



## **Autism Spectrum Disorders (ASDs) Services**

### **Final Report on Environmental Scan**

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## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>i</b>
<b>I. INTRODUCTION.....</b>	<b>1</b>
Background and Legislative Context.....	1
Purpose of Environmental Scan.....	2
<b>II. METHODOLOGY .....</b>	<b>3</b>
Populations of Interest .....	3
Data Sources .....	4
Search Parameters .....	4
Search Terms .....	5
Data Storage.....	7
<b>III. SUMMARY OF SEARCH RESULTS.....</b>	<b>8</b>
<b>IV. INFORMATION GATHERING TEMPLATE AND PROTOCOL.....</b>	<b>9</b>
Manuscript Rating System.....	14
Quality Assurance .....	16
Categorizing Interventions.....	17
Assessing Intervention Effectiveness .....	20
Evidence Level Criteria .....	20
<b>V. DISCUSSION OF THE EVIDENCE BASE FOR AUTISM SERVICES .....</b>	<b>22</b>
Introduction.....	22
Children.....	23
Transitioning Youth.....	34
Adults.....	42
<b>VI. SUMMARY OF POPULATION SPECIFIC SCAN RESULTS .....</b>	<b>49</b>
<b>VII. COST AND FUNDING ISSUES .....</b>	<b>51</b>

Intervention Specific Analyses .....	51
Service Use, Availability, and Access for Individuals with ASD .....	54
The Economic Impact of ASD.....	59
<b>VIII. CONCLUSION .....</b>	<b>65</b>
<b>Appendix A .....</b>	<b>68</b>
<b>Appendix B .....</b>	<b>71</b>
<b>Appendix C .....</b>	<b>88</b>

**List of Tables**

Table 1: Manuscripts Reviewed by Population Type/Category and Year of Publication ..... 9

Table 2: Manuscript Rating Scale..... 16

Table 3: Intervention Categories and Descriptions..... 17

Table 4: Number and Percentage of Interventions for Children by Level of Evidence ..... 23

Table 5: Level 1 Evidence-based Interventions for Children ..... 25

Table 6: Level 2 Emerging Evidence-based Interventions for Children ..... 29

Table 7: Level 3 Unestablished Interventions for Children..... 33

Table 8: Number and Percentage of Interventions for Children by Level of Evidence ..... 34

Table 9: Level 1 Evidence-based Interventions for Transitioning Youth..... 36

Table 10: Level 2 Emerging Evidence-based Interventions for Transitioning Youth..... 38

Table 11: Level 3 Unestablished Interventions for Transitioning Youth ..... 40

Table 12: Number and Percentage of Interventions for Children by Level of Evidence ..... 42

Table 13: Level 1 Evidence-based Interventions for Adults ..... 44

Table 14: Level 2 Emerging Evidence-based Interventions for Adults..... 46

Table 15: Level 3 Unestablished Interventions for Adults ..... 48

Table 16: Intervention Specific Analyses ..... 52

Table 17: Service Use, Availability, and Access for Individuals with ASD ..... 55

Table 18: The Economic Impact of ASD ..... 60

**List of Exhibits**

Exhibit 1: Keywords for Literature Search..... 6

Exhibit 2: Screenshot of EndNote Database..... 7

Exhibit 3: Information Gathering Protocol ..... 10

Exhibit 4: Percent of Studies Found by Population Group..... 49

Exhibit 5: Number of Interventions by Level of Evidence for Each Population Group..... 50

## **EXECUTIVE SUMMARY**

Recent estimates from the Centers for Disease Control and Prevention (CDC) indicate that the number of children diagnosed with autism is increasing. As the number of individuals diagnosed with Autism Spectrum Disorders (ASD) rises, budgetary constraints limit the capacity of states to provide related services and supports. To make the most effective use of limited resources, federal and state policymakers need empirical data to make informed decisions about which services and support systems are safe and cost-effective. Currently, relatively little is known about the effectiveness of many autism interventions and services. Few initiatives and studies have focused on providing information about the most effective services for individuals with ASD. To address this information need, the Centers for Medicare and Medicaid Services (CMS) contracted with IMPAQ International, LLC to conduct an environmental scan of the scientific evidence regarding the efficacy, effectiveness, safety, and availability of ASD-related psychosocial services and supports for children, transitioning youth, and adults with ASD. This report describes findings from the literature review, including data on the evidence base for interventions for individuals with autism across the age span as well as data on the significant costs associated with caring for individuals with autism. These data provide CMS with much-needed information to inform policy and funding decisions related to ASD services and supports.

### **Methods**

The environmental scan focused on behavioral and psychosocial interventions (e.g., behavioral therapy services/supports) and did not include services traditionally considered medical or pharmaceutical. The search included manuscripts published in the ten years prior to the start of the environmental scan (1998 through 2008). An Information Gathering Template was developed to extract the most relevant information from each article reviewed. Each study was rated on a 9 point scale based on the rigor of the research design (e.g., study design, sample selection and potential for selection bias, sample size, effect on participants). The researchers grouped the interventions into the following three levels based upon the pool of evidence provided by the manuscripts reviewed:

- Level 1, Evidence-Based Interventions
- Level 2, Emerging Evidence-Based Interventions
- Level 3, Unestablished Interventions

Interventions were placed in levels 1, 2, or 3 based on the National Professional Development Center's (NPDC) criteria for assessing evidence-based practices. The researchers also reviewed relevant cost and funding literature relating to ASDs in the environmental scan. The results of this scan provide key information on each intervention category within the three evidence levels as well as a synthesis of the cost and funding articles.

### **Overview of Major Findings**

- While considerable evidence exists for interventions that target children, little evidence exists for interventions that target transitioning youth and adults with ASD.
- A total of 214 studies covering 31 interventions were reviewed for children. Of these 31 interventions, almost half (48 percent) were rated as evidence-based, 42 percent were rated as emerging evidence-based, and 10 percent were rated as unestablished.
- We reviewed studies providing evidence on 15 different interventions for transitioning youth with ASD. The majority of interventions (73 percent) were rated as unestablished. Few interventions (7 percent) met the criteria for evidence-based practices.
- We found evidence of the effectiveness of only nine interventions for adults with ASD. One-third of the interventions (33 percent) were rated as evidence-based, only one intervention was rated as emerging evidence-based, and the majority (56 percent) was rated as unestablished.
- The scan highlights the need for further research into effective interventions for individuals with ASD, specifically interventions that can be successfully implemented within community settings.

## I. INTRODUCTION

### Background and Legislative Context

Recent estimates from the Centers for Disease Control and Prevention (CDC) indicate that the number of children diagnosed with autism is increasing. Prevalence data collected from various communities around the country show that about 1 in 110 children has an Autism Spectrum Disorder (ASD).<sup>1</sup> These findings corroborate various reports from State Medicaid Agencies, which indicate that an increasing number of people diagnosed with ASDs are seeking services and support through publicly-funded systems. These dramatic increases have generated much interest and concern in Congress, the executive branch of the Federal government, State and local governments, advocacy groups, and people with ASDs and their families about the best ways to address the unmet service and support needs. Many initiatives and legislative actions that aim to address existing gaps have been developed and implemented. One of these initiatives is Real Choice Systems Change (RCSC) Grants funded by the Centers for Medicare & Medicaid Services (CMS). These grants are targeted at improving the community-based infrastructure of States' long-term care systems, including services and supports for people with ASDs and their families.

Congress also has taken action to address the needs of people with ASDs and their families by enacting the Combating Autism Act (CAA) of 2006. At the end of 2007, about \$160 million in CAA funds was appropriated to Federal agencies for autism research and awareness programs for the 2008 fiscal year. The Health Services and Resources Administration (HRSA) received \$36 million, the CDC received \$16 million, and the National Institutes of Health (NIH) received \$108.5 million. These funds will assist in combating ASDs through education, early detection, and intervention. For example, the Act seeks to promote the use of evidence-based interventions and techniques for people with ASDs or other developmental disabilities and reduce barriers to screening and diagnosis. In addition, the legislation also established the Interagency Autism Coordinating Committee (IACC) to coordinate all autism spectrum disorder efforts within the

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<sup>1</sup> Centers for Disease Control and Prevention (2009). *Fact Sheet – CDC Autism Activities*.  
<http://www.cdc.gov/ncbddd/autism/facts.html>



Department of Health and Human Services. The IACC is tasked with developing and annually updating a Strategic Plan for the conduct and support of ASD research, including proposed budgetary requirements. A representative from the CMS is a member of the IACC, and co-chairs the Services Subcommittee, which is the only Subcommittee formed to date by the IACC. One of the priority areas identified by the IACC is research on services and support systems for individuals with ASDs.

### **Purpose of Environmental Scan**

As the number of individuals diagnosed with ASD rises, budgetary constraints limit the capacity of states to provide related services and supports. To make the most effective use of limited resources, federal and state policymakers need empirical data to make informed decisions about which services and support systems are safe and cost-effective. Currently, relatively little is known about the effectiveness of many autism interventions and services. Few initiatives and studies have focused on providing information about the most effective services for individuals with ASD. For example, several reviews have been published examining the evidence for the effectiveness of behavioral interventions for children with ASD.<sup>2</sup> A more comprehensive recent initiative is the National Standards Project, which gathered and analyzed comprehensive information about the evidence base for interventions for individuals with ASDs under 22 years of age.<sup>3</sup> These efforts have provided useful information about the most effective services and supports for individuals with ASD. However, these studies and most other research on ASD services have focused on children, and as a result, little or no data exist on services for adolescents and adults. In addition, no efforts exist at the national level to examine ASD services and supports within the context of Medicaid. To address this information need, CMS contracted with IMPAQ International to conduct an environmental scan of the scientific evidence regarding the effectiveness, safety, and quality of services and supports for children, transitioning youth, and adults with ASD. The IMPAQ team also included relevant cost and funding literature relating to ASDs in the environmental scan. The findings from the environmental scan will help CMS address the following questions:

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<sup>2</sup> Howlin Patricia & Magiati Iliana (2009). "Systematic Review of Early Intensive Behavioral Interventions for Children with Autism", *American Journal on Intellectual and Developmental*, 114 (1), 23-41.

<sup>3</sup> <http://www.nationalautismcenter.org/pdf/NAC%20Standards%20Report.pdf>

- What is the strength of the evidence for services that people with ASD may receive?
- What services can Medicaid cover as medical assistance under various statutory authorities?

Data collected on the strength of evidence for services in this environmental scan will provide CMS with much-needed information to inform policy and funding decisions related to ASD services and supports.

This report presents findings from the environmental scan of the existing scientific literature on the effectiveness, safety, and quality of ASD-related psychosocial services and supports. Section II describes the method used for the search strategy. Section III provides a summary of the search results from implementing IMPAQ's search strategy outlined in section II. Section IV outlines the process the IMPAQ team used to review each manuscript and evaluate the effectiveness of the intervention. In sections V and VI, the IMPAQ team provides the results of the intervention effectiveness assessment and Section VII provides a summary of the cost articles found.

## **II. METHODOLOGY**

In this section, we provide an overview of the search strategy that was used to identify and retrieve the relevant literature on ASD-related services and supports.

### **Populations of Interest**

We searched for publications that examined ASD services and supports for three groups: 1) children (birth to 16 years of age); 2) transitioning youth (17 to 21 years of age); and 3) adults (21+ years). The age range for each group was determined based upon the availability of Medicaid benefits and disability entitlement eligibility. Age cut-offs for children in Medicaid programs vary from age 17 to 21 depending on the state and entitlements for children with disabilities end at the age of 21. It is important to note that the Early Periodic Screening, Diagnosis and Treatment (EPSDT) program is a mandatory benefit that is extended to all Medicaid-eligible individuals under the age of 21. The program makes children eligible for

benefits through Section 1905(r) of the Social Security Act (the Act), which includes any medically necessary health care services listed in Section 1905(a) of the Act.

## **Data Sources**

The scan utilized a variety of data sources to identify and retrieve relevant information. These included healthcare literature databases such as PubMed/Medline, PsycINFO, Social Science Abstracts, CINAHL and HealthSTAR. The scan also included a review of relevant books, integrated reviews of the literature, meta-analyses, and grey literature (e.g., unpublished reports; conference proceedings).

To avoid omissions of key data sources, a snowballing technique was used to identify publications that were not uncovered during the initial search process. This entailed reviewing the bibliographies of books, articles, and reports retrieved during the initial search process to select additional relevant studies.

## **Search Parameters**

*Types of evidence.* The environmental scan focused on behavioral and psychosocial interventions (e.g., behavioral therapy services/supports) and did not include services traditionally considered medical or pharmaceutical. Examples of the types of services and supports included in the scan are comprehensive behavioral treatments, peer training, and supported employment. The scan included services designed to address the core deficits associated with ASD as well as ancillary healthcare services that individuals with ASD require, such as speech therapy and other “wraparound” services that may not be readily available to individuals with special needs. In addition to reviewing the scientific literature on autism services and supports, the scan included a review of publications describing cost and funding issues related to ASDs. These publications provide information relating to the overall cost of ASD, the availability of services for individuals with ASDs, and the costs associated with implementing specific ASD interventions.

*Time frame for scan.* To ensure that only publications relevant to the current policy and healthcare environment were retrieved, the literature search was limited to articles published in the ten years prior to the start of the environmental scan from 1998 through 2008.

*Other exclusions.* Research conducted outside of the United States (U.S.) was excluded from the scan if the intervention studied could not be readily implemented in the U.S. (e.g., if the intervention was idiosyncratic to the service delivery system of the country). In addition, literature that was not available in English was excluded from the scan.

### **Search Terms**

To identify all relevant manuscripts for the scan, a comprehensive set of keywords were developed to guide the database searches. The search process was performed in a systematic manner using four primary health keywords: 1) autism spectrum disorders, 2) ASD, 3) autistic disorder, and 4) Asperger Syndrome. These four keywords were used alone and in combination with keywords from four other categories: secondary health keywords, provider keywords, outcome keywords, and cost keywords. Exhibit 1 presents selected keywords that were used during the literature search process.

## Exhibit 1: Keywords for Literature Search

Primary Health Keywords			
• Autism Spectrum Disorders	• ASD	• Autistic Disorder	• Asperger Syndrome

Secondary Health Keywords			
• Pervasive Development Disorder	• Fragile X Syndrome	• Seizure Disorder	• Anxiety
• Learning Disabilities	• Tourette Syndrome	• Sleep Abnormalities	
• Mental Retardation	• Attention Deficit Disorder	• Developmental Disabilities	

Provider Keywords			
• Psychiatric Facilities	• Medicaid-Waiver Services	• Home and Community-Based Services	• Schools
• Home and Community-Based Care	• State Medicaid Agencies	• Case Management	• Group Homes
• Service Models	• Qualifications of Providers	• Vocational Rehabilitation	• Residential Treatment Facilities
• Institutional Care	• Family Support Services	• Independent Housing Supports	• Intermediate Care Facilities for the Mentally Retarded (ICF/MRs)
• Board-Certified Behavioral Analyst	• Occupational Therapist	• Psychiatrist/Child Psychiatrist	
• Speech Pathologist	• Physical Therapist	• Pediatric Neurologist/Neuro-developmental Pediatrician	

Outcome Keywords			
• Program Evaluation	• Self-Direction	• Evidence-Based Services	• Behavior Plan/Behavior Therapy
• Outcome Assessment	• Person-Centered	• Quality of Life	

Cost Keywords			
• Efficiency	• Cost-Effective	• Private Insurance	• Pay for Performance
• Cost Analysis	• Fee-for-Service	• Out-of-Pocket Family Expenses	
• Cost-Benefit Analysis	• Managed Care	• Medicaid	

## Data Storage

Once the citations were retrieved from the databases, they were assigned an identification number and stored in EndNote, a searchable bibliographic database that has the capability of storing, organizing and managing manuscripts. Literature was stored in four individual library groups, each corresponding to one of the four key groups of interest (i.e., children, transitioning youth, adults, and cost/funding). Exhibit 2 presents a screenshot of the EndNote database.

### Exhibit 2: Screenshot of EndNote Database

The screenshot displays the EndNote X2 software interface. The main window shows a list of references organized into groups. The 'Custom Groups' section is expanded, showing sub-groups like 'Adult, Asperger Syndrome', 'Adults', 'Children', 'Cost/Funding', 'Early Intervention', 'General', and 'Transitioning Youth/Adolescents'. A preview window is open at the bottom, showing the details of a selected reference (Record Number 14085).

Groups	Record Number	Author	Year	Title	Journal	Re
All References (6088)	14007		1998	Auditory integration training and facilitated communication for autism. American Acade...	Pediatrics	Jou
Trash (0)	14474		2000	A comprehensive program for treating profoundly autistic children	Psychiatric Services	Jou
	14493		2000	A comprehensive program for treating profoundly autistic children	Psychiatric Services	Jou
	13578	Ahearn	2003	Persistence of stereotypic behavior: examining the effects of external reinforcers	J Appl Behav Anal	Jou
<b>Custom Groups</b>	1439	Aldred	2004	A new social communication intervention for children with autism: pilot randomised con...	J Child Psychol Psychiatry	Jou
Adult, Asperger Syndrome (78)	14363	Anan	2008	Group Intensive Family Training (GIFT) for preschoolers with autism spectrum disorders	Behavioral Interventions	Jou
Adults (32)	14125	Baranek	2002	Efficacy of sensory and motor interventions for children with autism	J Autism Dev Disord	Jou
Children (167)	1433	Baumer	2008	Autism spectrum disorders, SIGN	Arch Dis Child Educ Pract Ed	Jou
Cost/Funding (32)	14459	Bellini	2007	A meta-analysis of school-based social skills interventions for children with autism spec...	Remedial and Special Education	Jou
Early Intervention (370)	13534	Bernard-Opitz	2000	[Analysis of pragmatic aspects of communication behavior of verbal and nonverbal auti...	Prax Kinderpsychol Kinderpsychiatr	Jou
General (6)	14085	Bernard-Opitz	2001	Enhancing social problem solving in children with autism and normal children through c...	J Autism Dev Disord	Jou
Transitioning Youth/Adolescents (32)	13735	Bibby	2002	Progress and outcomes for children with autism receiving parent-managed intensive in...	Res Dev Disabil	Jou
	14124	Bole	2002	[Intervention in autistic disorders: status quo, evidence-based, questionable and doubf...	Z Kinder Jugendpsychiatr Psychother	Jou
	13992	Bondy	1998	The picture exchange communication system	Semin Speech Lang	Jou
	14478	Bradley	2005	The deinstitutionalization of children: An evaluation of the efficacy of wraparound servic...	The	Jou
	14389	Brightman	1982	Effectiveness of alternative parent training formats	Journal of Behavior Therapy & Experi...	Jou
	13294	Brodin	2000	Computer play centres for children with disabilities	Int J Rehabil Res	Jou
	13533	Brown	2000	Evaluating the effects of functional communication training in the presence and absenc...	J Appl Behav Anal	Jou
	14137	Brownell	2002	Musically adapted social stories to modify behaviors in students with autism: four case ...	J Music Ther	Jou
	14306	Bryson	2003	Autism spectrum disorders: early detection, intervention, education, and psychopharm...	Can J Psychiatry	Jou
	13701	Buffington	1998	Procedures for teaching appropriate gestural communication skills to children with auti...	J Autism Dev Disord	Jou
	480	Burke	2005	Listening to young people with special needs: the influence of group activities	J Intellect Disabil	Jou
	13707	Cann	2000	Timely intervention	Nurs Stand	Jou
	13568	Carr	2002	Treatment of automatically reinforced object mouthing with noncontingent reinforcemen...	Res Dev Disabil	Jou
	14030	Case-Smith	1999	The effects of occupational therapy with sensory integration emphasis on preschool-ag...	Am J Occup Ther	Jou
	14028	Case-Smith	1999	Occupational therapy with children with pervasive developmental disorders	Am J Occup Ther	Jou
	14155	Chandler	2002	Developing a diagnostic and intervention package for 2- to 3-year-olds with autism: out...	Autism	Jou
	14264	Charlop-Chri...	1998	Using objects of obsession as token reinforcers for children with autism	J Autism Dev Disord	Jou

Showing 167 of 167 references in Group. (All References: 6088)

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NUM

Preview Search - Children

#14085, Bernard-Opitz, V., N. Sriram, et al. (2001). "Enhancing social problem solving in children with autism and normal children through computer-assisted instruction." *J Autism Dev Disord* 31(4): 377-84. Children with autism have difficulty in solving social problems and in generating multiple solutions to problems. They are, however, relatively skilled in responding to visual cues such as pictures and animations. Eight distinct social problems were presented on a computer, along with a choice of possible solutions, and an option to produce alternative solutions. Eight preschool children with autism and eight matched normal children went through 10 training sessions interleaved with 6 probe sessions. Children were asked to provide solutions to animated problem scenes in all the sessions. Unlike the probe sessions, in the training sessions problem solutions were first explained thoroughly by the trainer. Subsequently these explanations were illustrated using dynamic animations of the solutions. Although children with autism produced significantly fewer alternative solutions compared to their normal peers, a steady increase across probe sessions was observed for the autistic group. The frequency of new ideas was directly predicted by the diagnostic category of autism. Results suggest young children with autism and their normal peers can be taught problem-solving strategies with the aid of computer interfaces. More research is required to establish whether such computer-assisted instruction will generalize to nontrained problem situations in real-life contexts.

### **III. SUMMARY OF SEARCH RESULTS**

The IMPAQ team reviewed the titles and abstracts of the references identified using the search strategy outlined in Section II and selected 271 articles to be included in the environmental scan.

The selected references were organized into the following four categories: children, transitioning youth, adults, and cost/funding. While reviewing articles, evidence provided was considered for all categories for which it applied. As such, a single article may be represented in multiple categories.

Table 1 presents a breakdown of the number of references reviewed by population-type/category and year of publication. The table includes references that were retained as a result of both the initial search and the snowballing process. Although the IMPAQ team reviewed a total of 271 articles, many articles applied to more than one population-type/category. In this regard, the number of manuscripts shown in Table 1 includes duplicates. Thus, the total (320) number of articles attributed to population is greater than the total number of articles included in the environmental scan.

**Table 1: Manuscripts Reviewed by Population Type/Category and Year of Publication**

<b>Year of Publication</b>	<b>Children</b>	<b>Transitioning Youth</b>	<b>Adults</b>	<b>Cost/Funding</b>	<b>Total</b>
1998	16	0	1	2	<b>19</b>
1999	4	1	4	0	<b>9</b>
2000	19	3	4	1	<b>27</b>
2001	20	3	1	1	<b>25</b>
2002	24	2	1	1	<b>28</b>
2003	21	4	4	4	<b>33</b>
2004	27	4	0	1	<b>32</b>
2005	16	3	2	1	<b>22</b>
2006	29	4	2	5	<b>40</b>
2007	38	8	5	8	<b>59</b>
2008	19	4	2	1	<b>26</b>
<b>Total</b>	<b>233</b>	<b>36</b>	<b>26</b>	<b>25</b>	<b>320</b>

Although an article may have been counted under more than one category, the majority of articles in this review address children and ASD services. The numbers of articles on the other topics were more evenly distributed.

