	2	0	3	5
Total	2	0	3	5

Social	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	0 (0%)	0	1 (100%)	1 (100%)
Not Measured	2	0	2	4
Total	2	0	3	5

Emotion	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not Measured	2	0	3	5
Total	2	0	3	5

Cognitive	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	1 (100%)	0 (0%)	0 (0%)	1 (100%)
Not Measured	1	0	3	4
Total	2	0	3	5

Severity of ASD symptoms	Home	School	Clinic	Total
Effective	1 (100%)	0 (0%)	1(50%)	2 (67%)
Ineffective	0 (0%)	0 (0%)	1(50%)	1 (33%)
Not Measured	1	0	1	2
Total	2	0	3	5

Table 3. Summary of results of hybrid-based programs across settings.

Language	Home	School	Clinic	Total
Effective	2 (100%)	1(33%)	1(50%)	4 (57%)
Ineffective	0 (0%)	2(67%)	1(50%)	3 (43%)
Not Measured	0	0	1	1
Total	2	3	3	8

Adaptive	Home	School	Clinic	Total
Effective	2(100%)	0 (0%)	0 (0%)	2 (67%)
Ineffective	0 (0%)	0 (0%)	1 (100%)	1 (33%)
Not Measured	0	3	2	5
Total	2	3	3	8

Problem Behavior	Home	School	Clinic	Total
Effective	0 (0%)	1 (100%)	0 (0%)	1 (33%)
Ineffective	2 (100%)	0 (0%)	0 (0%)	2 (67%)
Not Measured	0	2	3	5
Total	2	3	3	8

Social	Home	School	Clinic	Total
Effective	0 (0%)	1(33%)	1(100%)	2 (50%)
Ineffective	0 (0%)	2(67%)	0 (0%)	2 (50%)
Not Measured	2	0	2	4
Total	2	3	3	8

Emotion	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not Measured	2	3	3	8
Total	2	3	3	8

Cognitive	Home	School	Clinic	Total
Effective	1(50%)	0 (0%)	1(100%)	2 (67%)
Ineffective	1(50%)	0 (0%)	0 (0%)	1 (33%)
Not Measured	0	3	2	5
Total	2	3	3	8

Severity of ASD symptoms	Home	School	Clinic	Total
Effective	0 (0%)	1 (100%)	0 (0%)	1 (33%)
Ineffective	2 (100%)	0 (0%)	0 (0%)	2 (67%)
Not Measured	0	2	3	5
Total	2	3	3	8

Table 4. Summary of results of idiosyncratic-based programs across settings.

Language	Home	School	Clinic	Total
Effective	1(50%)	1(50%)	0 (0%)	2 (50%)
Ineffective	1(50%)	1(50%)	0 (0%)	2 (50%)
Not Measured	3	1	1	5
Total	5	3	1	9

Adaptive	Home	School	Clinic	Total
Effective	1(50%)	1 (100%)	0 (0%)	2 (67%)
Ineffective	1(50%)	0 (0%)	0 (0%)	1 (33%)
Not Measured	3	2	1	6
Total	5	3	1	9

Problem Behavior	Home	School	Clinic	Total
Effective	1 (100%)	0 (0%)	0 (0%)	1 (100%)
Ineffective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not Measured	4	3	1	8
Total	5	3	1	9

Social	Home	School	Clinic	Total
Effective	2 (100%)	0 (0%)	0 (0%)	2 (50%)
Ineffective	0 (0%)	2 (100%)	0 (0%)	2 (50%)
Not Measured	3	1	1	5
Total	5	3	1	9

Emotion	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Not Measured	5	2	1	8
Total	5	3	1	9

Cognitive	Home	School	Clinic	Total
Effective	0 (0%)	1 (50%)	0 (0%)	1 (50%)
Ineffective	0 (0%)	1 (50%)	0 (0%)	1 (50%)
Not Measured	5	1	1	7
Total	5	3	1	9

Severity of ASD symptoms	Home	School	Clinic	Total
Effective	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ineffective	1 (100%)	1 (100%)	0 (0%)	2 (100%)
Not Measured	4	2	1	7
Total	5	3	1	9

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