#### **IV. INFORMATION GATHERING TEMPLATE AND PROTOCOL**

The IMPAQ team developed an Information Gathering Protocol and Template to systematically extract the most relevant information from each article reviewed. The Information Gathering Template is a data gathering tool that provides the reviewers with descriptive fields in which to enter relevant information from each article. Each reviewer received comprehensive training on how to use the template and protocol before they began to review manuscripts.

The IMPAQ team created the information gathering template using a Microsoft Access database which facilitated data storage and data analysis. Appendix A presents screenshots of the Information Gathering Template in Microsoft Access. This tool allowed the team to organize and analyze the data according to the template categories.



Exhibit 3 presents the Information Gathering Template Protocol. The IMPAQ team collected basic information about each manuscript, as well as specific information about the subjects of the study, the intervention, and the research methodology used to assess the effectiveness of the intervention. As an example, the intervention/service/treatment category is divided into three sub-categories: age group, target behavior(s)/skill(s) and description. The protocol provides detailed descriptions of the possible behaviors and/or skills that the intervention targets, as well as examples of interventions that are commonly used for each. The detailed explanations provided for each category in the protocol helped the IMPAQ team collect the necessary information required to assess the effectiveness of interventions.

The IMPAQ team piloted the Information Gathering Template and Protocol with 10 randomly selected manuscripts. The pilot results were used to refine and enhance the protocol and template before gathering information from a large number of manuscripts.

### **Exhibit 3: Information Gathering Protocol**

#### **Directions/Instructions**

As you read through the references please complete the Information Gathering Template in accordance with the category explanations below. Please include all relevant information in a clear and concise manner. If the requested information is not provided in the article, please leave the category blank.

#### **Category Descriptions**

**Document Number/EndNote Reference Number** - The EndNote Reference number can be found on the front page of the article.

**Citation** - The first author's name and year of publication.

**Purpose of the Study** - A one to two sentence description of the objective of the study. This can often be found in the Introduction or Objective section of the abstract.

**Diagnostic Labels** – This refers to all diagnoses on the autism spectrum given to the subjects of the study. If available, the methods used to assess the subjects would be helpful.

- ASD Diagnostic Labels Examples:
  - Pervasive Development Disorder
  - Asperger Syndrome
  - Fragile X Syndrome
  
- Assessment Method Examples:
  - Diagnostic Statistical Manual of Mental Disorders (DSM IV)
  - Autism Diagnostic Observation Schedule (ADOS)

**Co-morbidities:** This category refers to additional disorders or diseases the study assessed.

- Co-morbidity Examples:
  - Mental Retardation
  - Learning Disabilities
  - Attention Deficit Disorder

**Sample size/Sex** - The number of subjects included in the study as well as the age and sex of each subject (Ex. 14M, 8F). If multiple groups (e.g. a control group and an intervention group), the number of subjects in each group.

- **Minority Sample** – Include any information provided on the race/ethnicity of the subjects.

**Age** - The age range, mean and standard deviation (SD) for the sample. If multiple groups (e.g. a control group and an intervention group), the age, mean and SD for each group.

**Intervention/Service/Treatment** – Preferably the name of the intervention or service, or a description if there is no commonly accepted name.

- **Age Group** – Children, Transitioning Youth, or Adults. *Select all that apply.*
- **Target Behavior(s)/Skill(s)** - This category refers to the behavior(s) and/or skill(s) targeted by the intervention. Each behavior/skill below includes a description of skill deficits or examples of behaviors that are associated with autism spectrum disorders. *Select all that apply.*
  - **Development of Communication**
    - Difficulty coordinating attention between people and objects and is evident by deficits in orienting and attending to a social partner; shifting gaze between people and objects; sharing affect or emotional states with another person; following the gaze and point of another person; and being able to draw another persons’ attention to objects or events for the purpose of sharing experiences.
    - Difficulty learning conventional or shared meanings for symbols; and is evident in deficits in using conventional gestures; learning conventional meanings for words; and using objects functionally and in symbolic play.
    - Interventions include:
      - Teaching speech and language
      - Teaching communication
      - Augmentative and Alternative Communication and Assistive Technology
  - **Social Development**
    - Difficulties with social relationships and interactions.
    - Interventions include:
      - Child Parent Social Interactions
      - Child-Adult Interactions
      - Child-Child Interactions
      - Adult-Adult Interactions
  - **Cognitive Development**
    - Deficits in the process of acquisition of knowledge (learning and information processing), symbolic development, concept acquisition, or skill acquisition.

- Interventions are primarily instructional strategies designed to promote traditional reading and mathematics skills.
- **Sensory and Motor Development**
  - Under or over reactions to basic sensations and perceptions, including touch, taste, sight, hearing, and smell.
  - Deficits in motor imitation, balance, coordination, finger to thumb opposition, speech articulation, and the presence of hypotonia (disorder that causes low muscle tone).
  - Interventions include:
    - Sensory Integration Therapy
    - Auditory Integration Therapy
    - Vision Therapy
- **Adaptive Behavior**
  - Refers to a person’s social responsibility and independent performance of daily activities.
  - Behavioral interventions
    - Examples include toilet training, community living skills training, occupational training.
- **Problem Behavior**
  - Problem behaviors include property destruction, physical aggression, self-injury and tantrums.
  - Interventions include:
    - Appropriate Individualized Educational Plans
    - Comprehensive Treatment Programs
    - Applied Behavior Analysis Based Interventions
    - Communication Training
- **Description** - A description of the intervention. If available, describe the interaction between the provider and the subjects of the study.

**Setting** - The physical setting in which the intervention or service was administered. For example, home, school, clinic, etc.

**Comparison Group/Condition** – The group or condition that the results of the treated group are compared against. The treated group may be compared to a different group of subjects or to the same group pre-intervention.

**Provider Type & Qualifications** – The occupation/role, skill sets and/or qualifications of the person or group of people who provided the service or intervention. Include the provider to subject ratio if available.

**Provider Training** – Any training and/or support given to the service provider prior to and/or during the intervention/service.

**Intervention Duration** – The length of time the intervention/service was available or provided to the

subjects of the study.

**Intervention Intensity** –The number of hours per day and/or days per week the intervention was administered during the time period provided in the Intervention Duration category.

**Design** – The research methodology that was used to assess the effectiveness of the intervention. This will involve reviewing the articles to find out how the group membership (Treatment group vis-à-vis Control/Comparison group) was established. For example, was random assignment (randomization) used to select program participants into the Treatment group and Control group. If not (non-randomization), how was the assignment into each group determined. In this regard, the following represent different types of research designs that provide evidence for interventions. *Select the research design that was used by the researchers to evaluate the effectiveness of the intervention.*

Design	Description
<b>Randomized designs</b>	
<i>Randomized, controlled trial (including group randomized designs)</i>	An experimental design that studies the effect of an intervention or treatment using at least two groups: one that received the intervention and one that did not; participants are randomly assigned to a group.
<i>Group randomized trials with discrepant units of analysis, or with an inadequate number of aggregate units assigned to condition</i>	A randomized design study where different outcome measures used for the groups (i.e., discrepant units of analysis) or where there is an insufficient sample size in one or more of the groups (i.e., an inadequate number of aggregate units assigned to the conditions).
<b>Quasi-experimental designs</b>	
<i>Interrupted time series (ITS) designs</i>	ITS designs are multiple observations over time or rates that are ‘interrupted’ usually by an intervention or treatment. The investigators must indicate a specific point in time when the intervention occurred. A control group may or may not be present. [Cochrane Collaborative, EPOC Methods Paper, “Including Interrupted Time Series (ITS) Designs in a EPOC Review”]
<i>Regression discontinuity designs</i>	Assignment to the treatment group or comparison group is determined partly on a cutoff score on a measured covariate
<i>Pretest-posttest non-equivalent comparison group designs</i>	Comparison group is selected that is as similar as possible to the intervention group so can fairly compare the treated one with the comparison one. But it cannot be determined if the groups are comparable. [Research Methods Knowledge Base]
<b>Case control designs</b>	Begins with people with the disease (cases) and compares them to people without the disease (controls) [Gordis 2004]
<b>Cohort design studies (e.g., prospective cohort study, retrospective cohort study)</b>	Group of exposed individuals and group of non-exposed individuals are selected and

	followed to compare the incidence of disease in the two groups
<b>Cross-sectional study (e.g. prevalence study)</b>	Exposure and disease are determined simultaneously for each subject.
<b>Other designs (i.e., case study, case series)</b>	Case series has no control group

**Investigator** – Was the study conducted by investigative teams independent of the program developers? The intervention can be provided by the program developers as long as the investigative team who evaluated the intervention was independent.

**Measures/Instruments** –Type of measure used to assess outcomes. For example, aberrant behavior checklist, observable improvements in language acquisition, IQ, functioning, and cognitive skills.

**Outcome** – List the specific outcomes measures in the study, including Pre/Post or Group Mean Scores. Also standard deviations or effect sizes when available.

- **p-value** –the level of significance for the main outcome(s).

**Generalization** – The extent to which skills acquired in one setting can be carried over to other settings. For example, if the intervention was provided at home, are the children able to apply those skills at school or to other social settings.

- *Providers* – The extent to which skills acquired when one type of provider is present are used with another type of provider. For example, if the intervention was provided by a teacher, is the subject able to use those skills when with a parent.
- *Stimulus* – The extent to which subjects can apply acquired skills to other types of tasks. For example, if the subjects are taught to sort their toys by color, are they able to sort by other rules or in different settings.

**Maintenance** – The degree to which the program participants maintain the acquired skills after the intervention is concluded. In this case, the reviewer should indicate the time period beyond which the program effects/impacts are sustained (e.g., 3 months, 6 months, 12 months, etc.).

**Limitations** – Shortcomings of the research study. For example, inadequate sample size, selection bias, and weaknesses of the study design.

**Rating** – Please provide a rating score based on the Manuscript Rating Scale. Refer to the Design category to determine type of design. (**See Table 4: Manuscript Rating Scale**)

## Manuscript Rating System

An integral part of reviewing each manuscript and completing the Information Gathering Template was to assign a rating of methodological rigor to each study. The IMPAQ team chose the Campbell Collaborative rating system<sup>4</sup> as a manuscript rating system model for several

<sup>4</sup> Schuerman, J., Soydan, H., MacDonald, G., Forslund, M., de Moya, D., & Boruch, R. (2002). The Campbell Collaboration, *Research on Social Work Practice*. 12; 309.

reasons. First, it was established specifically to assess the quality of evidence supporting the effectiveness of psychosocial interventions, which is aligned with the purpose of this environmental scan. Second, it offers clear, published definitions for ranking evidence that can be reliably applied to the literature identified for this environmental scan. Third, this ranking system was developed based on international consensus, and represents the state of the field with regard to the meta-analysis of psychosocial and behavioral interventions.

Few rigorous research studies are available, which may be attributable to the relative newness of the ASD health services research field. For this review, the IMPAQ team modified the Campbell Criteria, primarily by creating two additional design categories that were originally apart of the “other design” category, to avoid marginalizing a large percentage of the available research.

During the review process, each study was rated on a 9 point scale based on the rigor of the research design. As presented in Table 2, a rating of 9 was assigned to a randomized, controlled trial, which provides the most rigorous level of evidence; a rating of 1 was assigned to a case study or series, which provides the lowest level of evidence according to the Campbell Criteria.

**Table 2: Manuscript Rating Scale**

<b>Design</b>	<b>Rating</b>
<b>Randomized Designs</b>	
a. Randomized, controlled trial (including group randomized designs)	9
b. Group randomized trials with discrepant units of analysis, or with an inadequate number of aggregate units assigned to condition	8
<b>Quasi-experimental designs</b>	
a. Interrupted time series	7
b. Regression discontinuity designs	6
c. Pretest-Posttest non-equivalent comparison group design	5
d. Case control designs	4
e. Cohort design studies	3
f. Cross-sectional study	2
g. Other designs (i.e. case study, case series)	1

### **Quality Assurance**

To ensure that reviewers entered data into the information gathering template consistently and correctly, the IMPAQ team implemented a quality review process. The process included multiple components to account for all possible errors that could be made during the review or analysis process.

The IMPAQ team performed a quality review of 20 percent of the completed entries in the Microsoft Access database. This process was conducted by two reviewers and involved reviewing the entire manuscript and confirming that each entry in the database was correct. During the quality assurance process, any inconsistencies between the entries in the database and the manuscripts were corrected. For example, queries were run in Access to identify and address issues such as missing or inaccurate data.

## Categorizing Interventions

As part of the quality review process, the IMPAQ team also standardized the intervention names entered into the database. The team adapted the intervention categories and descriptions used in the National Standards Project (described earlier in this report) for use with the environmental scan. Each intervention identified in the environmental scan was aligned with one of the categories based on the descriptions in the reviewed articles. Table 3 lists the 32 intervention categories used for the environmental scan.

**Table 3: Intervention Categories and Descriptions**

<b>Intervention</b>	<b>Description</b>
<b>Academic Interventions</b>	Interventions involving the use of traditional teaching methods to improve academic performance
<b>Antecedent Package</b>	Interventions involving the modifications of events that typically precede the occurrence of a target behavior. These alterations are made to increase the likelihood of success or reduce the likelihood of problems occurring
<b>Auditory Integration Training</b>	Intervention involving the presentation of modulated sounds through headphones in an attempt to retrain an individual's auditory system with the goal of improving distortions in hearing or sensitivities to sound
<b>Augmentative and Alternative Communication (ACC) Device</b>	Interventions involving the use of high or low devices to facilitate communication. Examples include but are not restricted to: pictures, photographs, symbols, communication books, computers, or other electronic devices
<b>Behavioral Package</b>	Interventions designed to reduce problem behavior and teach functional alternative behaviors or skills through the application of basic principles of behavior change
<b>Cognitive Behavioral Intervention Package</b>	Interventions designed to change negative or unrealistic thought patterns and behaviors with the aim of positively influencing emotions and life functioning
<b>Comprehensive Behavioral Treatment for Young Children</b>	Interventions involving a combination of instructional and behavior change strategies and a curriculum that addresses core and ancillary symptoms and behaviors of ASD
<b>Developmental Relationship-based Treatment</b>	Interventions involving a combination of procedures that are based on developmental theory and emphasize the importance of building social relationships
<b>Exercise</b>	Interventions involving an increase in physical exertion as a means of reducing problem behaviors or increasing appropriate behavior
<b>Exposure</b>	Interventions involving gradually increasing exposure to anxiety-provoking situations while preventing the use of maladaptive strategies used in the past under these conditions



**Table 3: Intervention Categories and Descriptions (Continued)**

<b>Intervention</b>	<b>Description</b>
<b>Initiation Training</b>	Interventions involving teaching individuals with ASD to initiate interactions with their peers
<b>Joint Attention Intervention</b>	Interventions involving teaching a child to respond to the nonverbal social bids of others or to initiate joint attention interactions
<b>Language Training (Production)</b>	Interventions that have as their primary goal to increase speech production
<b>Massage/Touch Therapy</b>	Interventions involving the provision of deep tissue stimulation
<b>Modeling</b>	Interventions relying on an adult or peer providing a demonstration of the target behavior that should result in an imitation of the target behavior by the individual with ASD
<b>Multi-component Package</b>	These interventions involve a combination of multiple treatment procedures that are derived from different fields of interest or different theoretical orientations. These treatments do not better fit one of the other treatment "packages" in this list nor are they associated with specific treatment programs
<b>Music Therapy</b>	Interventions that teach individual skills or goals through music
<b>Naturalistic Teaching Strategies</b>	Interventions involving using primarily child-directed interactions to teach functional skills in the natural environment. They often focus on providing a stimulating environment, modeling how to play, encouraging conversation, providing choices and direct/natural reinforcers, and rewarding reasonable attempts
<b>Peer Training</b>	These interventions involve teaching children without disabilities strategies for facilitating play and social interactions with children on the autism spectrum. Peers often include classmates or siblings
<b>Picture Exchange Communication System</b>	This intervention involves the application of a specific augmentative and alternative communication system based on behavioral principles that are designed to teach functional communication to children with limited verbal and/or communication skills
<b>Pivotal Response Treatment</b>	This treatment is also referred to as PRT, Pivotal Response Teaching, and Pivotal Response Training. PRT focuses on targeting "pivotal" behavioral areas - such as motivation to engage in social communication, self-initiation, self-management, and responsiveness to multiple cues, with development of these areas having the goal of very widespread and fluently integrated collateral improvements
<b>Reductive Package</b>	These interventions rely on strategies designed to reduce problem behaviors in the absence of increasing alternative appropriate behaviors

**Table 3: Intervention Categories and Descriptions (Continued)**

<b>Intervention</b>	<b>Description</b>
<b>Schedules</b>	Interventions involving the presentation of a task that communicates a series of activities or steps required to complete a specific activity. Schedules are often supplemented by other interventions such as reinforcement
<b>Scripting</b>	Interventions involving developing a verbal or written script about a specific skill or situation which serves as a model for the child with ASD. Scripts are usually practiced repeatedly before the skill is used in the actual situation
<b>Self-management</b>	These interventions involve independence by teaching individuals with ASD to regulate their behavior by recording the occurrence/non-occurrence of the target behavior, and securing reinforcement for doing so. Initial skills development may involve other strategies and may include the task of setting one's own goals
<b>Social Communication Intervention</b>	These psychosocial interventions involve targeting some combination impairments such as pragmatic communication skills, and the inability to successfully read social situations
<b>Social Skills Package</b>	These interventions seek to build social interaction skills in children with ASD by targeting basic responses (e.g., eye contact, name response) to complex social skills (e.g., how to initiate or maintain a conversation)
<b>Story-based Intervention Package</b>	These treatments involve a written description of the situations under which specific behaviors are expected to occur. Stories may be supplemented with additional components (e.g., prompting, reinforcement, discussion, etc)
<b>Structured Teaching</b>	This intervention involves a combination of procedures that rely on the physical organization of a setting, predictable schedules, and individualized use of teaching methods. These treatment programs may also be referred to as TEACCH (Treatment and Education of Autistic and related Communication-handicapped Children)
<b>Supported Employment</b>	The intervention focuses on enabling a person with ASD to secure and maintain a paid job in a regular work environment, by providing all appropriate training and support
<b>Technology-based Treatment</b>	These interventions require the presentation of instructional materials using the medium of computers or related technologies
<b>Theory of Mind Training</b>	These interventions are designed to teach individuals with ASD to recognize and identify mental states (i.e., a person's thoughts, beliefs, intentions, desires and emotions) in oneself or in others and to be able to take the perspective of another person in order to predict their actions

## Assessing Intervention Effectiveness

The IMPAQ team chose to use the definition of evidence-based practices (EBPs) that was adopted by the National Professional Development Center (NPDC), as a guide for evaluating the effectiveness of the interventions reviewed. The NPDC is a multi-university center that promotes the use of EBPs for children and adolescents with ASDs. According to the definition outlined by the NPDC, to be considered an EBP for individuals with ASD, efficacy or effectiveness must be established through peer-reviewed research that is published in scientific journals using the following criteria:

- **Randomized or quasi-experimental design studies.** Two high quality experimental or quasi-experimental group design studies,
- **Single-subject design studies.** Three different investigators or research groups must have conducted five high quality single subject design studies, or
- **Combination of evidence.** One high quality randomized or quasi-experimental group design study and three high quality single subject design studies conducted by at least three different investigators or research groups (across the group and single subject design studies).

High quality randomized or quasi-experimental design studies must not have critical design flaws that create confounders to the studies, and the design must allow readers/consumers to rule out competing hypotheses for study findings. High quality in single subject design studies is reflected by a) the absence of critical design flaws that create confounders and b) the demonstration of experimental control at least three times in each study. <sup>5</sup>

## Evidence Level Criteria

Using the NPDC definition of evidence-based practices, the IMPAQ team developed the following three levels in which to group the interventions based on the evidence provided by the articles reviewed.

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<sup>5</sup> <http://www.fpg.unc.edu/~autismpdc/>, The National Professional Development Center for Autism Spectrum Disorders

**Level 1, Evidence-Based Interventions:** Interventions that fully meet the NPDC criteria for evidence-based practices.

**Level 2, Emerging Evidence-Based Interventions:** Interventions that meet some of the NPDC criteria for evidence-based practices, but do not completely fulfill the requirements. Potential reasons that an intervention does not meet all of the NPDC requirements for evidence-based practice include, but are not limited to the following:

- An insufficient number of high quality studies meet the NPDC criteria.
- Some but not all studies that analyze the effects of the intervention show no effect on the participants.
- Some but not all studies that analyze the effects of the intervention have serious design flaws.
- Some but not all studies have not been published in a peer-reviewed journal.

**Level 3, Unestablished Interventions:** Includes interventions that do not meet any of the NPDC criteria for evidence-based practices due to poor quality studies or the lack of studies that show positive results. Potential reasons that an intervention does not meet any of the NPDC requirements for evidence-based practice include, but are not limited to the following:

- Only one study was reviewed for the intervention category.
- All studies that analyze the effects of the intervention show no or negative effect(s) on the participants.
- All studies that analyze the effects of the intervention have serious design flaws.

Using the NPDC's definition for evidence-based practices and the criteria outlined above for the three evidence levels, the IMPAQ team evaluated each intervention category based upon the pool of evidence provided by the manuscripts reviewed (e.g., study design, sample selection and potential for selection bias, sample size, effect on participants).

## V. DISCUSSION OF THE EVIDENCE BASE FOR AUTISM SERVICES

### Introduction

This section provides summary statistics and a discussion of our findings by population group. Each population-specific sub-section includes detailed tables with descriptions of the interventions for each population group and the level of evidence of these interventions. Interventions were organized by levels 1, 2, or 3 based on the NPDC criteria for assessing evidence-based practices (see section IV for descriptions of these evidence levels).

Each table includes a description of the intervention and key information about the intervention, such as the setting where it was implemented, type of providers, provider training, duration, intensity, generalization, maintenance, and number of studies that were reviewed for each intervention. A discussion of the findings is provided for each evidence level by population group.

For a detailed explanation of the column titles, please refer to Exhibit 3 (Information Gathering Protocol). Appendix B contains study level information for each of the interventions by population and level.

## Children

We reviewed a total of 214 studies of 31 interventions for children. In the following sections, we present the findings on effectiveness of interventions for children with ASD. The findings are organized by level of evidence, in order of ranking, beginning with level 1. Within each discussion, we address interventions, their effectiveness, and the targeted behaviors, Table 4 shows the number of interventions that were rated as level 1, level 2, and level 3 based on the rigor of evidence on their efficacy and effectiveness as presented in the reviewed studies.

**Table 4: Number and Percentage of Interventions for Children by Level of Evidence**

Level of Evidence	Total Number of Interventions	Percent
Level 1 Evidence-based interventions	15	48%
Level 2 Emerging evidence-based interventions	13	42%
Level 3 Unestablished interventions	3	10%
<b>TOTAL</b>	<b>31</b>	<b>100%</b>

### a) Level 1 Evidence-based interventions

Based on a review of 157 studies, 15 interventions had adequate evidence to be categorized as level 1 (Table 5). The most common interventions represented in the 157 articles/studies were Behavioral Package (reviews in 32 studies) and Cognitive Behavioral Intervention Package (reviewed in 23 studies). Structured Teaching met the level 1 criterion with only three high quality studies, the lowest amount of evidence provided for the level 1 interventions. The interventions evaluated in this level addressed all six of the target behaviors described in the Information Gathering Protocol. Communication and Social Development were the most common target behaviors addressed.

As shown in Table 5, all but one of the interventions were implemented in the home and at school. The remaining one intervention was implemented at school. Teachers and parents are the most common providers in this level, which correlates with the common settings of home and school. Therapists are also providers in many of the interventions in this level. Therapists were involved at the supervisory level, as well as in the

implementation phase of the intervention. Provider training was common across almost all the interventions in this level. Parent and teacher training workshops were used to train the providers in the procedures for implementing the intervention. For example, in many studies, therapists provided training to parents and teachers to enable them to effectively implement the intervention either in the home or school settings. In addition, training in specific intervention methods, such as the TEACCH model and the Integrated Play Groups Model were also used in a number of studies.

Overall, the studies reviewed for the interventions included in this group had positive outcomes. The behaviors targeted by the interventions were improved in the majority, if not all of the subjects of the study. None of the studies showed negative or harmful results. The outcomes for each intervention included in this group are provided in more detail in Table 5.

Children who received Antecedent Package interventions exhibited improved communication and social skills utilized in social play activities, increased compliance to parental and academic requests and reductions in problem behavior such as stereotypy and classroom disruption.

Outcomes from the studies that implemented Behavioral Package interventions included improved communication skills including the ability to ask questions in a classroom environment, improved social interaction with peers and improved scores on diagnostic assessments in the area of communication. Subjects of these studies also exhibited improvements in daily living skills, increases in IQ scores and reductions in problem behavior such as pica, stereotypy and general classroom disruption. Studies that reviewed the other interventions in this level exhibited very similar outcomes.

The majority of studies found measured for generalization of intervention effects. In the studies that did assess generalization, children were able to apply the skills and behavior gained from one setting, stimuli, and/or provider to another. For example, if the skills were acquired in the school setting, then the child was able to apply those skills in other social settings such as the home. For studies that examined maintenance of intervention effects, the findings showed that children were able to maintain the behavior and skills over time for a period of up to four years.

**Table 5: Level 1 Evidence-based Interventions for Children**

Intervention Name	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior										
Antecedent Package	✓	✓	✓	✓	✓	Home, School, Experimental Lab Environment, Community, Clinical Settings, Group Home	Teacher, Parent, Therapist, Group Home Staff	Bachelor's, Master's degree, and experience working with children with disabilities	Parent and staff training workshops	A range of 1 to 4 months	A range of 3 to 5 sessions per week (each 5 minutes to 3 hours)	Findings from some studies demonstrated that children applied the acquired skills from one setting to another	Evidence indicated that skills were maintained over a period of 1 to 6 months	12 studies	n/a
Behavioral Package	✓	✓	✓	✓	✓	Home, School, Community, Clinical Setting	Parent, Teacher, Therapist, Medical Professional, Caregiver, Tutor	Bachelor's and Master's degree in psychology, Training in Applied Behavioral Analysis	Supervised Apprenticeship, Parent Training Workshops, Training in Behavioral Modification Techniques	A range of 2 months to 3 years	A range of 20 minutes to 8 hours per day, conducted 2 to 5 days a week	Where tested, skills and behaviors were generalized across different providers, settings and stimuli	Treatment gains were maintained over a range of 4 months to 1 year	31 studies	1 RCT
Cognitive Behavioral Intervention Package	✓	✓	✓		✓	Home, School, Experimental Lab Environment, Clinical Setting	Parent, Teacher, Therapist, Typically Developing Peer	Bachelor's and Master's degree in psychology and education	Training Workshops, Supervisory feedback	A range of 2 to 7 months	Sessions ranged from 1 to 6 hours, conducted for 1 to 5 days a week	Not measured	Only one study reported the maintenance results. Long-term evaluation revealed the skills and behavior were maintained over time	9 studies	2 RCT
Comprehensive Behavioral Treatment for Young Children	✓	✓	✓	✓	✓	Home, School, Community, Clinical Setting	Parent, Teacher, Therapist, Medical Professional, Caregiver, Tutor	Bachelor's and Master's degree in applied psychology/behavioral analysis/education	Training on how to use applied behavior analytic procedures	A range of 9.5 months to 4 years	A range of 2 to 40 hours per week	Where tested, skills and behaviors were generalized across different settings and stimuli	Where measured, the findings indicated that treatment gains were maintained over a range of 1 to 4 years	20 studies	2 RCT
Joint Attention Intervention	✓	✓	✓	✓	✓	Home, School, Experimental Lab Environment	Parent, Therapist,	Master's degree in psychology	Parent training in behavioral management and promoting compliance; Supervisory feedback	A range of 2 to 13 months	A range of 2.5 to 5 hours per week (session duration ranged from 30 minutes to 1 hour)	Where measured, generalization findings were mixed. Some studies reported that children applied skills and behavior in novel settings and with different providers. Findings from other studies indicated that children did not apply the acquired skills/behavior in other settings	Where measured, the findings were mixed. One study showed that children maintained the treatment gains, however, the findings from another study indicated that the treatment gains were not maintained	7 studies	2 RCT
Multi-component Package	✓	✓	✓	✓	✓	Home, School, Community	Parent, Teacher, Therapist	Master's and Ph.D. degree in psychology/special education/early childhood education	Parent Training Workshops; Teacher training in implementing instruction procedures for children with ASD (applied behavior analysis, behavior reduction strategies)	A range of 2 weeks to 14 months	A range of 1 to 20 hours per week	Where tested, skills and behaviors were generalized across different providers, settings and stimuli	Two studies reported that treatment gains were maintained for a duration of 2 to 3 months	5 studies	2 RCT
Naturalistic Teaching Strategies	✓	✓			✓	Home, School, Clinical Setting, Experimental Lab Environment	Parent, Teacher, Therapist, Medical Professional	Master's degree in psychology; Work experience in psychology; Certification in special education	Procedural Training in Naturalistic Teaching procedures; Training in behavior modification and emergency restraint techniques	A range of 2 to 24 months	A range of 1 to 2 hours per week	Where measured, skills and behaviors were generalized across different providers, settings and stimuli	Not measured	6 studies	1 RCT



**Table 5: Level 1 Evidence-based Interventions for Children (continued)**

Intervention Name	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior										
Peer Training Package	✓	✓	✓			Home, School, Experimental Lab Environment, Child Daycare Center	Parent, Teacher, Therapist, Play Guides, Typically Developing Peers	Work experience in special education	Integrated Play Groups (IPG) Model training; Peers are taught methods for communicating and playing with children with autism	A range of 1 month to 4.5 years	A range of 20 minutes to 5 hours/week	Where measured, skills and behaviors were generalized across different providers, settings and stimuli	Where measured, treatment gains were maintained over time	10 studies	n/a
Picture Exchange Communication System	✓	✓			✓	Home, School	Parent, Teacher, Therapist, Child Care Giver, Peers	Work experience in using PECS (Picture Exchange Systems)	PECS training for providers	A range of 1 month to 2.5 years	A range of 4 to 12 hours per month	Where measured, skills and behaviors were generalized across different providers, settings and stimuli	Where tested, treatment gains were maintained for up to 10 months after the intervention was concluded	10 studies	4 RCT
Schedules	✓	✓	✓	✓	✓	School	Teacher, Therapist	Not specified	Not specified	Not specified	Sessions varied in length depending on task completion time	Only one study measured generalization. The findings indicated that skills were generalized across different stimuli	Where tested, treatment gains were maintained for a period of 3 to 5 months after the intervention was concluded	4 studies	n/a
Social Communication Intervention	✓	✓				Home, School, Community, Clinical Setting, Experimental Lab Environment	Parent, Teacher, Therapist, Graduate Students with a background in psychology	Board Certified Speech Language Pathologist; Experience working with children with ASD	Parent Training Workshops; Training in Developmental Social-Pragmatic (DSP) and Developmental Individualized Relationship (DIR) approaches; Supervisory feedback	A range of 3 months to 2 years	A range of 1.5 to 2.5 hours per week	Where measured, skills and behaviors were generalized across different providers	Only one study reported the maintenance results. Evidence showed that skills and behaviors were maintained at one month follow-up	4 studies	1 RCT
Social Skills Package	✓	✓				Home, School, Clinical Setting, Experimental Lab Environment	Parent, Teacher, Therapist, Medical Professional, Typically Developing Peers, Psychology Graduate Students	Master's degree in Psychology and Counseling	Parent and Peer Training Workshops	A range of 2 to 36 months	A range of 1 to 7 sessions per week	Where measured, skills and behaviors were generalized across different providers, settings and stimuli	Where measured, treatment gains were maintained over a range of 1 month to a year following intervention conclusion	9 studies	1 RCT
Story-based Intervention Package	✓	✓		✓	✓	Home, School, Clinical Setting	Parent, Teacher, Therapist, Medical Professional, Graduate Students in Speech Language Pathology	Background in speech language pathology	Parent/Teacher training in implementation procedures for Story-based interventions	A range of 3 weeks to 6 months	Session length ranged from 3 to 45 minutes, over a range of 1 to 5 days per week	Where measured, skills and behaviors were generalized across different settings	Only two studies provided results on maintenance phase. Evidence indicates that treatment gains were maintained over a range of 4 to 6 weeks following intervention conclusion	16 studies	n/a
Structured Teaching	✓	✓	✓	✓	✓	Home, School, Residential Treatment Facility	Parent, Teacher, Therapist, Group Home Staff	Background in psychology and experience working with children with autism	Parent/Teacher training in TEACCH methods	A range of 3 to 12 months	A range of 1 to 35 hours per week	Not measured	Not measured	3 studies	n/a

**Table 5: Level 1 Evidence-based Interventions for Children (continued)**

Intervention Name	Target Behavior						Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior										
Technology-based Treatment	✓	✓	✓	✓	✓	✓	Home, School, Community, Experimental Lab Environment	Parent, Teacher	Background in special education	Parent Training Workshop	A range of 1 to 6 months	Session length ranged from 10 to 40 minutes, 2 to 10 sessions a week	Where measured, skills and behaviors were generalized across different settings	Only one study reported the maintenance results. Evidence showed that skills and behaviors were maintained at one month follow-up	11 studies	1 RCT

## **b) Level 2 Emerging evidence-based interventions**

Based on a review of 53 studies, 13 interventions had adequate evidence to be categorized as level 2 (Table 6). In the level 2 category, Modeling was the most frequently studied intervention. The interventions represented in the smallest number of studies were Massage/Touch therapy, Initiation training, and Theory of Mind training.

As evident in Table 6, none of the interventions evaluated in these 53 studies addressed all of the six target behaviors outlined in the protocol, but most interventions involved general approaches that could be modified to address multiple behaviors. Only two interventions targeted a single behavior; the majority of the interventions addressed three or more of the behaviors of interest.

Similar to the interventions categorized as level 1, the majority of the interventions in level 2 were conducted in home and school settings, but a few were also implemented in clinical settings. For provider type, teachers were the most common followed by therapists and parents. Provider training in this level included basic training in the procedures necessary to implement the intervention. In addition, two specific training programs were required and included structured and intensive supervised training in the Developmental Individualized and Relationship-Oriented Model and peer procedural training for typically developing peers that served as providers.

Overall, the studies reviewed for the interventions included in this group had positive outcomes. The behaviors targeted by the interventions were improved in the majority, if not all of the subjects of the study. None of the studies showed negative or harmful results. Children who received Modeling interventions exhibited increased appropriate social engagement with peers, skill acquisition and task completion. Other outcomes from the modeling studies include improved spelling skills and decreased repetitive motor play.

The majority of studies found measured for generalization across settings. Where measured, children were able to apply the skills and behavior gained from one setting, stimuli and/or provider to another. For studies that measured for maintenance, the findings indicated that treatment gains were sustained beyond the intervention phase (for a period of up to 12 months).

**Table 6: Level 2 Emerging Evidence-based Interventions for Children**

Intervention Name	Description	Target Behavior						Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed
		Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior									
<b>Academic Interventions</b>	These interventions involve the use of traditional teaching methods to improve academic performance	✓	✓	✓	✓	✓	School	Teacher	Speech language pathology	Not specified	Only one study specified 4 weeks	A range of 1 to 3 sessions per day. Each session lasted 15 minutes to 1 hour	Not measured	Not measured	4 studies	
<b>Augmentative and Alternative Communication (ACC) Device</b>	These interventions involved the use of high or low technologically sophisticated devices to facilitate communication. Examples include but are not restricted to: pictures, photographs, symbols, communication books, computers, or other electronic devices	✓					Home, School	Teacher	Not specified	Procedural training in the use of voice output communication aide (VOCA)	One study specified a duration of 5 months	Not measured	Only one study measured generalization outcomes. Skills and behaviors were generalized across settings	Not measured	3 studies	
<b>Developmental Relationship-based Treatment</b>	These treatments involve a combination of procedures that are based on developmental theory and emphasize the importance of building social relationships	✓	✓	✓	✓	✓	Home, School, Clinical Setting	Parent, Teacher, Therapist, Child Development Specialist	Master's degree in speech pathology/psychology/education; Experience in child development	Structured and intensive supervised training in the DIR (Developmental Individualized and Relationship-Oriented Model)	A range of 6 to 12 months	A range of 1 to 40 hours per week	Not measured	Not measured	6 studies	
<b>Initiation Training</b>	These interventions involve directly teaching individuals with ASD to initiate interactions with their peers	✓	✓	✓			Home, Experimental Lab Environment	Therapist, Medical Profession	Not specified	Not specified	A range of 3 to 6 weeks	A range of 1 to 1.5 hours per week	Of the studies reviewed, only one reported the findings on generalization. Skills and behaviors were generalized across different providers, settings and stimuli	Not measured	2 studies	
<b>Language Training (Production)</b>	These interventions have as their primary goal to increase speech production	✓	✓	✓			Home, School, Experimental Lab Environment	Parent, Instructor, Trainer	Not specified	Parent Training	A range of 2 weeks to 3 months	Session duration ranged between 15 minutes to 1 hour	Of the studies reviewed, two studies showed that generalization occurred across different providers and stimuli	Skills and behavior were maintained over a range of 2 to 9 months following treatment	4 studies	
<b>Massage/Touch Therapy</b>	These interventions involve the provision of deep tissue stimulation	✓	✓	✓	✓		Home, Clinical Setting	Parent, Medical Professional, Alternative Medicine Professional	Not specified	Parents Training in Massage Therapy	A range of 1 to 2.5 months	A range of 5 to 7 massages per week	Findings from one study demonstrated that children generalized behavior to classroom settings	Not measured	2 studies	
<b>Modeling</b>	These interventions rely on an adult or peer providing a demonstration of the target behavior that should result in an imitation of the target behavior by the individual with ASD	✓	✓	✓	✓		Home, School, Community	Parent, Teacher, Therapist, Residential Group Home Staff	Master's degree in education	Not specified	A range of 4 to 6 weeks	A range of 5 to 20-minute sessions, conducted 3 to 5 times a week	Where tested, children generalized behavior/skills across settings and peers	Where tested, behavior/skills were maintained over a range of 1 to 10 months	9 studies	

**Table 6: Level 2 Emerging Evidence-based Interventions for Children (continued)**

Intervention Name	Description	Target Behavior						Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed
		Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior									
Music Therapy	These interventions seek to teach individual skills or goals through music	✓	✓	✓	✓	✓	✓	School, Clinical Setting	Teacher, Therapist	Not specified	Not specified	A range of 1 month to 2 years	A range of 12 to 28 sessions, each lasting for a range of 20 to 30 minutes	In one study, a survey of parents and caregivers indicated that children generalized the acquired skills from the music therapy setting to non music therapy environment	Not measured	4 studies
Pivotal Response Treatment	This treatment is also referred to as PRT, Pivotal Response Teaching, and Pivotal Response Training. PRT focuses on targeting "pivotal" behavioral areas - such as motivation to engage in social communication, self-initiation, self-management, and responsiveness to multiple cues, with development of these areas having the goal of very widespread and fluently integrated collateral improvements	✓	✓		✓	✓		Home, School, Experimental Lab Environment	Parent, Teacher, Therapist, Medical Professional, Typically Developing Peer	Not specified	Parent Training Workshops; Provider and Peer Procedural Training	A range of 2 to 12 months	A range of 4 to 15 hours per month	Where measured, skills and behaviors were generalized across different providers, settings and stimuli	Where tested, behavior/skills were maintained over a range of 6 to 12 months	5 studies
Reductive Package	These interventions rely on strategies designed to reduce problem behaviors in the absence of increasing alternative appropriate behaviors						✓	School, Experimental Lab Environment	Teacher, Therapist	Not specified	Not specified	Not specified	A range of 2 to 6 hours a day, for 3 to 5 days per week	Where measured, reduction in problem behavior was generalized across different providers, settings and stimuli	Findings from one study demonstrated that treatment gains were maintained for 12 months after the intervention was concluded	3 studies
Scripting	These interventions involve developing a verbal and/or written script about a specific skill or situation which serves as a model for the child with ASD. Scripts are usually practiced repeatedly before the skill is used in the actual situation	✓	✓	✓				School, Experimental Lab Environment	Teacher	Not specified	Not specified	Not specified	A range of 3 to 15-minute sessions	Only one study measured generalization. The findings indicated that skills were generalized across different stimuli	Not measured	3 studies

**Table 6: Level 2 Emerging Evidence-based Interventions for Children (continued)**

Intervention Name	Description	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed
		Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior									
<b>Self-management</b>	These interventions involve independence by teaching individuals with ASD to regulate their behavior by recording the occurrence/non-occurrence of the target behavior, and securing reinforcement for doing so. Initial skills development may involve other strategies and may include the task of setting one's own goals	✓	✓	✓			Home, School, Clinical Setting	Parent, Teacher, Therapist	Work experience using behavioral techniques to teach children with autism	Training in Self-management procedures	A range of 2 weeks to 7 months	Session length ranged between 5 to 15 minutes, 2 to 6 times a day, 2 to 5 times a week	Where measured, skills and behavior were generalized across different providers, settings and stimuli	Where tested, behavior/skills were maintained for 1 month after the intervention was concluded	6 studies
<b>Theory of Mind Training</b>	These interventions are designed to teach individuals with ASD to recognize and identify mental states (i.e., a person's thoughts, beliefs, intentions, desires and emotions) in oneself or in others and to be able to take the perspective of another person in order to predict their actions	✓	✓	✓			Clinical setting	Not specified	Not specified	Not specified	A range of 2 to 5 weeks	Session length ranged between 25 to 60 minutes	Only one study measured generalization. The findings indicated that skills were generalized across different stimuli	Only one study reported the maintenance results. Evidence showed that skills were maintained at 6 and 12 weeks following the intervention conclusion.	2 studies

### **c) Level 3 Unestablished interventions**

Three interventions had been reviewed by only one study and therefore were classified as level 3. In these studies, the interventions addressed a range of one to three target behaviors. Settings and providers varied, with school and teachers being the only consistent groupings across the interventions. Only one study provided information on provider qualifications and training. In this study, the intervention presented was the Auditory Integration Training. The providers were required to have experience working with children with autism and received training in auditory integration techniques.

Generalization was only measured in one study of a single child. The child was able to apply the skills and behavior gained during the Exposure Package intervention to different settings and stimuli. Maintenance was measured for two of the interventions in this level.

The study that reviewed the Exposure Package intervention found that improvements were maintained over a period of two weeks. Findings from the study that evaluated the Auditory Integration Training demonstrated that improvements were not maintained over time.

**Table 7: Level 3 Unestablished Interventions for Children**

Intervention Name	Description	Target Behavior						Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed
		Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior									
<b>Auditory Integration Training</b>	This intervention involves the presentation of modulated sounds through headphones in an attempt to retrain an individual's auditory system with the goal of improving distortions in hearing or sensitivities to sound	✓					✓	Experimental Lab Environment	Auditory Integration Trainer	Experience working with children with Autism	Training in auditory integration techniques	2 weeks	Two 30-minute sessions per day	Not measured	Improvements were not maintained over time	1 study
<b>Exercise</b>	These interventions involve an increase in physical exertion as a means of reducing problem behaviors or increasing appropriate behavior		✓	✓	✓			School	Teacher	Not specified	Not specified	8 weeks	10 minutes a day	Not measured	Not measured	1 study
<b>Exposure Package</b>	These interventions require that the individual with ASD increasingly face anxiety-provoking situations while preventing the use of maladaptive strategies used in the past under these conditions					✓		Home, School, Clinical Setting	Parent, Teacher, Therapist	Not specified	Not specified	A range of 5 days to 29 weeks	Not specified	Generalization was only measured for one child. The results show that generalization occurred across different settings and stimuli	All children maintained decreased anxiety levels during anxiety-provoking situations at 2-week follow-up	1 study



## Transitioning Youth

We reviewed studies providing evidence on 15 different interventions for transitioning youth with ASD. Table 8 shows the distribution of these interventions by the degree of rigor of the evidence of effectiveness. We categorized the majority of interventions (73 percent) as level 3 (i.e. having unestablished evidence). Few interventions (7 percent) met the criteria for evidence-based practices.

**Table 8: Number and Percentage of Interventions for Children by Level of Evidence**

Level of Evidence	Total Number of Interventions	Percent
Level 1 Evidenced-based interventions	1	7%
Level 2 Emerging evidenced-based interventions	3	20%
Level 3 Unestablished interventions	11	73%
<b>TOTAL</b>	<b>15</b>	<b>100%</b>

### a) Level 1 Evidence-based interventions

As shown in Table 9, we rated only one intervention – Antecedent Package – as level 1 for transitioning youth. These interventions focus on modifying the conditions or events that usually precede the occurrence of targeted behavior(s), with the objective of increasing the success of a preferred behavior or reducing the likelihood of a problem behavior from occurring. In the two studies that we found, the following behaviors were targeted by the Antecedent Package – communication, social development, sensory and motor development, adaptive and problem behaviors. The interventions were implemented in a variety of settings, including homes/group homes, schools, and community. In addition to teachers and therapists, the parents of adolescents with autism were also involved in implementing the interventions. Parent and staff training workshops were conducted to ensure that the interventions were effectively implemented.

Outcomes from the two studies that evaluated Antecedent Package interventions for transitioning youth included a drastic reduction in disruptive behaviors and increased compliance to requests that had produced low compliance rates prior to the intervention.

Evidence from the studies indicated that skills/behaviors acquired in one setting were applied to other settings. In addition, treatment gains were maintained beyond the intervention phase.

**Table 9: Level 1 Evidence-based Interventions for Transitioning Youth**

Intervention Name	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior Problem Behavior										
Antecedent Package	✓	✓	✓	✓	✓	Home, School, Experimental Lab Environment, Community, Clinical Settings, Group Home	Teacher, Parent, Therapist, Group Home Staff	Bachelor's, Master's degree, and experience working with children with disabilities	Parent and staff training workshops	A range of 1 to 4 months	A range of 3 to 5 sessions per week (each ranging from 5 minutes to 3 hours)	Findings demonstrated that children applied skills acquired in one setting to other settings	Evidence indicated that skills were maintained over a period of 1 to 6 months following the conclusion of the intervention	2 studies	n/a

## **b) Level 2 Emerging evidence-based interventions**

We rated three interventions as level 2 interventions for transitioning youth. These interventions included Behavioral Package, Social Skills Package, and Technology-based Treatment. We reviewed 6 studies that examined the efficacy of Social Skill Packages, 3 studies for Behavioral Package, and 2 studies for Technology-based Treatments. The behaviors that were targeted by these interventions included communication, social development, adaptive and problem behaviors. In terms of settings, the interventions were mainly implemented in schools and community, and some of the provider types included teachers, therapists, and typically developing peers.

Outcomes from the 6 studies that evaluated the effectiveness of social skills interventions included an increased availability to develop and maintain social relationships and a reduction in problem behaviors such as aggressive and repetitive behaviors. The outcomes from the Behavioral Package interventions in for transitioning youth consist of a decrease in disruptive behaviors and the ability to consume food an appropriate speed. Technology-based Treatment outcomes involved improvements in emotional recognition and communications skills.

Overall, generalization results across many of the interventions indicated that the participants were able to apply skills acquired in one setting to other settings and across different providers and stimuli. However, for maintenance, the findings were mixed. That is, some studies reported that the treatment gains were not maintained beyond the intervention phase, while one study showed that the skills were maintained one month following the conclusion of the intervention.

**Table 10: Level 2 Emerging Evidence-based Interventions for Transitioning Youth**

Intervention Name	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior										
Behavioral Package				✓	✓	School, Community, Clinical Setting	Teacher, Therapist	Not specified	Not specified	Not specified	A range of 14 to 80 sessions. Two studies specified a range of 5 to 10 minutes per session	Where tested, behaviors were generalized across different settings, however, across different stimuli the results were mixed	Where tested, treatment gains were not maintained	3 studies	n/a
Social Skills Package	✓	✓				Community, Clinical Setting, Experimental Lab Environment	Teacher, Therapist, Medical Professional, Typically Developing Peers, Psychology Graduate Students, Social Worker	Experience in teaching individuals with ASD; Experience in applied behavior analysis	Parent and Peer Training Workshops	A range of 1 to 8 months	A range of 1 to 3 hours per week	Two studies showed that subjects generalized skills/behaviors across different providers and settings	Only one study reported results. Treatment gains were maintained up to 1 month following the conclusion of intervention	6 studies	n/a
Technology-based Treatment		✓			✓	School, Community	Teacher	Not specified	Not specified	One study specified a duration 3 weeks	One study specified ten sessions (half an hour per session)	Where measured, skills/behaviors were generalized across different providers, settings and stimuli	Not measured	2 studies	1 RCT

### c) Level 3 Unestablished interventions

As shown in Table 11, we rated the majority of interventions targeting transitioning youth as level 3 (Unestablished). They include the following 11 interventions:

- Augmentative and Alternative Communication (ACC) Device
- Exercise
- Cognitive Behavioral Intervention Package
- Initiation Training, Modeling
- Multi-component Package
- Naturalistic Teaching Strategies
- Self-management
- Social Communication Intervention
- Story-based Intervention Package
- Structured Teaching.

The evidence of effectiveness is seriously lacking for these interventions. For most of them, only one study evaluated the effectiveness of the intervention for this age group. The majority of the interventions were implemented in settings such as schools, homes, and residential treatment facilities. The providers included teachers, staff at residential treatment facilities, and parents.

Findings on generalization across settings showed that for many of the intervention types, the participants applied skills/behaviors acquired in one setting to other settings and providers. For example, if the intervention was provided at school, the participants were able to apply the skills/behaviors at home. For maintenance, only a few studies measured the degree to which the treatment gains were sustained beyond the conclusion of the intervention phase. For example, for Naturalistic Teaching Strategies, the findings from one study suggested that treatment gains were maintained at 1 month following intervention conclusion, however, the levels were below those attained during the intervention phase.

**Table 11: Level 3 Unestablished Interventions for Transitioning Youth**

Intervention Name	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior										
Augmentative and Alternative Communication (ACC) Device	✓				✓	School, Vocational Training Center	Vocational Trainer	Not specified	Not specified	Not specified	1 to 2 sessions per week, each session lasting 10 minutes	Skills/behaviors were generalized across different providers	Not measured	1 study	n/a
Cognitive Behavioral Intervention Package		✓	✓			Home, School	Parent, Teacher, Typically Developing Peer	Not specified	Procedural training for teachers; Supervisory feedback; Informational training for parents on how to implement components of the intervention at home	7 months	3 hours per week	Not measured	Not measured	1 study	n/a
Exercise				✓		Gym at the residential treatment facility	Residential Treatment Facility Staff	Master's degree in adaptive physical activity	Not specified	7 months	3 hours per week	Not measured	Not measured	1 study	n/a
Initiation Training	✓	✓				School	After-school program staff	Not specified	Not specified	Not specified	40 sessions, 15 minutes per session	Not measured	Not measured	1 study	n/a
Modeling			✓		✓	School, Day Care/Treatment Facility	Therapist	Not specified	Not specified	Not specified	One study specified 17 sessions. The second study specified 15-minute sessions.	Where measured, skills and behavior were generalized across different stimuli.	One study tested for maintenance. Treatment gains were maintained at 1 week and 3 months following intervention conclusion	2 study	n/a
Multi-component Package				✓	✓	School	Teacher/Teacher Aide	Not specified	Procedural training for implementing the intervention	2 months	5 to 15-minute check-in intervals	Behavior was generalized across different settings	Not measured	1 study	n/a

**Table 11: Level 3 Unestablished Interventions for Transitioning Youth (continued)**

Intervention Name	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior/ Problem Behavior										
Music Therapy	✓	✓	✓	✓	✓	School	Therapist	Background in music	Not specified	2 years	Not specified	Findings from a parents and caregivers survey indicated that skills/behavior were generalized across settings	Not measured	1 study	n/a
Naturalistic Teaching Strategies		✓			✓	School	Teacher	Special education teachers	Procedural Training in Naturalistic Teaching procedures; Training in behavior modification and emergency restraint techniques	A range of 2 to 6 months	A range of 1 to 40 sessions a week. One study specified 45 to 50 minutes per session	Not measured	One study tested for maintenance. Treatment gains were maintained at 1 month following intervention conclusion, however, the levels were below those in the intervention phase	2 studies	n/a
Self-management	✓			✓	✓	Home, School	Parent, Teacher	Background in Special Education and experience in using behavioral techniques for teaching individuals with ASD	Procedural training in how to use personal digital assistant	Only one study specified a duration of 3 weeks	Two studies specified 20 to 30-minute sessions for 3 to 5 times a week	Where measured, skills and behavior were generalized across different providers, settings and stimuli	Not measured	3 studies	n/a
Social Communication Intervention	✓	✓	✓			School	Teacher	Not specified	Not specified	10 weeks	Ten 2 to 3-hour sessions	Findings from parent interviews indicated that subjects generalized skills/behaviors across different settings	Not measured	1 study	n/a
Structured Teaching	✓	✓	✓	✓	✓	Home, Residential Treatment Facility, Community	Residential Facility Staff	Not specified	Not specified	1 year	Not specified	Not measured	Not measured	1 study	1 RCT



## Adults

We found evidence of the effectiveness of only nine interventions for adults with ASD. As shown in Table 12, we rated a third of the interventions (33 percent) as evidence-based, only one intervention as emerging evidence based, and the majority (56 percent) as unestablished.

**Table 12: Number and Percentage of Interventions for Children by Level of Evidence**

<b>Interventions By Level of Evidence</b>	<b>Total Number of Interventions</b>	<b>Percent</b>
Level 1 Evidence-based interventions	3	33%
Level 2 Emerging evidence-based interventions	1	11%
Level 3 Unestablished interventions	5	56%
<b>TOTAL</b>	<b>9</b>	<b>100%</b>

### a) Level 1 Evidence-based interventions

Eleven studies provided evidence of effectiveness for the interventions classified in this level. As indicated in Table 13, only three interventions (Supported Employment, Structured Teaching, and Behavioral Package) were defined as being evidence-based. The adult interventions evaluated at this level were used to address all six of the identified target behaviors. Communication, Social Development and Adaptive behaviors were targeted by all three of the interventions at this level.

These interventions were implemented across different settings such as job sites, community, homes/group homes, residential treatment facilities, and adult day care facilities. Behavioral Package interventions for adults exhibited outcomes such as reductions in problem behaviors and an increased use of appropriate verbal responses.

The findings show that these interventions were effective in achieving positive and lasting outcomes for the targeted behavior and skills. For example, based on the evidence presented by the studies that evaluated these interventions, the treatment gains were maintained beyond the intervention phase. Outcomes for studies that evaluated Structured Teaching for adults included decreases in negative behavior and increased levels of independence. Studies that implemented Supported Employment found that the intervention lead to an increase in job performance as well as increased an individual's ability to find work.

Overall, the maintenance results demonstrated that treatment gains were sustained after the interventions were concluded.

**Table 13: Level 1 Evidence-based Interventions for Adults**

Intervention Name	Target Behavior						Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior										
Behavioral Package	✓	✓			✓		Home, Residential Care Facility, Adult Day Care Program	Therapists, Medical Professionals	Not specified	Workshop training in restraining and program procedures	One study specified a duration of 2 years	Number of sessions ranged from 10 to 20. However, frequency of sessions was not specified	Not measured	Behavior and skills were maintained for a period of up to 24 months	5 studies	n/a
Structured Teaching	✓	✓	✓		✓	✓	Home (Group Home), Community	Group Home Staff	Not specified	Staff working in group homes were trained by TEACCH personnel on how to use the elements of TEACCH program	A range of 2.5 to 6 years	One study specified 6 hours per day	Not measured	One study indicated that behavior and skills were maintained over time	3 studies	1 RCT
Supported Employment	✓	✓	✓	✓	✓		Job sites	Job coaches	Experience working with adults with disabilities	Not specified	A range of 1.5 to 2 years	8 to 20 hours per week	Not measured	Evidence indicated that skills required for employment were maintained over time	3 studies	1 RCT

**b) Level 2 Emerging evidence-based interventions**

We rated only one intervention, Schedules, in level 2 as an emerging evidence-based intervention for adults. Table 14 presents synthesized results from the two studies that evaluated the effectiveness of Schedules interventions in addressing the targeted behavioral outcomes. These interventions were rated as level 2 because the evidence presented in the reviewed studies met some, but not all the requirements for evidence-based practices. These interventions involve modifying an individual's behavior through the use of task lists, which outline the process required to complete the specified tasks. The findings demonstrated that the interventions were used to address target behaviors, such as social development, adaptive and problem behaviors. The interventions were implemented in schools, job sites, and community settings. Evidence showed that treatments gains were maintained beyond the conclusion of the intervention phase.

**Table 14: Level 2 Emerging Evidence-based Interventions for Adults**

Intervention Name	Target Behavior					Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior										
Schedules	✓			✓	✓	School, Community, Job Site	Teacher, Job Site Staff	Not specified	Not specified	One study specified 3 weeks	23 to 24 sessions	Not measured	Time on task and number of tasks completed were maintained for a period of up to one month following the conclusion of the intervention	2 studies	n/a

**c) Level 3 Unestablished interventions**

We reviewed seven studies for the five interventions placed in level 3 for adults (Table 15). These interventions include Music Therapy, Social Communication Intervention, Social Skills Package, Antecedent Package, and Naturalistic Teaching Strategies. Evidence presented by the studies that evaluated these interventions did not meet any of the NPDC criteria. For example, most of the studies had critical design flaws that could not account for counterfactual hypotheses. Thus the outcomes could not be fully attributed to the interventions. A wide range of behaviors were targeted by these interventions, including communication, social development, cognitive development, sensory and motor development, adaptive and problem behaviors. Generalization findings for three interventions (Music Therapy, Social Communication Intervention, and Social Skills Package) indicated that skills acquired in one setting were applied to other settings and across providers.

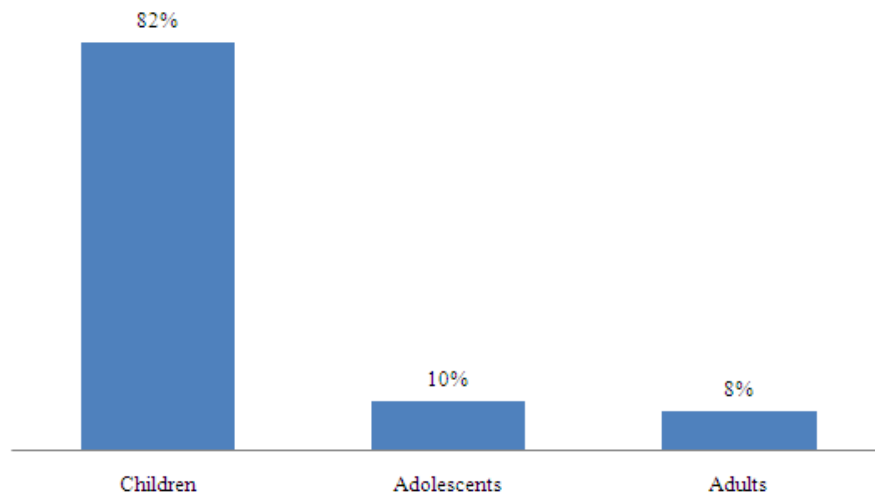
**Table 15: Level 3 Unestablished Interventions for Adults**

Intervention Name	Target Behavior						Setting(s)	Provider Type	Provider Qualifications	Provider Training	Duration	Intensity	Generalization	Maintenance	Number of Studies Reviewed	Number of Randomized Controlled Trials (RCT)
	Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior										
Antecedent Package					✓	✓	Group Home	Group Home Staff	1 year experience working with individuals with disabilities	Not specified	Not specified	Two 10- trial sessions per day	Not measured	Not measured	1 study	n/a
Music Therapy	✓	✓	✓	✓	✓	✓	Community, School	Music Therapists	Not specified	Not specified	A range of 1 to 2 years	One study specified 1-hour sessions per week	Anecdotal evidence from parents and caregivers showed that transfer of skills from music therapy sessions to home, school and community settings occurred	Not measured	2 studies	n/a
Naturalistic Teaching Strategies	✓	✓			✓	✓	Home, School, Community	Skills Coaches	Masters degree in Psychology or Education	Supervised practice sessions	Not specified	Not specified	Not specified	Not specified	1 study	n/a
Social Communication Intervention	✓	✓	✓	✓			School	Teacher	Not specified	Not specified	10 weeks	One 2 to 3-hour session per week	Findings from student and parent interviews indicated that subjects used acquired skills across different settings	Not measured	1 study	n/a
Social Skills Package	✓	✓			✓	✓	Medical Treatment Facility	Trainer	Not specified	Not specified	A Range of 6 weeks to 1 year	A Range of 2.5 to 4 hours per month	Participants in one study applied their skills across different settings and providers	Only one study reported that social skills were maintained up to one month following the conclusion of intervention	2 studies	n/a

## VI. SUMMARY OF POPULATION SPECIFIC SCAN RESULTS

In this section, we present a summary of findings from the environmental scan across the three population groups – Children, Transitioning Youth, and Adults. Exhibit 4 displays the percent of studies found by population in the literature review. Eighty-two percent of the studies (n=217) focused on children with ASDs, whereas 10 percent (n=28) focused on transitioning youth and 8 percent (n=20) focused on adults. While a substantial number of studies conducted in the past decade have focused on the effectiveness of interventions for children with ASDs, the number of studies of the effectiveness of psychosocial and behavioral interventions for youth and adults with ASDs is more limited.

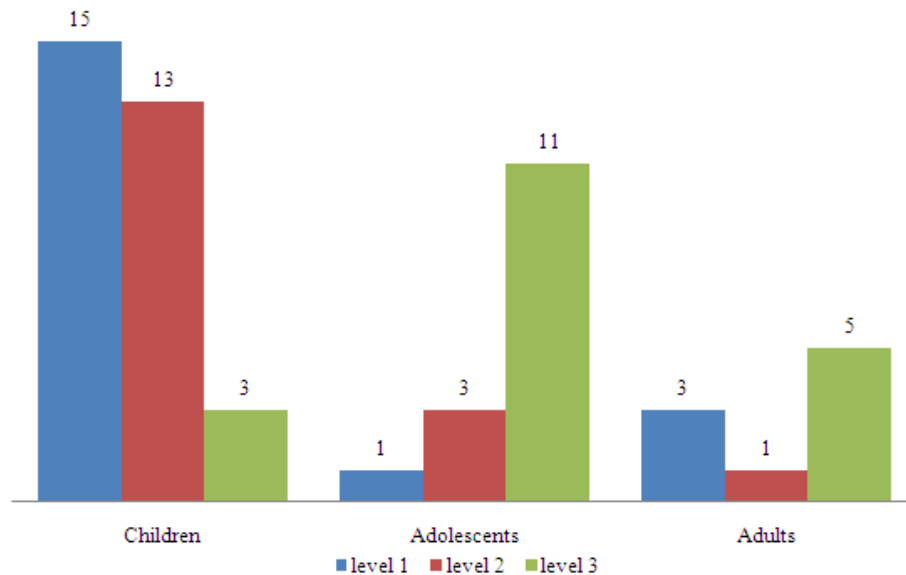
**Exhibit 4: Percent of Studies Found by Population Group**



As shown in Exhibit 5, the majority of interventions for children with ASD were rated as level 1 (n=15) compared with (n=1) for transitioning youth and (n=3) for adults. These findings show that numerous psychosocial and behavioral interventions for children with ASD have been determined to be effective, but only a small number of interventions that focus on transitioning youth and adults have been established to be evidence-based.



## Exhibit 5: Number of Interventions by Level of Evidence for Each Population Group



The results of this environmental scan are largely consistent with findings from the National Standards Study described earlier in this report. However, there are some minor differences between the two reviews in the way that interventions were classified by levels of evidence. This variation can be attributed to several factors:

- *Criteria used for evaluating evidence-based practices.* As previously mentioned in this report, the IMPAQ team utilized criteria based on the definition of evidence-based practices adopted by the National Professional Development Center on Autism Spectrum Disorders. The National Standards Study developed its own criteria for evaluating the effectiveness of interventions for children with autism.
- *Target population(s) for review.* This environmental scan encompassed three populations – children, transitioning youth, and adults, whereas the National Standards Study focused on interventions targeted at children. Findings for interventions targeted at children were similar across the two efforts.
- *Time frame for literature review.* Whereas this environmental scan covered relevant scientific literature published in the past ten years (1998-2008), the National Standards Study considered research that was conducted prior to 1998.

## VII. COST AND FUNDING ISSUES

As discussed in the Methodology section, the IMPAQ team included a number of cost keywords in the search criteria. Based on these criteria, a total of 24 cost articles were identified and reviewed. The articles were categorized into the following three categories: 1) Intervention Specific Analyses, 2) Service Use, Availability, and Access for Individuals with ASDs, and 3) Economic Impact of ASDs. Key findings from the articles reviewed in each of these categories are included below.

### **Intervention Specific Analyses**

The four studies included in this category present the findings of cost-benefit analyses of specific interventions for individuals with ASDs, specifically, the early intensive behavioral interventions (EIBI). Included in this group are studies that compare the costs of implementing EIBI to a typical special education program, a study that examined the costs and consequences of expanding an Intensive Behavioral Intervention program in Ontario, Canada, as well as a study that analyzed factors that lead to the success or failure of an EIBI program. Table 16 provides a summary of the studies included in this group.

**Table 16: Intervention Specific Analyses**

Title	Citation	Purpose	Outcome/Key Points
Cost Comparison of Early Intensive Behavioral Intervention and Special Education for Children with Autism	Chasson, G. S., G. E. Harris, et al. (2007). <i>Journal of Child and Family Studies</i> 16(3): 401-413.	To compare the costs associated with 18 years of special education in the state of Texas to the costs associated with the implementation of an average of 3 years of Discrete Trial Training as an Early intensive Behavioral Intervention (EIBI) in an effort to minimize the need for special education.	Study results indicated that based on a child receiving three years of Discrete Trial Training as an EIBI, then realizing a 72% offset in special education costs over the remaining 15-year period, a total savings of \$84,300 per child in Texas state-budgeted funds is achieved over the total school years. Comparing the reported actual costs of a special education program to a three-year EIBI program, savings \$208,500 per child are achieved. There is a higher up-front cost for EIBI with \$67,500 over a three year period vs. a state-budgeted cost of \$33,000 for special education services over the same three-year period. However, the early additional cost of EIBI is recovered within five years, and the savings over the remaining years are substantial.
Cost-Benefit Estimates for Early Intensive Behavioral Intervention for Young Children with Autism - General Case Model and Single State Case	Jacobson, J. W., J. A. Mulick, et al. (1998). <i>Behavioral Interventions</i> 13(4): 201-226.	To perform a cost benefit analysis for Early Intensive Behavioral Intervention (EIBI) for young children with autism.	At varying rates of effectiveness and in constant dollars, this model estimates the cost savings to range from \$187,000 to \$203,000 per child for ages 3-22 years, and from \$656,000 to \$1,082,000 per child from 3-55 years. Differences in initial costs of \$33,000 and \$50,000 per year for EIBI have modest impact on cost-benefit balance, but are greatly outweighed by the estimated savings. The analysis indicated that significant cost-aversion or cost-avoidance may be possible with EIBI. The majority of savings to the lifespan-oriented developmental disabilities sector accrue from children who achieve normal functioning rather than partial benefit. Savings increase substantially on average with increased rates of children achieving normal functioning.
Facilitating factors and barriers to the implementation of intensive home-based behavioral intervention for young children with autism	Johnson, E. and R. P. Hastings (2002). <i>Child Care Health Dev</i> 28(2): 123-9.	To identify factors that acted as facilitative factors and barriers to the implementation of intensive home-based behavioral interventions for young children with autism by surveying UK parents conducting these types of programs in their homes.	The most common barriers cited were developing and/or maintaining a team, program funding and personal/family resource constraints. Common facilitating factors were supportive and committed team, financial resources and child progress. Several of the facilitative factors and barriers were found to be similar. For example, a supportive therapy team was the most frequently cited facilitative factor, and problems recruiting and maintaining a suitable team was the most frequently reported barrier. Other factors seemed to be more independent constructs. For example, an important barrier was the lack of time and personal energy, but plenty of time and energy was not cited as a facilitative factor.
The Cost-Effectiveness of Expanding Intensive Behavioral Intervention to All Autistic Children in Ontario	Motiwala, S. S., S. Gupta, et al. (2006). <i>Healthcare Policy</i> 1(2): 135-51.	To examine the cost and consequences of expanding an Intensive Behavioral Intervention program. This economic evaluation assessed the costs and consequences of expanding an IBI program from current coverage for one-third of children to all autistic children.	Total savings from the expansion of the current program were \$45,133,011 in 2003 Canadian dollars. Under the model parameters, expansion of IBI to all eligible children represents a cost-savings policy whereby total costs of care for autistic individuals are lower and gains in dependency-free life years are higher. While significant costs were incurred under all scenarios, the cost of Expansion was lowest, resulting in savings of \$34,479 per individual over his or her lifetime compared to the Status Quo. The greatest number of dependency-free life years was gained under Expansion: 4.5 years per person compared to No Intervention and 2.8 years per person compared to Status Quo.

Overall, these studies present findings in favor of implementing EIBI in place of the status quo for children with ASDs but it is important to take into account the factors that may facilitate or impede the success of an EIBI program. Key findings from these studies are provided below.

- Two studies compared the costs associated with 18 years of special education to the costs associated with the implementation of an early intensive behavioral intervention program. Using representative cost data from two states, the models estimated that cost savings range from \$187,000 to \$203,000 per child for ages 3-22 years or \$208,500 per child across eighteen years of education. The findings indicate that significant cost aversion or cost-avoidance may be possible with EIBI.<sup>6, 7</sup> Both of these studies are approximations of costs saved by implementing EIBI. Incidences of spontaneous recovery and special education are not taken into account. Also both studies make assumptions about service and expenditure trends that, while they seem reasonable in the short term, may not continue in the long run.
- One study examined the cost-effectiveness of expanding an Intensive Behavioral Intervention program in Ontario, Canada. The study found that the program expansion would result in the greatest amount of savings per individual and the greatest amount of dependency-free life years.<sup>8</sup>
- Another study identified facilitating factors and barriers to the implementation of intensive home-based behavioral intervention using a survey of parents of young children with autism living in the UK. Facilitating factors and barriers were found to be similar in nature. For example, a supportive therapy team was the most frequently cited facilitative factor, and problems associated with recruiting and maintaining a suitable team was the most frequently reported barrier. The second most frequently

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<sup>6</sup> Jacobson, J. W., Mulick, J. A., & Green, G. (1998). Cost-benefit estimates for early intensive behavioral intervention for young children with autism--general model and single state case. *Behavioral Interventions*, 13(4), 201-226.

<sup>7</sup> Chasson, G. S., Harris, G. E., & Neely, W. J. (2007). Cost comparison of early intensive behavioral intervention and special education for children with autism. *Journal of Child and Family Studies*, 16(3), 401-413.

<sup>8</sup> Motiwala, S. S., S. Gupta, et al. (2006). "The Cost-Effectiveness of Expanding Intensive Behavioral Intervention to All Autistic Children in Ontario." *Healthcare Policy* 1(2): 135-51.

reported barrier was concerns over obtaining funding from education departments, financial costs of the program, and other financial and fundraising concerns.<sup>9</sup>

### **Service Use, Availability, and Access for Individuals with ASD**

The seven studies included in this section evaluate the availability of services for individuals with disabilities, as well as the level of access individuals have to these services. The studies in this group address policy, financial and delivery issues that influence use, availability and access to services. Survey data was used for two studies to identify what types of services are most commonly used by individuals with disabilities as well as demographic characteristics that affect an individuals' access to care. Table 17 provides a summary of the studies included in this group.

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<sup>9</sup> Johnson, E., & Hastings, R. P. (2002). Facilitating factors and barriers to the implementation of intensive home-based behavioral intervention for young children with autism. *Child Care Health Dev*, 28(2), 123-129.

**Table 17: Service Use, Availability, and Access for Individuals with ASD**

Title	Citation	Purpose	Outcome/Key Points
Access to Care for Autism-Related Services	Thomas, K. C., A. R. Ellis, et al. (2007). <i>Journal of Autism and Developmental Disorders</i> 37(10): 1902-1912.	This paper identifies family characteristics associated with use of autism-related services. A telephone or in-person survey was completed during 2003-2005 by North Carolina families with a child with Autism. The family and child characteristics identified include age, sex, race, diagnosis, insurance coverage, household composition, Education, income and stress levels.	<p><b>Treatment Approach:</b> Three quarters of the families of the youngest (4 years or younger) children and two thirds of the remaining families reported using one or more of the listed major treatment approaches for ASD. Thirty seven percent of the families of the youngest children were using more than one approach; the use of multiple approaches diminished to 11% of the older children. Just over 1/2 of families used a TEACCH approach.</p> <p><b>Services Use:</b> Families were using 46 of the 56 services listed.</p> <p><b>Sample Characteristics:</b> In comparison to North Carolina and national populations, the sample was slightly less likely to be of minority race or ethnicity, had slightly higher education and income, and was more likely to have health insurance. The older elementary children (9-11 years) were more likely to have a diagnosis of Asperger syndrome or mental retardation, compared to younger children. The study sample appears similar to those of other epidemiological studies of ASD with respect to gender.</p> <p><b>Predisposing Characteristics:</b> Racial and ethnic minority families had half the odds of suing a case manager, and only a quarter the odds of using a psychologist, developmental pediatrician, or sensory integration.</p>
Access to Specialty Medical Care for Children with Mental Retardation, Autism, and Other Special Health Care Needs	Krauss, M. W., S. Gulley, et al. (2003). <i>Mental Retardation</i> 41(5): 329-339.	Data from a national survey was used to investigate two questions: 1. What types of problems in obtaining care from specialty medical doctors are reported by parents of children with mental retardation, autism, or other types of special health care needs? 2. To what extent are characteristics of the children, their families, and their health care coverage associated with the probability of having specific types of problems accessing this care?	<p>Results indicate that over a third of the children with autism, over a fifth with mental retardation, and over a fifth with other types of special health care needs had problems obtaining needed care from specialty doctors in the preceding year. The most common problems included getting referrals and finding providers with appropriate training. Children with unstable health conditions, autism, or those whose parent was in poor health were at greater risk for problems. Primary Medicaid coverage and public secondary coverage were associated with fewer access problems.</p> <ul style="list-style-type: none"> <li>• Over a third of the children with autism were reported to have experienced an access problem with respect to specialty care from a medical doctor.</li> <li>• Children with autism were significantly more likely to experience difficulties with both health plan-based access and provider-based access.</li> <li>• Children with autism were more likely to experience overall access problems.</li> </ul>
Increases in Identified Cases of Autism Spectrum Disorders	Steuernagel, T. (2005). <i>Journal of Disability Policy Studies</i> 16(3): 138-146.	The article assesses the policy implications of the autism "epidemic". It includes an analysis of federal and state governments' institutional capacity to respond to the autism epidemic.	Currently, people with disabilities make up 15% of all Medicaid recipients and account for 37% of expenditures. In the period from 1977 to 1992, Medicaid spending for mental retardation and development disabilities rose from \$3.5 billion to \$17.2 billion. The long term care components of these expenditures could rise dramatically if the autistic population of tomorrow requires the same kinds of care as today's autistic population. At this point in time, many children diagnosed with autism are not eligible to receive Social Security Income (SSI) because their family income is too high. This exclusion is referred to as "deeming". When these children reach the age of 18, however, their parents' income is not counted, and they may be eligible for SSI. Unfortunately, the federal government does not provide data on the number of individuals with autism receiving SSI.
Issues Related to the Diagnosis and Treatment of Autism Spectrum Disorders	Shattuck, P. T. and S. D. Grosse (2007). <i>Mental Retardation and Developmental Disabilities Research Reviews</i> 13(2): 129-135.	To explore the issues and implications for diagnosis and treatment, stemming from the growing number of children identified with autism spectrum disorders. The cost and financing of assessments and interventions are included.	Recently there has been an increased interest in improving and expanding diagnostic and treatment services for children diagnosed with ASDs. Many of these obstacles are outlined in this article. Clinicians' concerns about getting reimbursed for developmental screening are often cited as a barrier to its inclusion in primary care visits. Developmental screening using a validated formal screening tool was assigned a relative value of \$13.64, although the average private insurance reimbursement in 2004 for this billing code was \$27. Cost reimbursement issues are likely to present more of a barrier to access for comprehensive developmental assessments. Such an assessment performed by a single practitioner is estimated to cost \$1,000 which far exceeds the prevailing reimbursement rates for developmental assessments as noted earlier. The cost of serving children with ASDs in special education is another barrier to intervention. Intensive Intervention averages \$40,000 per child per year for a full time program. The cost can be higher for center-based programs. The article cited a national study that calculated that during the 1999-2000 school year, total spending on students receiving special education services in the autism category averaged \$18,790 compared with average expenditures of \$6,556 per child for children not receiving special education services.
Medicaid Managed Care and Individuals with Disabilities: Status Report	Hemp, R. and D. Braddock (1998). <i>Mental Retardation</i> 36(1): 84-5.	The article reviews trends and milestones in Medicaid managed care for individuals with disabilities.	Twenty states have enrolled individuals with disabilities to some extent in Medicaid managed care. Generally, states are using Medicaid Section 1115, or "research and demonstration" Waiver, for comprehensive health reform that affects enrollees' choices of providers, periods of mandated enrollment, or benefit packages. With few exceptions, individuals with disabilities enrolled in managed care participate in basic health care plans and not long-term care. People with developmental disabilities participate in many of the other managed-care plans but the extent to which is not precisely known.

**Table 17: Service Use, Availability, and Access for Individuals with ASD (Continued)**

Title	Citation	Purpose	Outcome/Key Points
Medicaid Managed Care Model of Primary Care and Health Care Management for Individuals with Developmental Disabilities	Kastner, T. A. and K. K. Walsh (2006). <i>Mental Retardation</i> 44(1): 41-55.	To discuss the lack of sufficient accessible community-based health care services for individuals with developmental disabilities and how this has led to disparities in health outcomes and the overreliance on expensive models of care delivered in hospitals and other safety net or state-subsidized providers. The article also describes a functioning community-based primary health care model, with an integrated care management component, functioning in the general health care practice marketplace. The article explains how the model addresses recent Surgeon General recommendations as well as evaluative criteria for availability, affordability, acceptability, and appropriateness of care.	The need for scalability and replicability in health care models coupled with the need to work toward the goals of the Surgeon General's report are best addressed through specialized community based primary care practices that include care management and operate within the general health care system. The article presents a model, developed by the Developmental Disabilities Health Alliance (DDHA), that pairs primary care with care management in a managed care environment without reliance on state subsidies or extremely high capitation rates. The DDHA model has shown both scalability and replicability in that the five current office settings have developed in a 6-year span without large subsidies from the state. The model simplifies health care for those with developmental disabilities by creating a medical "home" that provides answers to questions and alleviates the anxieties of these patients and their caregivers. The DDHA model holds that the primary care provider should initially address over 90% of the health care needs of the population. In the DDHA practice model in New Jersey is both easy to access and the sites are physically accessible. According to a survey of users of the model, there is a high level of satisfaction with the quality of care. The DDHA model was also developed to operate successfully in a Medicaid managed care marketplace without state or federal subsidies. It has worked so well that the administrators have been able to expand its services to cover the entire state in slightly over 6 years by relying on available health care funding most notably Medicaid managed care contracts.
State Infant/Toddler Program Policies for Eligibility and Services Provision for Young Children with Autism	Stahmer, A. C. and D. S. Mandell (2007). <i>Administration and Policy in Mental Health and Mental Health Services Research</i> 34(1): 29-37.	The study describes states' policies for providing early intervention services to children with Autistic Spectrum Disorders under the Individuals with Disabilities Education Act Part C and examines how Part C policies are associated with the proportion of school-age children diagnosed with autism served under IDEA.	Results indicated an absence of uniformity among states in policies and practices regarding the identification and care of infants and toddlers with autism. Few states have clear policies or practices in place specific to service delivery to young children with ASD. A fifth of states have diagnostic guidelines and a quarter have treatment guidelines in place, although few states endorse models that have achieved some level of national consensus or recognition. One quarter of states used the department of education as the lead agency; the use of departments of developmental disability/mental retardation was relatively infrequent. In all states, referrals to early intervention could be made by anyone; however, referrals came most commonly from outside the system (family members and healthcare professionals) in 74% of states. Only 7% of states required that professionals use a specific discipline for diagnosis; others mandated that a multi-disciplinary team be involved in assessment and diagnosis (15%). Only one state accepted a diagnosis from a school psychologist or school team. Twenty-two percent had no requirements for the diagnostician. States differed in DSM-IV codes, levels, and definitions of developmental delay/impairment, services provided, endorsements of specific treatments, and guidelines for diagnostic assessment and treatment.

The key findings from these studies are highlighted below, and fall into two broad categories: access to all ASD services and access to Medical services.

**Access to all ASD services:**

- Children with ASD receive a very broad range of services. Younger children receive a wider variety of services.
- Clinicians concerns about reimbursements for developmental screenings and assessments of children with are often cited as a major reason for their exclusion from primary care visits. Discrepancies between the actual cost of developmental assessments and the prevailing reimbursement rates are likely to be a major access barrier to these types of assessments.
- Drastic differences in criteria for the diagnosis, assessment, and care of infants and toddlers with autism. Few states have policies or practices in place to provide services to children with ASD. A fifth of states have diagnostic guidelines and one quarter have treatment guidelines in place. Only 7% of states require that professionals use a specific discipline for diagnosis.<sup>10</sup>
- Based on a survey of 383 families with a child with ASD in North Carolina, access to care is limited for individuals with ASD in racial and ethnic minority families, with low parental education, living in nonmetropolitan areas, and for individuals not following a major treatment approach.<sup>11</sup>
- Many children with ASD are not eligible to receive social security income because their parent's income is too high. When these children reach the age of 18 and their parent's income is not counted, they may become eligible.

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<sup>10</sup> Stahmer, A. C. and D. S. Mandell (2007). "State infant/toddler program policies for eligibility and services provision for young children with autism." *Administration and Policy in Mental Health and Mental Health Services Research* 34(1): 29-37.

<sup>11</sup> Thomas, K. C., Ellis, A. R., McLaurin, C., Daniels, J., & Morrissey, J. P. (2007). Access to care for autism-related services. *Journal of Autism and Developmental Disorders*, 37(10), 1902-1912.



## Access to Medical Services:

- For individuals with developmental disabilities, limited access to sufficient community-based health care services has led to disparate health outcomes as well as an overreliance on health care models delivered in hospitals and other safety net or state-subsidized providers.<sup>12</sup>
- Individuals with developmental disabilities who do receive health care through community-based health care services tend to do so through fee-for-service arrangements in the Medicaid and/or Medicare programs. These arrangements are often found to be inadequate because the low reimbursement rates discourage many practitioners from participating.<sup>13</sup>
- In general, individuals with disabilities who are enrolled in managed care only participate in basic health care plans and do not receive long-term care.<sup>14</sup>
- The most common problems that are encountered by individuals with disabilities when seeking specialty medical care are getting referrals and finding providers with the appropriate training.<sup>15</sup>
- Primary Medicaid coverage and public secondary health coverage were associated with fewer access problems.<sup>16</sup>

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<sup>12</sup> Kastner, T. A., & Walsh, K. K. (2006). Medicaid managed care model of primary care and health care management for individuals with developmental disabilities. *Ment Retard*, 44(1), 41-55.

<sup>13</sup> Ibid.

<sup>14</sup> Hemp, R. and D. Braddock (1998). "Medicaid managed care and individuals with disabilities: status report." *Mental Retardation* 36(1): 84-5.

<sup>15</sup> Krauss, M. W., Gulley, S., Sciegaj, M., & Wells, N. (2003). Access to specialty medical care for children with mental retardation, autism, and other special health care needs. *Mental Retardation*, 41(5), 329-339.

<sup>16</sup> Krauss, M. W., Gulley, S., Sciegaj, M., & Wells, N. (2003). Access to specialty medical care for children with mental retardation, autism, and other special health care needs. *Mental Retardation*, 41(5), 329-339.

## **The Economic Impact of ASD**

The thirteen studies included in this section investigated the overall costs associated with ASDs as well as the main expenses that drive these costs. These studies analyzed data from a variety of data sources that are collected using different methods and from different populations. This accounts for variance among cost estimates. In general, these studies demonstrate that the costs associated with ASD are significant. The need for cost effective and replicable services and supports for individuals with ASD is highlighted. Table 18 provides a summary of the studies included in this group.

**Table 18: The Economic Impact of ASD**

Title	Citation	Purpose	Outcome/Key Points
A Comparison of Health Care Utilization and Costs of Children With and Without Autism Spectrum Disorders in Large Group-Model Health Plan	Croen, L. A., D. V. Najjar, et al. (2006). <i>Pediatrics</i> 118(4): e1203-11.	To compare health care utilization and costs of children with and without autism spectrum disorders in the same health plan.	Children with ASDs have a higher annual mean number of total clinic (5.6 vs. 2.8), pediatric (2.3 vs. 0.3) outpatient visits. A higher percentage of children with ASDs experienced inpatient (3% vs. 1%) and outpatient (5% vs. 2%) hospitalizations. Children with ASDs were nearly 9 times more likely to use psychotherapeutic medications and twice as likely to use gastrointestinal agents than children without autism spectrum disorders.
Cost-impact of Young Adults with High-Functioning Autistic Spectrum Disorder	Jarbrink, K., P. McCrone, et al. (2007). <i>Research in Developmental Disabilities</i> 28(1): 94-104.	To investigate the societal economic consequences of ASD using a sample of young high functioning adults in need of employment support.	This study demonstrated that ASDs result in high costs. Results indicated that a lack of supported employment programs for people with ASD may have negative resource consequences for the economy. Cost information was collected for 19 individuals with ASDs in western Sweden. The subjects were involved with a project that aimed to support individuals with ASDs who were seeking employment. The costs for services provided by the community and health care provided by the county council were similar and represented half of the total cost. The costs for services provided by the employment agency were relatively small and together represented less than 5% of the total cost. The cost for informal care was low and represented 2% of the total cost when parental expenses are included. The cost of productivity losses represented 45% of the total societal costs. All costs have been adjusted to 2001 levels.
Health Care Expenditures Associated With Autism Spectrum Disorders	Leslie, D. L. and A. Martin (2007). <i>Archives of Pediatrics &amp; Adolescent Medicine</i> 161(4): 350-5.	To examine the health care expenditures associated with autism spectrum disorders (ASDs) in medical care settings.	This study performed retrospective analysis of health insurance claims data. Results indicated that the average health care expenditures for individuals with an ASD increased 20.4% from \$4965 per patient in 2000 to \$5979 per patient in 2004 even after adjustment for inflation. When combined with rising ASD prevalence rates, total expenditures per 10,000 covered lives associated with ASDs increased 142.1% over the five year period. Although total expenditures per treated patient were higher for patients with ASDs than for individuals with other mental disorders, ASDs created a smaller burden on health insurers because of their relatively low treated prevalence.
Health Care Utilization and Expenditures for Children with Autism: Data from U.S. National Samples	Liptak, G. S., T. Stuart, et al. (2006). <i>Journal of Autism and Developmental Disorders</i> 36(7): 871-879.	To provide nationally representative data for health services utilization and expenditures of children with ASD.	Data were obtained from three national surveys, the Medical Expenditure Panel Survey (MEPS, 1999), the National Hospital Ambulatory Medical Care Survey (NAMCS, 1997-2000) and the National Hospital Ambulatory Care Survey (NHAMCS, 1997-2000). A total of 80 children with ASDs were identified from (N(H)AMCS) and 31 from MEPS. Children with ASDs had more outpatient visits, physician visits, and medications prescribed than children in general. They spent more time during physician visits than other children. Annual expenses for children with ASDs (\$6,132) were more than for other children (\$860) Children with ASDs have a substantial burden of medical illness.
Health Services Use and Health Care Expenditures for Children With Disabilities	Newacheck, P. W., M. Inkelas, et al. (2004). <i>Pediatrics</i> 114(1): 79-85.	To examine health care utilization and expenditure patterns for children with disabilities.	The findings demonstrate that the 7.3% of US children with disabilities used many more services than their counterparts without disabilities in 1999-2000. The largest differences in utilization were for hospital days (464 vs. 55 days per 1000), non physician professional visits (3.0 vs. 6.0), and home health provider days (3.8 vs. 0.04). As a result of their greater use, children with disabilities also had much higher health care expenditures and higher out of pocket expenses. The study also found that the distributions of total and out of pocket expenses were highly skewed, with a small fraction of the disabled population accounting for a large proportion of the expenditures. After controlling for insurance status, low-income families experienced greater financial burdens than higher income families.
Measuring the Parental, Service and Cost Impacts of Children with Autistic Spectrum Disorder: A Pilot Study	Shimabukuro, T. T., S. D. Grosse, et al. (2008). <i>Journal of Autism and Developmental Disorders</i> 38(3): 546-552.	To carry out a preliminary examination of a research instrument developed specifically to collect cost information for individuals with autistic spectrum disorder. The paper also discusses the results of a small pilot study which applied the instrument described in the paper.	Sixteen parents of children under 10 years of age with ASDs responded to the invitation to participate in the pilot exercise. Results from the pilot study indicate a considerable economic burden in placed on parents of children with ASDs. The total societal cost for a child with autism spectrum disorder estimated from this small sample is £689 per week when the only time cost included is the average reported income loss of £231. All parents reported that their child's disorder had negatively affected their career and/or income. The weekly losses quoted by parents and averaged per autistic child in the family had a mean of £231/week and median of £250. Education was the second highest weekly expense at £224/week.
Medicaid Expenditures for Children with Autistic Spectrum Disorders: 1994-1999	Mandell, D. S., J. Cao, et al. (2006). <i>Journal of Autism and Developmental Disorders</i> 36(4): 475-485.	To estimate the Medicaid expenditures of children diagnosed with autism spectrum disorders (ASD) from 1994 to 1999 in a large metropolitan county of Pennsylvania, and then to compare these expenditures with those of other Medicaid-eligible children from the same county during the same time period.	Over the course of the study, 334 children diagnosed with ASDs, 1,467 children with Mental Retardation (MR), and 183,488 other children received Medicaid-reimbursed services, most in more than one year of the study. Average expenditures for children with ASDs (\$9,980) were 3.5 times those of children with MR (\$2,868) and nine times those of other children (\$1,109). The bulk of this difference was concentrated in inpatient and outpatient psychiatric expenditures, which averaged \$9,558 for children with ASDs, \$1,875 for children with MR and \$401 for other children. Children with ASDs had the lowest average emergency care and general inpatient expenditures. Expenditures for all three groups fluctuated over time. Individuals were rank ordered by expenditures within each of the three groups, Children with ASDs had the highest expenditures in each decile, followed by children with MR. Over the course of the study, children with ASDs averaged 0.6 inpatient episodes (204 episodes total), children with MR averaged 0.4 episodes (624 total), and other children averaged 0.2 episodes.

**Table 18: The Economic Impact of ASDs (Continued)**

Title	Citation	Purpose	Outcome/Key Points
Medical Expenditures for Children with an Autism Spectrum Disorder in a Privately Insured Population	Shimabukuro, T. T., S. D. Grosse, et al. (2008). <i>Journal of Autism and Developmental Disorders</i> 38(3): 546-552.	To provide estimates of medical expenditures for a subset of children and adolescents who receive employer-based health insurance and have a medical diagnosis of an autism spectrum disorder.	Individuals with an ASD had average medical expenditures that exceeded those without an ASD by \$4,110-\$6,200 per year. On average, medical expenditures for individuals with ASD were 4.1-6.2 times greater than for those without an ASD. Differences in median expenditures ranged from \$2,240 to 3,360 per year with median expenditures 8.4-9.5 times greater. Average incremental expenditures associated with an ASD ranged from a low of \$4,110 in 11-17 year olds to a high of \$6,200 in 1-4 year olds. Because total expenditures were much higher, average out-of-pocket expenses for families in the ASD group, including co-pays and deductibles, amounted to approximately \$500-\$600 per year across all age groups compared with \$150-\$200 per year for the non-ASD group. This study analyzed 2003 data.
National Estimates of Health Services Expenditures for Children With Behavioral Disorders: An analysis of the Medical Expenditure Panel Survey	Guevara, J. P., D. S. Mandell, et al. (2003). <i>Pediatrics</i> 112(6): e440-6.	To determine if children with behavioral disorders have similar health services expenditures as children with physical conditions and to assess whether children with emotional behavior problems incur greater expenditures than children with disruptive behavioral disorders.	This study used data from the 1996 Medical Expenditure Panel Survey. Children with behavioral disorders incurred overall expenditures similar to children with physical conditions (adjusted \$1492 vs. \$1245) but greater than children without these conditions (adjusted \$1492 vs. \$834). Children with behavioral disorders had greater expenditures for office-based visits (adjusted \$410; 95% confidence interval: \$146-672) and prescription medications (adjusted \$361; 95% confidence interval: \$72-648) than those of children in either control group (physical disorders & children without these conditions).
System and Cost Research Issues in Treatments for People with Autistic Disorders	Jacobson, J. W. and J. A. Mulick (2000). <i>Journal of Autism &amp; Developmental Disorders</i> 30(6): 585-93.	To discuss a wide range of service selection and financial decisions faced by parents of children with autism that are not yet effectively addressed by applied research.	Relevant systems issues span a very broad range of concerns: (a) systems delivery models and issues, (b) how best to integrate treatments, (c) providing treatment to those with limited monetary resources, (d) cost and cost/benefit analysis, (e) how to educate adult psychiatrists regarding autism, and (f) gaps between research and practice. In the United States, aggregate costs are difficult to track for a specific diagnosis because eligibility criteria are never completely consistent for disability classifications. Economic forecasts require assumptions about future service expenditures, future service use, and inflation. In addition, the rate of attainment of normal functioning remains unknown and will depend on the actual replicability of the early intervention effect ascribed to Early Intensive Behavioral Interventions (EIBI). Well-designed surveys would be useful in determining just how much of the applied Research and Development for EIBI services have actually been transferred to families and other third parties by public agencies.
The Economic Consequences of Autistic Spectrum Disorder Among Children in a Swedish Municipality	Jarbrink, K. (2007). <i>Autism</i> 11(5): 453-63.	To describe and evaluate the cost consequences of autistic spectrum disorder for children living in a concentrated geographical area.	A postal questionnaire developed based on the results of a pilot study where parents of children with ASDs were interviewed regarding costs of the disorder (Jarbrink et al. 2003). All estimated costs from this study are shown at the 2005 level. The total estimated cost of healthcare as a result of the disorder was €2,361 per child per year. These costs were divided among several different services. Most children had visited a pediatrician (54%) and this was also the service that represented the greatest individual share of the health care cost. Cost for pharmaceuticals was the next greatest cost, followed by hospital care, specialist dentist and visits to the psychologist. More than one child in four was in respite care at some time. This accounted for almost half of the cost for community support. The second most influential item among the costs for community support was for a personal assistant or support worker that seven children utilized outside the school. In total, the cost for community support was estimated to be €14,320 annually per child. The total additional cost for schooling was on average €26,263 annually per child. The total cost for time losses (for informal care providers) was estimated at €7,759 per child per year, including time loss for paid work. The total average societal cost due to ASD was €51,877.
The Economic Impact of Autism in Britain	Jarbrink, K. and M. Knapp (2001). <i>Autism</i> 5(1): 7-22.	To estimate the economic consequences of autism in the United Kingdom using published evidence and the reanalysis of data holdings at the Center for Economic of Mental Health (CEMH).	With an assumed prevalence of Autism to be 5 per every 10,000 in the UK, the annual societal cost of Autism for the UK was estimated to exceed £1 billion. The lifetime cost for a person with autism exceeded £2.4 million. The main expenses were for living support and day activities (87%). Family costs account for only 2.3 percent of the total cost, but a lack of relevant information limited the ability to estimate these costs. To account for price and wage inflation over time, all costs were converted to 1997-8 levels using the national pay and prices index for hospital and community health services and the retail price index.
The Lifetime Distribution of the Incremental Societal Costs of Autism	Ganz, M. L. (2007). <i>Archives of Pediatrics &amp; Adolescent Medicine</i> 161(4): 343-9.	To describe the age-specific and lifetime incremental societal costs of autism in the United States.	The lifetime per capita incremental societal cost of autism is \$3.2 million. Lost productivity and adult care are the largest components of costs. The distribution of costs over the life span varies by cost category. All costs were adjusted for the different periods in which they would be incurred.

The key findings from these studies are highlighted below.

- The lifetime per-capita incremental societal cost of autism has been estimated to be \$3.2 million. All costs were adjusted to the different periods for which they were incurred.<sup>17</sup>
- The lifetime costs of an individual with autism exceeded £2.4 million in the UK at 1997-98 cost levels.<sup>18</sup>
- Among children, the major cost drivers are at the community level for support and schooling.<sup>19</sup>
- Based on a survey of 33 families with children with ASD living in four municipalities in Sweden, the total cost for healthcare as a result of the disorder was €2,361 per child per year. The total additional cost for schooling was on average €26,263 annually per child. These costs were estimated at 2005 levels.<sup>20</sup>
- Using 2003 data from the MarketScan<sup>®</sup> Commercial Claims and Encounters database on Americans with private employer-sponsored insurance, one study estimated that on average, medical expenditures for individuals with ASDs were 4.1 to 6.2 times greater than those without an ASD.<sup>21</sup>
- Over seven percent of U.S. children with disabilities used many more services than their counterparts without disabilities in 1999-2000. The largest differences in utilization were for hospital days, non-physician professional visits and home health provider days. The greater uses resulted in higher healthcare expenditures and higher out-of-pocket costs.<sup>22</sup>

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<sup>17</sup> Ganz, Michael. "The Lifetime Distribution of the Incremental Societal Costs of Autism." *Pediatric Adolescent Medicine*, 2007; 161:343-349.

<sup>18</sup> Jarbrink, Krister. "The Economic Impact of Autism in Britain." Sage Publications, 2001; 5(1): 7-22.

<sup>19</sup> Jarbrink, Krister. "The Economic Consequences of Autistic Spectrum Disorder Among Children in a Swedish Municipality." Sage Publications, 2007; 11(5): 453-463.

<sup>20</sup> Ibid.

<sup>21</sup> Shimabukuro, T. T., S. D. Grosse, et al. (2008). "Medical expenditures for children with an autism spectrum disorder in a privately insured population." *J Autism Dev Disord* 38(3): 546-52.

<sup>22</sup> Newacheck, P. W., M. Inkelas, et al. (2004). "Health Services Use and Health Care Expenditures for Children With Disabilities." *Pediatrics* 114(1): 79-85.

- Using data from the 1996 Medical Expenditure Panel Survey it was found that children with behavioral disorders had greater expenditures for office-based visits and prescription medications than those of children with physical disorders and children without these conditions.<sup>23</sup>
- A retrospective analysis of health insurance claims data indicated that the average healthcare expenditures for individuals with ASDs increased 20.4% per patient between the years 2000 and 2004 after adjusting for inflation.<sup>24</sup>
- In a study that compared Medicaid expenditures for children with ASDs to those of other Medicaid-eligible children in a metro county of Pennsylvania, it was found that, on average, children diagnosed with ASDs had expenditures 10 times more than those of other children. One of the main drivers of this significant cost difference was shown to be inpatient psychiatric care.<sup>25</sup>
- An analysis of administrative data from a large group model health plan in California showed that children with ASDs have a higher annual mean number of total clinic, pediatric, and out-patient visits than children without autism in the same plan. The mean annual age- and gender-adjusted total cost per member was more than threefold higher for children with autism spectrum disorders.<sup>26</sup>
- An analysis of 3 national healthcare surveys revealed that children with ASDs had more out-patient visits, physician visits, and medications prescribed than children in general. Data from the Medical Expenditure Panel Survey (MEPS) showed that children with autism spend more than children in general on total healthcare, total out-patient care, physician visits and prescription medications. Children with autism

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<sup>23</sup> Guevara, J. P., D. S. Mandell, et al. (2003). "National Estimates of Health Services Expenditures for Children With Behavioral Disorders: An analysis of the Medical Expenditure Panel Survey." *Pediatrics* 112(6): e440-6.

<sup>24</sup> Leslie, D. L. and A. Martin (2007). "Health care expenditures associated with autism spectrum disorders." *Archives of Pediatrics & Adolescent Medicine* 161(4): 350-5.

<sup>25</sup> Mandell, David, et al. "Medicaid Expenditures for Children with Autism Spectrum Disorders: 1994-1999." *Journal of Autism and Developmental Disorders*, 2006, 36(4): 457-485.

<sup>26</sup> Croen, L. A., D. V. Najjar, et al. (2006). "A comparison of health care utilization and costs of children with and without autism spectrum disorders in a large group-model health plan." *Pediatrics* 118(4): e1203-11.

also spend significantly more than children with Mental Retardation on total outpatient care and physician visits.<sup>27</sup>

- Results from a small pilot study that measured the parental cost impact of children with ASDs pointed to a considerable economic burden. The study estimated that fifty percent of the total societal costs fall to parents. These costs include out-of-pocket costs and income loss.<sup>28</sup>
- Lost productivity of both individuals with autism and their parents, as well as the costs of adult care, are two of the largest components of the costs of ASDs.<sup>29</sup>
- The lack of supported employment programs for adults with ASD may have negative resource consequences for the economy due to the loss of productivity and the continued need for day care.<sup>30</sup>

In the United States, aggregate costs for specific diagnosis are difficult to track due to inconsistent eligibility criteria for disability classifications.<sup>31</sup> Standardized criteria and processes for diagnosing and tracking the treatment of individuals with ASDs may help to better evaluate the most cost effective services and supports.

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<sup>27</sup> Liptak, G. S., T. Stuart, et al. (2006). "Health Care Utilization and Expenditures for Children with Autism: Data from U.S. National Samples." *Journal of Autism and Developmental Disorders* 36(7): 871-879.

<sup>28</sup> Jarbrink, K., Fombonne, E., & Knapp, M. (2003). Measuring the Parental, Service and Cost Impacts of Children with Autistic Spectrum Disorder: A Pilot Study. *Journal of Autism and Developmental Disorders*, 33(4), 395-402.

<sup>29</sup> Ganz, Michael. "The Lifetime Distribution of the Incremental Societal Costs of Autism." *Pediatric Adolescent Medicine*, 2007; 161:343-349.

<sup>30</sup> Jarbrink, Krister, et al.(2007), "Cost-Impact of Young Adults with High-Functioning Autistic Spectrum Disorder." *Research in Developmental Disabilities*. 28:94-104.

<sup>31</sup> Jacobson, J. W. and J. A. Mulick (2000). "System and cost research issues in treatments for people with autistic disorders." *Journal of Autism and Developmental Disorders* 30(6): 585-593.

## VIII. CONCLUSION

The summary provided in these pages describes in detail the evidence base for interventions for individuals with autism across the age span, and briefly describes the significant costs associated with caring for individuals with autism. This report takes a broader perspective on interventions than the recent National Autism Center report, but comes to similar conclusions. In essence, there is growing and encouraging support for behavioral interventions for young children with autism. Data are scarce or missing altogether, however, on the efficacy of interventions for adolescents and adults with autism.

Beyond the lack of proven efficacy for interventions in older children and adults, there are a number of other challenges to interpreting the implications of findings from efficacy studies for a Medicaid-reimbursed healthcare environment. These challenges include the nature of outcome measures used in efficacy studies, lack of data on effectiveness, ambiguity regarding how the intervention translates into Medicaid-reimbursed services, and lack of studies examining interventions in combinations designed to address more holistically the challenges facing individuals with autism and their families. Below, we address each of these four points.

*Outcome measures.* Most intervention studies reviewed in this document rely on discrete measures of cognitive ability or highly specialized measures of socialization to determine outcomes. While these are important outcomes in their own right, they do not necessarily directly address the mission of Medicaid-reimbursed services to maximize health status and functioning in the community. Intervention studies should consider the use of measures that maximize the ecological validity of findings, including measures of adaptive functioning, maladaptive behavior, and community participation. This distinction is particularly important for children with autism, since many of their needs and associated interventions straddle the often-blurry line between education and healthcare services. If the health issue addressed by interventions is not clearly delineated, the intervention may not be eligible to be considered a health service and therefore covered by Medicaid.

*Measures of effectiveness.* An important distinction must be drawn between efficacy studies, which examine the outcomes of interventions under ideal circumstances, and effectiveness studies, which examine intervention outcomes under conditions approximating those found in



community settings. The often-considerable differences between university-based research settings and community practice settings include the training and motivation of clinicians, resources for implementing the program as it was designed, and the clinical and socio-economic heterogeneity of subjects and their families. As a result of these differences, the effects of interventions observed in research studies often are significantly diminished when the same intervention is used in a community-based practice setting.

A related challenge is the lack of comparative effectiveness studies, in which outcomes of two interventions are compared. In most intervention studies, the comparison group comprises waitlist controls or subjects receiving “treatment as usual.” What constitutes treatment as usual rarely is described, although all evidence suggests that the quality, training and motivation of clinicians in each group differ considerably between settings. It is difficult to assess, therefore, whether improved outcomes in the treatment group relative to the control group are due to the intervention *per se* or to other differences in the setting. Conversely, a lack of difference between groups may mean that elements of the intervention, though unmeasured are being implemented in the comparison condition. More useful for administrators trying to make decisions about intervention packages would be a direct comparison of two evidence-based or promising interventions.

A third consideration with regard to effectiveness, again rarely addressed in intervention studies, is cost effectiveness. Cost effectiveness should be part of comparative effectiveness studies, to examine the return for dollar in each intervention condition. Cost effectiveness also can be examined in more traditional intervention studies, by examining whether the use of an intervention reduces the use of more expensive services, such as emergency or inpatient services. Data on cost effectiveness can provide important support for the adoption of an intervention.

*Translating interventions to community settings.* The fourth set of challenges relate to the extent to which interventions developed and tested in university-based research settings are readily implemented in the context of the community-based service delivery system. For example, what is the service system responsible for implementing the intervention? Generally for children with autism, the choice is between the education and healthcare systems. For adults, the vocational rehabilitation system is another system to consider. If the intervention is designed for use in the healthcare system, which is most relevant for Medicaid-funded services, the biggest issue related to implementation is whether the intervention fits into existing service lines in a given state’s

Medicaid plan. Unless the intervention can be considered a service within the state plan, it cannot be reimbursed using Medicaid funds. Related issues are the qualifications required of the service provider, and whether the reimbursement rate will support those qualifications. One way to address these issues within the context of Medicaid is to consider an intervention as a combination of services that are then bundled. This strategy has been used for Medicaid reimbursed service packages such as Assertive Community Treatment (used to provide intensive case management and other supports to people with serious mental illness).

# **Appendix A**

## **Information Gathering Template**

### **Microsoft Access Database Screenshots**

## Autism Spectrum Disorder (ASD) Services Project Information Gathering Template: Interventions and Services

1. To begin, click the **Add New Record** button at right: Add New Record
2. Then type in the **EndNote Reference #**:
3. And enter information in the fields below:

Page 1 Page 2 Page 3 Page 4

Title of the Study:

Category	Sub-category	Comments
Purpose of the Study:		<input style="width: 100%; height: 30px;" type="text"/>
Diagnostic Labels:	Assessment Method:	<input style="width: 100%; height: 20px;" type="text"/> <input style="width: 100%; height: 20px;" type="text"/>
Co-Morbidities:		<input style="width: 100%; height: 20px;" type="text"/>
Sample Size/Sex:		<input style="width: 100%; height: 20px;" type="text"/>
	Race/Ethnicity:	<input style="width: 100%; height: 20px;" type="text"/>
Age:		<input style="width: 100%; height: 20px;" type="text"/>

Click Page 2 tab to continue...

## Autism Spectrum Disorder (ASD) Services Project Information Gathering Template: Interventions and Services

Page 1 Page 2 Page 3 Page 4

Category	Sub-category	Comments
Intervention/ Service/ Treatment	Name:	<input style="width: 100%; height: 20px;" type="text"/>
	Age Category:	<input type="checkbox"/> Children <input type="checkbox"/> Transitioning Youth <input type="checkbox"/> Adults
	Target Behavior:	<input type="checkbox"/> Development of Communication <input type="checkbox"/> Social Development <input type="checkbox"/> Cognitive Development <input type="checkbox"/> Sensory and Motor Development <input type="checkbox"/> Adaptive Behaviors <input type="checkbox"/> Problem Behaviors
	Description:	<input style="width: 100%; height: 20px;" type="text"/>
Comparison Condition:		<input style="width: 100%; height: 20px;" type="text"/>
Setting:		<input style="width: 100%; height: 20px;" type="text"/>
Provider Type/ Qualifications:		<input style="width: 100%; height: 20px;" type="text"/>
Provider Training:		<input style="width: 100%; height: 20px;" type="text"/>

Click Page 3 tab to continue...

## Autism Spectrum Disorder (ASD) Services Project Information Gathering Template: Interventions and Services

Page 1 Page 2 Page 3 Page 4

Category	Sub-category	Comments
Intervention Duration:		
Intervention Intensity:		
Study Design:		RCT- Randomized, controlled trial (including group randomized designs) RCT- Group randomized trials with discrepant units of analysis, or with an inadequate number of aggregate units ass Quasi- Interrupted time series design Quasi- Regression discontinuity design Quasi- Pretest-posttest non-equivalent comparison group design Case control Cohort study Cross-sectional study Other design
Investigator:		
Measures/ Instruments:		

Click Page 4 tab to continue...

## Autism Spectrum Disorder (ASD) Services Project Information Gathering Template: Interventions and Services

Page 1 Page 2 Page 3 Page 4

Category	Sub-category	Comments
Outcome:		
	Pre/Post or Group Mean Score:	
	p value:	
Generalization:		
	Providers:	
	Stimulus:	
Maintenance:		
Limitations:		
Rating:		<input type="text" value=""/>
Comments:		

4. When you have finished entering information into the form, click the Save button:

Save Record



# **Appendix B**

## **Manuscript Citations by Population Group and Level**

Children, Level 1

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Antecedent Package	Anan, R. M., Warner, L. J., McGillivray, J. E., Chong, I. M., & Hines, S. J. (2008). Group Intensive Family Training (GIFT) for preschoolers with autism spectrum disorders. <i>Behavioral Interventions</i> , 23(3), 165-180.	Other design	72	✓	✓		✓	✓	✓	
	Conroy, M. A., Asmus, J. M., Sellers, J. A., & Ladwig, C. N. (2005). The Use of an Antecedent-Based Intervention to Decrease Stereotypic Behavior in a General Education Classroom: A Case Study. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 20(4), 223-230.	Other design	1		✓				✓	
	DeLeon, I. G., Neidert, P. L., Anders, B. M., & Rodriguez-Catter, V. (2001). Choices between positive and negative reinforcement during treatment for escape-maintained behavior. <i>J Appl Behav Anal</i> , 34(4), 521-525.	Other design	1						✓	
	Ducharme, J. M., & Drain, T. L. (2004). Errorless Academic Compliance Training: Improving Generalized Cooperation With Parental Requests in Children With Autism. <i>Journal of the American Academy of Child &amp; Adolescent Psychiatry</i> , 43(2), 163-171.	Other design	4						✓	
	Ducharme, J. M., Sanjuan, E., & Drain, T. (2007). Errorless compliance training: success-focused behavioral treatment of children with Asperger syndrome. <i>Behav Modif</i> , 31(3), 329-344.	Other design	3	✓			✓		✓	
	Finkel, A. S., & Williams, R. L. (2001). A comparison of textual and echoic prompts on the acquisition of intraverbal behavior in a six-year-old boy with autism. <i>Analysis of Verbal Behavior</i> , 18, 61-70.	Other design	1	✓						
	Koegel, L. K., Koegel, R. L., Frea, W., & Green-Hopkins, I. (2003). Clinical forum. Priming as a method of coordinating educational services for students with autism. <i>Language, Speech, &amp; Hearing Services in Schools</i> , 34(3), 228.	Interrupted time series design	2						✓	
	Ledford, J. R., Gast, D. L., Luscre, D., & Ayres, K. M. (2008). Observational and incidental learning by children with autism during small group instruction. <i>J Autism Dev Disord</i> , 38(1), 86-103.	Other design	6	✓	✓					
	Liber, D. B., Frea, W. D., & Symon, J. B. (2008). Using time-delay to improve social play skills with peers for children with autism. <i>J Autism Dev Disord</i> , 38(2), 312-323.	Other design	3		✓					
	Romano, J. P., & Roll, D. (2000). Expanding the utility of behavioral momentum for youth with developmental disabilities. <i>Behavioral Interventions</i> , 15(2), 99-111.	Interrupted time series design	3					✓	✓	
	Sawyer, L. M., Luiselli, J. K., Ricciardi, J. N., & Gower, J. L. (2005). Teaching a Child with Autism to Share Among Peers in an Integrated Preschool Classroom: Acquisition, Maintenance, and Social Validation. <i>Education and Treatment of Children</i> , 28(1), 1-10.	Other design	1		✓					
	Schreibman, & Whalen, L. (2000). The use of video priming to reduce disruptive transition behavior in children with autism. <i>Journal of Positive Behavior Interventions</i> , 2(1), 3.	Other design	3		✓				✓	
	Behavioral Package	Ahearn, W. H., Clark, K. M., Gardenier, N. C., Chung, B. I., & Dube, W. V. (2003). Persistence of stereotypic behavior: examining the effects of external reinforcers. <i>J Appl Behav Anal</i> , 36(4), 439-448.	Interrupted time series design	3						✓
		Ahearn, W. H., Clark, K. M., MacDonald, R. P. F., & Chung, B. I. (2007). Assessing and treating vocal stereotypy in children with autism. <i>Journal of Applied Behavior Analysis</i> , 40(2), 263-275.	Other design	4						✓
Athens, E. S., Vollmer, T. R., Sloman, K. N., & St Peter Pipkin, C. (2008). An analysis of vocal stereotypy and therapist fading. <i>J Appl Behav Anal</i> , 41(2), 291-297.		Other design	1	✓						
Bernard-Opitz, V., Ing, S., & Kong, T. Y. (2004). Comparison of behavioural and natural play interventions for young children with autism. <i>Autism</i> , 8(3), 319-333.		Other design	8	✓						
Britton, L. N., Carr, J. E., Kellum, K. K., Dozier, C. L., & Weil, T. M. (2000). A variation of noncontingent reinforcement in the treatment of aberrant behavior. <i>Res Dev Disabil</i> , 21(6), 425-435.		Other design	3						✓	
Brown, K. A., Wacker, D. P., Derby, K. M., Peck, S. M., Richman, D. M., Sasso, G. M., et al. (2000). Evaluating the effects of functional communication training in the presence and absence of establishing operations. <i>J Appl</i>		Other design	4						✓	
Buffington, D. M., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1998). Procedures for teaching appropriate gestural communication skills to children with autism. <i>J Autism Dev Disord</i> , 28(6), 535-545.		Other design	4	✓						
Carr, J. E., Dozier, C. L., Patel, M. R., Adams, A. N., & Martin, N. (2002). Treatment of automatically reinforced object mouthing with noncontingent reinforcement and response blocking: experimental analysis and social		Interrupted time series design	1						✓	
Chandler, S., Christie, P., Newson, E., & Prevezer, W. (2002). Developing a diagnostic and intervention package for 2- to 3-year-olds with autism: outcomes of the frameworks for communication approach. <i>Autism</i> , 6(1), 47-69.		Other design	10	✓	✓					
Charlop-Christy, M. H., & Haymes, L. K. (1998). Using objects of obsession as token reinforcers for children with autism. <i>J Autism Dev Disord</i> , 28(3), 189-198.		Interrupted time series design	3	✓	✓				✓	
Cicero, F. R., & Pfadt, A. (2002). Investigation of a reinforcement-based toilet training procedure for children with autism. <i>Res Dev Disabil</i> , 23(5), 319-331.		Other design	3					✓		
DeLeon, I. G., Fisher, W. W., Herman, K. M., & Crosland, K. C. (2000). Assessment of a response bias for aggression over functionally equivalent appropriate behavior. <i>Journal of Applied Behavior Analysis</i> , 33(1), 73-77.		Other design	1	✓	✓					
Dixon, M. R., & Cummings, A. (2001). Self-control in children with autism: response allocation during delays to reinforcement. <i>J Appl Behav Anal</i> , 34(4), 491-495.		Interrupted time series design	3						✓	
Dyer, K., Martino, G. M., & Parvenski, T. (2006). The River Street Autism Program: a case study of a regional service center behavioral intervention program. <i>Behav Modif</i> , 30(6), 925-943.		Other design	19	✓	✓	✓				
Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2002). Intensive behavioral treatment at school for 4- to 7-year-old children with autism. A 1-year comparison controlled study. <i>Behav Modif</i> , 26(1), 49-68.		Pretest-posttest non-equivalent comparison group design	25	✓	✓		✓	✓		
Gresham, F. M., & MacMillan, D. L. (1998). Early intervention project: Can its claims be substantiated and its effects replicated? <i>Journal of Autism and Developmental Disorders</i> , 28(1), 5-13.		Pretest-posttest non-equivalent comparison group design	59	✓	✓	✓		✓	✓	
Hoch, H., McComas, J. J., Thompson, A. L., & Paone, D. (2002). Concurrent reinforcement schedules: behavior change and maintenance without extinction. <i>J Appl Behav Anal</i> , 35(2), 155-169.	Interrupted time series design	3						✓		

Children, Level 1

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Behavioral Package	Jahr, E. (2001). Teaching children with autism to answer novel wh-questions by utilizing a multiple exemplar strategy. <i>Res Dev Disabil</i> , 22(5), 407-423.	Other design	4	✓						
	Keen, D., Sigafoos, J., & Woodyatt, G. (2001). Replacing prelinguistic behaviors with functional communication. <i>J Autism Dev Disord</i> , 31(4), 385-398.	Other design	4	✓						
	Kennedy, C. H., Meyer, K. A., Knowles, T., & Shukla, S. (2000). Analyzing the multiple functions of stereotypical behavior for students with autism: implications for assessment and treatment. <i>Journal of Applied Behavior Analysis</i> , 27(2), 257-266.	Other design	1				✓			✓
	Kern, L., Starosta, K., & Adelman, B. E. (2006). Reducing pica by teaching children to exchange inedible items for edibles. <i>Behav Modif</i> , 30(2), 135-158.	Interrupted time series design	2							✓
	Levin, L., & Carr, E. G. (2001). Food selectivity and problem behavior in children with developmental disabilities. <i>Analysis and Intervention</i> , 25(3), 443-470.	Interrupted time series design	4							✓
	Magiati, I., Charman, T., & Howlin, P. (2007). A two-year prospective follow-up study of community-based early intensive behavioural intervention and specialist nursery provision for children with autism spectrum disorders. <i>J Child Psychol Psychiatry</i> , 48(8), 803-812.	Pretest-posttest non-equivalent comparison group design	44	✓	✓	✓	✓	✓	✓	✓
	Mullins, J. L., & Christian, L. (2001). The effects of progressive relaxation training on the disruptive behavior of a boy with autism. <i>Res Dev Disabil</i> , 22(6), 449-462.	Other design	1							✓
	O'Neill, R. E., & Sweetland-Baker, M. (2001). Brief report: An assessment of stimulus generalization and contingency effects in functional communication training with two students with autism. <i>J Autism Dev Disord</i> , 31(4), 385-398.	Other design	2							✓
	Ricciardi, J. N., Luiselli, J. K., Terrill, S., & Reardon, K. (2003). Alternative response training with contingent practice as intervention for pica in a school setting. <i>Behavioral Interventions</i> , 18(3), 219-226.	Interrupted time series design	1							✓
	Ross, D. E., & Greer, R. D. (2003). Generalized imitation and the mand: inducing first instances of speech in young children with autism. <i>Res Dev Disabil</i> , 24(1), 58-74.	Other design	5	✓						
	Sidener, T. M., Carr, J. E., & Firth, A. M. (2005). Superimposition and withholding of edible consequences as treatment for automatically reinforced stereotypy. <i>J Appl Behav Anal</i> , 38(1), 121-124.	Other design	2							✓
	Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. [erratum appears in Am J Ment Retard 2000 Nov;105(6):508]. <i>American Journal of Mental Retardation</i> , 105(4), 269-285.	Group randomized trial with discrepant units of analysis, or with an inadequate number of aggregate units assigned to condition	28		✓				✓	
Solomon, M., Ono, M., Timmer, S., & Goodlin-Jones, B. (2008). The effectiveness of parent-child interaction therapy for families of children on the autism spectrum. <i>J Autism Dev Disord</i> , 38(9), 1767-1776.	Pretest-posttest non-equivalent comparison group design	19		✓				✓	✓	
Vollmer, T. R., Borrero, J. C., Lalli, J. S., & Daniel, D. (1999). Evaluating self-control and impulsivity in children with severe behavior disorders. <i>J Appl Behav Anal</i> , 32(4), 451-466.	Interrupted time series design	2							✓	
Cognitive Behavioral Intervention Package	Bauminger, N. (2002). The facilitation of social-emotional understanding and social interaction in high-functioning children with autism: intervention outcomes. <i>J Autism Dev Disord</i> , 32(4), 283-298.	Other design	15		✓	✓				
	Bauminger, N. (2007). Brief report: individual social-multi-modal intervention for HFASD. <i>J Autism Dev Disord</i> , 37(8), 1593-1604.	Other design	19	✓	✓	✓				
	Chalfant, A. M., Rapee, R., & Carroll, L. (2007). Treating anxiety disorders in children with high functioning autism spectrum disorders: a controlled trial. <i>J Autism Dev Disord</i> , 37(10), 1842-1857.	Pretest-posttest non-equivalent comparison group design	47			✓			✓	
	Lopata, C., Thomeer, M. L., Volker, M. A., & Nida, R. E. (2006). Effectiveness of a Cognitive-Behavioral Treatment on the Social Behaviors of Children With Asperger Disorder. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 21(4), 237-244.	Other design	21		✓					
	Lopata, C., Thomeer, M. L., Volker, M. A., Nida, R. E., & Lee, G. K. (2008). Effectiveness of a manualized summer social treatment program for high-functioning children with autism spectrum disorders. <i>J Autism Dev Disord</i> , 38(5), 890-904.	Randomized, controlled trial (including group randomized designs)	54	✓	✓					
	Ooi, Y. P., Lam, C. M., Sung, M., Tan, W. T., Goh, T. J., Fung, D. S., et al. (2008). Effects of cognitive-behavioural therapy on anxiety for children with high-functioning autistic spectrum disorders. <i>Singapore Med J</i> , 49(3), 215-220.	Other design	6		✓				✓	
	Reaven, J., & Hepburn, S. (2003). Cognitive-behavioral treatment of obsessive-compulsive disorder in a child with Asperger syndrome: A case report. <i>Autism</i> , 7(2), 145-164.	Other design	1						✓	
	Sofronoff, K., Attwood, T., & Hinton, S. (2005). A randomised controlled trial of a CBT intervention for anxiety in children with Asperger syndrome. <i>J Child Psychol Psychiatry</i> , 46(11), 1152-1160.	Randomized, controlled trial (including group randomized designs)	71		✓	✓				
	Sze, K. M., & Wood, J. J. (2007). Cognitive behavioral treatment of comorbid anxiety disorders and social difficulties in children with high-functioning autism: A case report. <i>Journal of Contemporary Psychotherapy</i> , 37(3), 133-143.	Other design	1		✓				✓	
	Bibby, P., Eikeseth, S., Martin, N. T., Mudford, O. C., & Reeves, D. (2001). Progress and outcomes for children with autism receiving parent-managed intensive interventions. <i>Research in Developmental Disabilities</i> , 22(6), 425-447.	Pretest-posttest non-equivalent comparison group design	66	✓		✓			✓	
Boulware, G.-L., Schwartz, I. S., Sandall, S. R., & McBride, B. J. (2006). Project DATA for Toddlers: An Inclusive Approach to Very Young Children With Autism Spectrum Disorder. <i>Topics in Early Childhood Special Education</i> , 26(2), 94-105.	Other design	8	✓		✓			✓		
Boyd, R. D., & Corley, M. J. (2001). Outcome survey of early intensive behavioral intervention for young children with autism in a community setting. <i>Autism</i> , 5(4), 430-441.	Pretest-posttest non-equivalent comparison group design	22	✓		✓			✓		
Butter, E. M., Mulick, J. A., & Metz, B. (2006). Eight case reports of learning recovery in children with pervasive developmental disorders after early intervention. <i>Behavioral Interventions</i> , 21(4), 227-243.	Other design	8	✓	✓	✓			✓		



Children, Level 1

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Comprehensive Behavioral Treatment for Young Children	Cohen, H., Amerine-Dickens, M., & Smith, T. (2006). Early intensive behavioral treatment: replication of the UCLA model in a community setting. <i>J Dev Behav Pediatr</i> , 27(2 Suppl), S145-155.	Pretest-posttest non-equivalent comparison group design	42	✓	✓	✓		✓		
	Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2007). Outcome for children with autism who began intensive behavioral treatment between ages 4 and 7: a comparison controlled study. <i>Behav Modif</i> , 31(3), 264-278.	Pretest-posttest non-equivalent comparison group design	25	✓	✓	✓		✓	✓	
	Eldevik, S., Eikeseth, S., Jahr, E., & Smith, T. (2006). Effects of low-intensity behavioral treatment for children with autism and mental retardation. <i>J Autism Dev Disord</i> , 36(2), 211-224.	Pretest-posttest non-equivalent comparison group design	28	✓	✓	✓	✓	✓		
	Graff, R. B., Green, G., & Libby, M. E. (1998). Effects of two levels of treatment intensity on a young child with severe disabilities. <i>Behavioral Interventions</i> , 13(1), 21-41.	Other design	1	✓	✓	✓	✓		✓	
	Green, G., Brennan, L. C., & Fein, D. (2002). Intensive behavioral treatment for a toddler at high risk for autism. <i>Behav Modif</i> , 26(1), 69-102.	Other design	1	✓	✓					
	Hilton, J. C., & Seal, B. C. (2007). Brief report: comparative ABA and DIR trials in twin brothers with autism. <i>J Autism Dev Disord</i> , 37(6), 1197-1201.	Pretest-posttest non-equivalent comparison group design	2	✓						
	Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive behavior analytic and eclectic treatments for young children with autism. <i>Res Dev Disabil</i> , 26(4), 359-383.	Pretest-posttest non-equivalent comparison group design	61	✓	✓	✓	✓	✓		
	Reed, P., Osborne, L. A., & Corness, M. (2007). Brief report: relative effectiveness of different home-based behavioral approaches to early teaching intervention. <i>J Autism Dev Disord</i> , 37(9), 1815-1821.	Pretest-posttest non-equivalent comparison group design	27			✓		✓		
	Reed, P., Osborne, L. A., & Corness, M. (2007). The Real-World Effectiveness of Early Teaching Interventions for Children With Autism Spectrum Disorder. <i>Exceptional Children</i> , 73(4), 417-433.	Pretest-posttest non-equivalent comparison group design	48			✓		✓		
	Remington, B., Hastings, R. P., Kovshoff, H., degli Espinosa, F., Jahr, E., Brown, T., et al. (2007). Early intensive behavioral intervention: outcomes for children with autism and their parents after two years. <i>Am J Ment Retard</i> , 112(6), 418-438.	Pretest-posttest non-equivalent comparison group design	44							
	Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: four-year outcome and predictors. <i>Am J Ment Retard</i> , 110(6), 417-438.	Randomized, controlled trial (including group randomized designs)	23	✓	✓	✓		✓		
	Schwartz, I. S., Sandall, S. R., McBride, B. J., & Bouliware, G.-L. (2004). Project DATA (Developmentally Appropriate Treatment for Autism): An Inclusive School-Based Approach to Educating Young Children with Autism. <i>Topics in Early Childhood Special Education</i> , 24(3), 156-168.	Other design	48	✓	✓	✓	✓	✓	✓	
	Sheinkopf, S. J., & Siegel, B. (1998). Home-based behavioral treatment of young children with autism. <i>J Autism Dev Disord</i> , 28(1), 15-23.	Cohort study	22			✓				
	Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. <i>Am J Ment Retard</i> , 105(4), 269-285.	Randomized, controlled trial (including group randomized designs)	28	✓	✓	✓	✓	✓	✓	
Stahmer, A. C., Ingersoll, B., & Koegel, R. L. (2004). Inclusive programming for toddlers autism spectrum disorders: Outcomes from the Children's Toddler School. <i>Journal of Positive Behavior Interventions</i> , 6(2), 67-82.	Other design	20	✓	✓	✓		✓			
Zachor, D. A., Ben-Itzhak, E., Rabinovich, A.-L., & Lahat, E. (2007). Change in autism core symptoms with intervention. <i>Research in Autism Spectrum Disorders</i> , 1(4), 304-317.	Pretest-posttest non-equivalent comparison group design	39	✓	✓	✓					
Joint Attention Intervention	Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright, S., et al. (2002). A pilot randomised controlled trial of a parent training intervention for pre-school children with autism: Preliminary findings and methodological challenges. <i>European Child &amp; Adolescent Psychiatry</i> , 11(6), 266-272.	Randomized, controlled trial (including group randomized designs)	24	✓	✓	✓		✓		
	Kasari, C., Freeman, S., & Paparella, T. (2006). Joint attention and symbolic play in young children with autism: a randomized controlled intervention study. <i>J Child Psychol Psychiatry</i> , 47(6), 611-620.	Randomized, controlled trial (including group randomized designs)	58	✓	✓					
	McDuffie, A. S., Yoder, P. J., & Stone, W. L. (2006). Labels increase attention to novel objects in children with autism and comprehension-matched children with typical development. <i>Autism</i> , 10(3), 288-301.	Case control	34	✓	✓		✓			
	Rollins, P. R., Wambach, I., Dowell, D., Mathews, L., & Reese, P. B. (1998). An intervention technique for children with autistic spectrum disorder: joint attentional routines. <i>J Commun Disord</i> , 31(2), 181-192; quiz 192-183.	Other design	1	✓	✓					
	Schertz, H. H., & Odom, S. L. (2007). Promoting joint attention in toddlers with autism: a parent-mediated developmental model. <i>J Autism Dev Disord</i> , 37(8), 1562-1575.	Interrupted time series design	3		✓					
	Taylor, B. A., & Hoch, H. (2008). Teaching children with autism to respond to and initiate bids for joint attention. <i>J Appl Behav Anal</i> , 41(3), 377-391.	Other design	3	✓	✓					
	Whalen, C., & Schreibman, L. (2003). Joint attention training for children with autism using behavior modification procedures. <i>J Child Psychol Psychiatry</i> , 44(3), 456-468.	Other design	5	✓	✓					
Multi-component Package	Luiselli, J. K., Wolongevicz, J., Egan, P., Amirault, D., Sciaraffa, N., & Trembl, T. (1999). The Family Support Program: Description of a preventive, community-based behavioral intervention for children with pervasive developmental disorders. <i>Child &amp; Family Behavior Therapy</i> , 21(1), 1-18.	Other design	7					✓	✓	
	Perez-Gonzalez, L. A., & Williams, G. (2002). Multi-component procedure to teach conditional discriminations to children with autism. <i>Am J Ment Retard</i> , 107(4), 293-301.	Other design	5			✓				
	Reeve, S. A., Reeve, K. F., Townsend, D. B., & Poulson, C. L. (2007). Establishing a generalized repertoire of helping behavior in children with autism. <i>J Appl Behav Anal</i> , 40(1), 123-136.	Other design	4		✓					
		Other design								

Children, Level 1

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Multi-component Package	Rickards, A. L., Walstab, J. E., Wright-Rossi, R. A., Simpson, J., & Reddibough, D. S. (2007). A randomized, controlled trial of a home-based intervention program for children with autism and developmental delay. <i>J Dev Behav Pediatr</i> , 28(4), 308-316.	Randomized, controlled trial (including group randomized designs)	59			✓		✓		
	Sofronoff, K., Leslie, A., & Brown, W. (2004). Parent management training and Asperger syndrome: a randomized controlled trial to evaluate a parent based intervention. <i>Autism: The International Journal Of Research And Practice</i> , 8(3), 301-317.	Randomized, controlled trial (including group randomized designs)	51	✓	✓				✓	
Naturalistic Teaching Strategies	Carter, C. M. (2001). Using choice with game play to increase language skills and interactive behaviors in children with autism. <i>Journal of Positive Behavior Interventions</i> , 3(3), 131-151.	Pretest-posttest non-equivalent comparison group design	3	✓	✓					
	Grela, B. G., & McLaughlin, K. S. (2006). Focused stimulation for a child with autism spectrum disorder: a treatment study. <i>Journal of Autism &amp; Developmental Disorders</i> , 36(6), 753-756.	Interrupted time series design	1		✓	✓				
	Ingersoll, B., & Schreibman, L. (2006). Teaching reciprocal imitation skills to young children with autism using a naturalistic behavioral approach: effects on language, pretend play, and joint attention. <i>Journal of Autism &amp; Developmental Disorders</i> , 36(4), 487-505.	Other design	5		✓					
	Jewell, J. D., Grippi, A., Hupp, S. D., & Krohn, E. J. (2007). The effects of a rotating classroom schedule on classroom crisis events in a school for autism. <i>North American Journal of Psychology</i> , 9(1), 37-52.	Other design	81						✓	
	Koegel, R. L., Camarata, S., Koegel, L. K., Ben-Tall, A., & Smith, A. E. (1998). Increasing speech intelligibility in children with autism. <i>J Autism Dev Disord</i> , 28(3), 241-251.	Interrupted time series design	5	✓						
	Yoder, P., & Stone, W. L. (2006). Randomized comparison of two communication interventions for preschoolers with autism spectrum disorders. <i>J Consult Clin Psychol</i> , 74(3), 426-435.	Randomized, controlled trial (including group randomized designs)	36		✓					
	Chung, K. M., Reavis, S., Mosconi, M., Drewry, J., Matthews, T., & Tasse, M. J. (2007). Peer-mediated social skills training program for young children with high-functioning autism. <i>Res Dev Disabil</i> , 28(4), 423-436.	Other design	7	✓	✓					
Peer Training Package	Garfinkle, A. N., & Schwartz, I. S. (2002). Peer Imitation: Increasing Social Interactions in Children with Autism and Other Developmental Disabilities in Inclusive Preschool Classrooms. <i>Topics in Early Childhood Special Education</i> , 22(1), 26.	Pretest-posttest non-equivalent comparison group design	4		✓					
	Kok, A. J., Kong, T. Y., & Bernard-Opitz, V. (2002). A comparison of the effects of structured play and facilitated play approaches on preschoolers with autism. <i>Autism</i> , 6(2), 181-196.	Pretest-posttest non-equivalent comparison group design	8	✓	✓					
	Laushey, K. M., & Heflin, L. J. (2000). Enhancing social skills of kindergarten children with autism through the training of multiple peers as tutors. <i>Journal of Autism and Developmental Disorders</i> , 30(3), 183-193.	Interrupted time series design	2		✓					
	Lofin, R. L., Odum, S. L., & Lantz, J. F. (2008). Social interaction and repetitive motor behaviors. <i>J Autism Dev Disord</i> , 38(6), 1124-1135.	Other design	3	✓	✓		✓			
	Petursdottir, A.-L., McComas, J., McMaster, K., & Horner, K. (2007). The effects of scripted peer tutoring and programming common stimuli on social interactions of a student with autism spectrum disorder. <i>Journal of Applied Behavior Analysis</i> , 40(2), 353-357.	Pretest-posttest non-equivalent comparison group design	4		✓					
	Smith, T., Lovaas, N. W., & Lovaas, O. I. (2002). Behaviors of children with high-functioning autism when paired with typically developing versus delayed peers: A preliminary study. <i>Behavioral Interventions</i> , 17(3), 129-143.	Pretest-posttest non-equivalent comparison group design	24	✓	✓					
	Thiemann, K. S., & Goldstein, H. (2004). Effects of peer training and written text cueing on social communication of school-age children with pervasive developmental disorder. <i>J Speech Lang Hear Res</i> , 47(1), 126-144.	Interrupted time series design	5	✓	✓					
	Woodmansee, K. B. (2005). Sorting out the puzzle pieces of autistic disorders: Examining the effectiveness of group treatment on social functioning of children with pervasive developmental disorders (pdd). Woodmansee, Katva B.: The Wright Inst., US.	Other design	33		✓					
	Yang, T. R., Wolfberg, P. J., Wu, S. C., & Hwu, P. Y. (2003). Supporting children on the autism spectrum in peer play at home and school: piloting the integrated play groups model in Taiwan. <i>Autism</i> , 7(4), 437-453.	Other design	2		✓					
	Picture Exchange Communication System	Carr, D., & Felce, J. (2007). The effects of PECS teaching to Phase III on the communicative interactions between children with autism and their teachers. <i>J Autism Dev Disord</i> , 37(4), 724-737.	Randomized, controlled trial (including group randomized designs)	24	✓					
Charlop-Christy, M. H., Carpenter, M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using the picture exchange communication system (PECS) with children with autism: assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. <i>Journal of Applied Behavior Analysis</i> , 35(3), 213-231.		Other design	3	✓	✓				✓	
Ganz, J. B., & Simpson, R. L. (2004). Effects on communicative requesting and speech development of the Picture Exchange Communication System in children with characteristics of autism. <i>J Autism Dev Disord</i> , 34(4), 395-409.		Other design	3	✓						
Howlin, P., Gordon, R. K., Pasco, G., Wade, A., & Charman, T. (2007). The effectiveness of Picture Exchange Communication System (PECS) training for teachers of children with autism: a pragmatic, group randomised controlled trial. <i>J Child Psychol Psychiatry</i> , 48(5), 473-481.		Randomized, controlled trial (including group randomized designs)	84	✓						
Kravits, T. R., Kamps, D. M., Kemmerer, K., & Potucek, J. (2002). Brief report: increasing communication skills for an elementary-aged student with autism using the Picture Exchange Communication System. <i>J Autism Dev Disord</i> , 32(3), 225-230.		Other design	1	✓	✓					
Marckel, J. M., Neef, N. A., & Ferreri, S. J. (2006). A preliminary analysis of teaching improvisation with the picture exchange communication system to children with autism. <i>J Appl Behav Anal</i> , 39(1), 109-115.		Other design	2	✓						
Schwartz, I. S., Garfinkle, A. N., & Bauer, J. (1998). The Picture Exchange Communication System: Communicative outcomes for young children with disabilities. <i>Topics in Early Childhood Special Education</i> , 18(3), 144-159.		Other design	49	✓	✓					

Children, Level 1

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Picture Exchange Communication System	Tincani, M. (2004). Comparing the Picture Exchange Communication System and Sign Language Training for Children with Autism. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 19(3), 152-163.	Other design	2	✓						
	Yoder, P., & Stone, W. L. (2006). A randomized comparison of the effect of two prelinguistic communication interventions on the acquisition of spoken communication in preschoolers with ASD. <i>J Speech Lang Hear Res</i> , 49(4), 698-711.	Randomized, controlled trial (including group randomized designs)	36	✓						
	Yoder, P., & Stone, W. L. (2006). Randomized comparison of two communication interventions for preschoolers with autism spectrum disorders. <i>J Consult Clin Psychol</i> , 74(3), 426-435.	Randomized, controlled trial (including group randomized designs)	36		✓					
Schedules	Betz, A., Higbee, T. S., & Reagon, K. A. (2008). Using joint activity schedules to promote peer engagement in preschoolers with autism. <i>J Appl Behav Anal</i> , 41(2), 237-241.	Other design	6	✓	✓					
	Bryan, L. C., & Gast, D. L. (2000). Teaching on-task and on-schedule behaviors to high-functioning children with autism via picture activity schedules. <i>Journal of Autism and Developmental Disorders</i> , 30(6), 553-567.	Interrupted time series design	4			✓				
	Hume, K., & Odom, S. (2007). Effects of an Individual Work System on the Independent Functioning of Students with Autism. <i>Journal of Autism and Developmental Disorders</i> , 37(6), 1166-1180.	Interrupted time series design	3		✓				✓	
	O'Reilly, M., Sigafoos, J., Lancioni, G., Edrisinha, C., & Andrews, A. (2005). An examination of the effects of a classroom activity schedule on levels of self-injury and engagement for a child with severe autism. <i>J Autism Dev Disord</i> , 35(3), 305-311.	Other design	1							✓
	Aldred, C., Green, J., & Adams, C. (2004). A new social communication intervention for children with autism: pilot randomised controlled treatment study suggesting effectiveness. <i>J Child Psychol Psychiatry</i> , 45(8), 1420-1430.	Randomized, controlled trial (including group randomized designs)	28	✓						
Social Communication Intervention	Ingersoll, B., Dvortcsak, A., Whalen, C., & Sikora, D. (2005). The Effects of a Developmental, Social-Pragmatic Language Intervention on Rate of Expressive Language Production in Young Children With Autistic Spectrum Disorders. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 20(4), 213-222.	Other design	3	✓						
	Mackay, T., Knott, F., & Dunlop, A. W. (2007). Developing social interaction and understanding in individuals with autism spectrum disorder: a groupwork intervention. <i>J Intellect Dev Disabil</i> , 32(4), 279-290.	Other design	46	✓	✓					
	McConachie, H., Randle, V., Hammal, D., & Le Couteur, A. (2005). A controlled trial of a training course for parents of children with suspected autism spectrum disorder. <i>J Pediatr</i> , 147(3), 335-340.	Pretest-posttest non-equivalent comparison group design	51	✓						
	Barry, T. D., Klinger, L. G., Lee, J. M., Palardy, N., Gilmore, T., & Bodin, S. D. (2003). Examining the Effectiveness of an Outpatient Clinic-Based Social Skills Group for High-Functioning Children with Autism. <i>Journal of Autism &amp; Developmental Disorders</i> , 33(6), 685-701.	Other design	4		✓					
Social Skills Package	Bauminger, N. (2007). Brief report: group social-multimodal intervention for HFASD. <i>J Autism Dev Disord</i> , 37(8), 1605-1615.	Other design	26		✓					
	Beaumont, R., & Sofronoff, K. (2008). A multi-component social skills intervention for children with Asperger syndrome: the Junior Detective Training Program. <i>J Child Psychol Psychiatry</i> , 49(7), 743-753.	Randomized, controlled trial (including group randomized designs)	49	✓	✓					
	Chin, H. Y., & Bernard-Opitz, V. (2000). Teaching conversation skills to children with autism: Effect on the development of a theory of mind. <i>Journal of Autism and Developmental Disorders</i> , 30(6), 569-583.	Pretest-posttest non-equivalent comparison group design	3	✓						
	Crooke, P. J., Hendrix, R. E., & Rachman, J. Y. (2008). Brief Report: measuring the effectiveness of teaching social thinking to children with Asperger syndrome (AS) and High Functioning Autism (HFA). <i>J Autism Dev Disord</i> , 38(3), 581-591.	Other design	6	✓						
	Hupp, S. D. A., & Reitman, D. (2000). Parent-Assisted Modification of Pivotal Social Skills for a Child Diagnosed with PDD: A Clinical Replication. <i>Journal of Positive Behavior Interventions</i> , 2(3), 183.	Other design	1	✓						
	LeGoff, D. B. (2004). Use of LEGO as a therapeutic medium for improving social competence. <i>J Autism Dev Disord</i> , 34(5), 557-571.	Pretest-posttest non-equivalent comparison group design	47		✓					
	LeGoff, D. B., & Sherman, M. (2006). Long-term outcome of social skills intervention based on interactive LEGO play. <i>Autism</i> , 10(4), 317-329.	Pretest-posttest non-equivalent comparison group design	60		✓					
	Trimarchi, C. L. (2004). The implementation and evaluation of a social skills training program for children with asperger syndrome. Trimarchi, Carrie L : State U New York At Albany, US.	Other design	11		✓					
	Adams, L., Gouvousis, A., VanLue, M., & Waldron, C. (2004). Social Story Intervention: Improving Communication Skills in a Child with an Autism Spectrum Disorder. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 19(2), 87-94.	Interrupted time series design	1							✓
	Barry, L. M., & Burrell, S. B. (2004). Using Social Stories to Teach Choice and Play Skills to Children with Autism. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 19(1), 45-51.	Other design	2		✓				✓	
Bellon, M. L., Ogletree, B. T., & Harn, W. E. (2000). Repeated Storybook Reading as a Language Intervention for Children with Autism. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 15(1), 52.	Other design	1	✓							
Bledsoe, R., Myles, B. S., & Simpson, R. (2003). Use of a Social Story intervention to improve mealtime skills of an adolescent with Asperger syndrome. <i>Autism</i> , 7(3), 289-295.	Interrupted time series design	1						✓		
Hagiwara, T., & Myles, B. S. (1999). A Multimedia Social Story Intervention: Teaching Skills to Children with Autism. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 14(2), 82.	Other design	3						✓		
Ivey, M. L., Heflin, L. J., & Alberto, P. (2004). The Use of Social Stories to Promote Independent Behaviors in Novel Events for Children with PDD-NOS. <i>Focus on Autism and Other Developmental Disabilities</i> , 19(3), 164-176.	Interrupted time series design	3		✓						
Story-based Intervention Package	Kuoch, H., & Mirenda, P. (2003). Social Story Interventions for Young Children with Autism Spectrum Disorders. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 18(4), 219-227.	Interrupted time series design	3						✓	
	Kuttler, S., & Myles, B. S. (1998). The Use of Social Stories to Reduce Precursors to Tantrum Behavior in a Student with Autism. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 13(3), 176.	Interrupted time series design	1		✓					✓

Children, Level 1

Intervention Name	Citation	Design	Sample Size	Target Behaviors							
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior		
	Lorimer, P. A., Simpson, R. L., Myles, B. S., & Ganz, J. B. (2002). The use of social stories as a preventative behavioral intervention in a home setting with a child with autism. <i>Journal of Positive Behavior Interventions</i> , 4(1), 53-60.	Case control	1						✓	✓	
	Norris, C., & Dattilo, J. (1999). Evaluating Effects of a Social Story Intervention on a Young Girl with Autism. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 14(3), 180.	Other design	1		✓						
	Ozdemir, S. (2008). The effectiveness of social stories on decreasing disruptive behaviors of children with autism: three case studies. <i>J Autism Dev Disord</i> , 38(9), 1689-1696.	Other design	3		✓						
	Reynhout, G., & Carter, M. (2007). Social Story Efficacy With a Child With Autism Spectrum Disorder and Moderate Intellectual Disability. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 22(3), 173-182.	Other design	1							✓	
	Sansosti, F. J., & Powell-Smith, K. A. (2006). Using social stories to improve the social behavior of children with Asperger syndrome. <i>Journal of Positive Behavior Interventions</i> , 8(1), 43-57.	Other design	3		✓						
	Scattone, D., Tingstrom, D. H., & Wilczynski, S. M. (2006). Increasing Appropriate Social Interactions of Children With Autism Spectrum Disorders Using Social Stories. <i>Focus on Autism and Other Developmental Disabilities</i> , 21(4), 211-222.	Other design	3		✓					✓	
	Scattone, D., Wilczynski, S. M., Edwards, R. P., & Rabian, B. (2002). Decreasing disruptive behaviors of children with autism using social stories. <i>Journal of Autism and Developmental Disorders</i> , 32(6), 535-543.	Other design	3							✓	
	Thiemann, K. S., & Goldstein, H. (2001). Social stories, written text cues, and video feedback: effects on social communication of children with autism. <i>J Appl Behav Anal</i> , 34(4), 425-446.	Other design	5	✓							
Structured Teaching	Ozonoff, S., & Cathcart, K. (1998). Effectiveness of a home program intervention for young children with autism. <i>Journal of Autism and Developmental Disorders</i> , 28(1), 25-32.	Pretest-posttest non-equivalent comparison group design	22	✓		✓	✓				
	Panerai, S., Ferrante, L., & Zingale, M. (2002). Benefits of the Treatment and Education of Autistic and Communication Handicapped Children (TEACCH) programme as compared with a non-specific approach. <i>J Intellect Disabil Res</i> , 46(Pt 4), 318-327.	Pretest-posttest non-equivalent comparison group design	16	✓	✓	✓	✓	✓	✓	✓	
	Tsang, S. K., Shek, D. T., Lam, L. L., Tang, F. L., & Cheung, P. M. (2007). Brief report: application of the TEACCH program on Chinese pre-school children with autism--Does culture make a difference? <i>J Autism Dev Disord</i> , 37(2), 390-396.	Pretest-posttest non-equivalent comparison group design	34	✓	✓	✓	✓	✓	✓		
Technology-based Treatment	Baharav, E., & Darling, R. (2008). Case report: Using an auditory trainer with caregiver video modeling to enhance communication and socialization behaviors in autism. <i>J Autism Dev Disord</i> , 38(4), 771-775.	Other design	1	✓	✓						
	Bernard-Opitz, V., Sriram, N., & Nakhoda-Sapuan, S. (2001). Enhancing social problem solving in children with autism and normal children through computer-assisted instruction. <i>J Autism Dev Disord</i> , 31(4), 377-384.	Other design	16	✓		✓	✓				
	Bosseler, A., & Massaro, D. W. (2003). Development and Evaluation of a Computer-Animated Tutor for Vocabulary and Language Learning in Children with Autism. <i>Journal of Autism and Developmental Disorders</i> , 33(6), 653-672.	Other design	14	✓	✓						
	Herrera, G., Alcantud, F., Jordan, R., Blanquer, A., Labajo, G., & De Pablo, C. (2008). Development of symbolic play through the use of virtual reality tools in children with autistic spectrum disorders: two case studies. <i>Autism</i> , 12(2), 143-157.	Other design	2			✓			✓		
	Hetzroni, O. E., & Tannous, J. (2004). Effects of a computer-based intervention program on the communicative functions of children with autism. <i>J Autism Dev Disord</i> , 34(2), 95-113.	Other design	5	✓							
	Silver, M., & Oakes, P. (2001). Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognize and predict emotions in others. <i>Autism</i> , 5(3), 299-316.	Randomized, controlled trial (including group randomized designs)	22		✓						
	Taylor, B. A., Hughes, C. E., Richard, E., Hoch, H., & Rodriguez Coello, A. (2004). Teaching teenagers with autism to seek assistance when lost. <i>Journal of Applied Behavior Analysis</i> , 37(1), 79-82.	Other design	3							✓	
	Tjus, T., Heimann, M., & Nelson, K. (1998). Gains in Literacy through the Use of a Specially Developed Multimedia Computer Strategy. <i>Autism</i> , 2(2), 139-156.	Other design	13			✓					
	Tjus, T., Heimann, M., & Nelson, K. E. (2001). Interaction patterns between children and their teachers when using a specific multimedia and communication strategy: observations from children with autism and mixed intellectual disabilities. <i>Autism</i> , 5(2), 175-187.	Pretest-posttest non-equivalent comparison group design	20	✓	✓	✓					
	Williams, C., Wright, B., Callaghan, G., & Coughlan, B. (2002). Do children with autism learn to read more readily by computer assisted instruction or traditional book methods? A pilot study. <i>Autism</i> , 6(1), 71-91.	Pretest-posttest non-equivalent comparison group design	8	✓	✓					✓	
	Williams, J. H., D. W. Massaro, et al. (2004). Visual-auditory integration during speech imitation in autism. <i>Res Dev Disabil</i> 25(6): 559-75.	Randomized, controlled trial (including group randomized designs)	35	✓	✓	✓	✓				

Children, Level 2

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
<b>Academic Intervention</b>	Ludlow, A. K., Wilkins, A. J., & Heaton, P. (2006). The effect of coloured overlays on reading ability in children with autism. <i>J Autism Dev Disord</i> , 36(4), 507-516.	Pretest-posttest non-equivalent comparison group design	19			✓	✓			
	Schlosser, R. W., & Blischak, D. M. (2004). Effects of speech and print feedback on spelling by children with autism. <i>J Speech Lang Hear Res</i> , 47(4), 848-862.	Other design	4	✓		✓				
	Schlosser, R. W., Blischak, D. M., Belfiore, P. J., Bartley, C., & Barnett, N. (1998). Effects of synthetic speech output and orthographic feedback on spelling in a student with autism: a preliminary study. <i>J Autism Dev Disord</i> , 28(4), 309-319.	Other design	1	✓		✓				
<b>Augmentative and Alternative Communication Device</b>	Cafiero, J. M. (2001). The Effect of an Augmentative Communication Intervention on the Communication, Behavior, and Academic Program of an Adolescent with Autism. Focus on Autism & Other Developmental Disabilities, 16(3), 179.	Other design	1	✓		✓			✓	
	Schepis, M. M., Reid, D. H., Behrmann, M. M., & Sutton, K. A. (1998). Increasing communicative interactions of young children with autism using a voice output communication aid and naturalistic teaching. <i>J Appl Behav Anal</i> , 31(4), 561-578.	Other design	4	✓						
	Shabani, D. B., Katz, R. C., Wilder, D. A., Beauchamp, K., Taylor, C. R., & Fischer, K. J. (2002). Increasing social initiations in children with autism: effects of a tactile prompt. <i>Journal of Applied Behavior Analysis</i> , 35(1), 79-83.	Interrupted time series design	3	✓						
	Sigafoos, J., O'Reilly, M., Seely-York, S., & Edrisinha, C. (2004). Teaching students with developmental disabilities to locate their AAC device. <i>Res Dev Disabil</i> , 25(4), 371-383.	Other design	3	✓				✓		
<b>Developmental Relationship-based Treatment</b>	Gutstein, S. E., Burgess, A. F., & Montfort, K. (2007). Evaluation of the relationship development intervention program. <i>Autism</i> , 11(5), 397-411.	Other design	16	✓	✓	✓	✓			
	Mahoney, G., & Perales, F. (2003). Using Relationship-Focused Intervention to Enhance the Social-Emotional Functioning of Young Children with Autism Spectrum Disorders. <i>Topics in Early Childhood Special Education</i> , 23(2), 77.	Other design	20		✓					
	Rogers, S. J., Hayden, D., Hepburn, S., Charlifue-Smith, R., Hall, T., & Hayes, A. (2006). Teaching young nonverbal children with autism useful speech: a pilot study of the Denver Model and PROMPT interventions. <i>J Autism Dev Disord</i> , 36(8), 1007-1024.	Other design		✓						
	Salt, J., Shemilt, J., Sellars, V., Boyd, S., Coulson, T., & McCool, S. (2002). The Scottish Centre for autism preschool treatment programme. II: The results of a controlled treatment outcome study. <i>Autism</i> , 6(1), 33-46.	Pretest-posttest non-equivalent comparison group design	20	✓	✓	✓	✓	✓		
	Solomon, R., Necheles, J., Ferch, C., & Bruckman, D. (2007). Pilot study of a parent training program for young children with autism: the PLAY Project Home Consultation program. <i>Autism</i> , 11(3), 205-224.	Other design	68	✓	✓			✓		
	Vorgaft, Y., Farbstein, I., Spiegel, R., & Apter, A. (2007). Retrospective evaluation of an intensive method of treatment for children with pervasive developmental disorder. <i>Autism</i> , 11(5), 413-424.	Other design	23	✓	✓	✓	✓			
<b>Initiation Training</b>	Koegel, L. K., Camarata, S. M., Valdez-Menchaca, M., & Koegel, R. L. (1998). Setting generalization of question-asking by children with autism. <i>American Journal Of Mental Retardation: AJMR</i> , 102(4), 346-357.	Other design	3	✓	✓	✓				
	Solomon, M., Goodlin-Jones, B. L., & Anders, T. F. (2004). A social adjustment enhancement intervention for high functioning autism, Asperger's syndrome, and pervasive developmental disorder NOS. <i>Journal of Autism and Developmental Disorders</i> , 34(6), 649-668.	Randomized, controlled trial (including group randomized designs)	18	✓	✓		✓			
<b>Language Training Production</b>	Clark, K. M., & Green, G. (2004). Comparison of two procedures for teaching dictated-word/symbol relations to learners with autism. <i>J Appl Behav Anal</i> , 37(4), 503-507.	Other design		✓			✓			
	Foxx, R. M., Schreck, K. A., Garito, J., Smith, A., & Weisenberger, S. (2004). Replacing the Echolalia of Children With Autism With Functional Use of Verbal Labeling. <i>Journal of Developmental and Physical Disabilities</i> , 16(4), 307-320.	Other design	2	✓						
	Kroeger, K. A., & Nelson, W. M., 3rd (2006). A language programme to increase the verbal production of a child dually diagnosed with Down syndrome and autism. <i>J Intellect Disabil Res</i> , 50(Pt 2), 101-108.	Other design	1	✓						
	Seung, H. K., Ashwell, S., Elder, J. H., & Valcante, G. (2006). Verbal communication outcomes in children with autism after in-home father training. <i>J Intellect Disabil Res</i> , 50(Pt 2), 139-150.	Other design	8	✓						
<b>Massage/Touch Therapy</b>	Escalona, A., Field, T., Singer-Strunck, R., Cullen, C., & Hartshorn, K. (2001). Brief report: improvements in the behavior of children with autism following massage therapy. <i>J Autism Dev Disord</i> , 31(5), 513-516.	Group randomized trial with discrepant units of analysis, or with an inadequate number of aggregate units assigned to condition	20		✓				✓	
	Silva, L. M., & Cignolini, A. (2005). A medical qigong methodology for early intervention in autism spectrum disorder: a case series. <i>Am J Chin Med</i> , 33(2), 315-327.	Other design	8	✓	✓		✓			

Children, Level 2

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Modeling	Bellini, S., Akullian, J., & Hopf, A. (2007). Increasing Social Engagement in Young Children With Autism Spectrum Disorders Using Video Self-Modeling. <i>School Psychology Review</i> , 36(1), 80-90.	Other design	2		✓					
	Drager, K. D., Postal, V. J., Carrolus, L., Castellano, M., Gagliano, C., & Glynn, J. (2006). The effect of aided language modeling on symbol comprehension and production in 2 preschoolers with autism. <i>Am J Speech Lang Pathol</i> , 15(2), 112-125.	Other design	2	✓						
	Jahr, E., Eldevik, S., & Eikeseth, S. (2000). Teaching children with autism to initiate and sustain cooperative play. <i>Res Dev Disabil</i> , 21(2), 151-169.	Other design	6		✓					
	Kinney, E. M., Vedora, J., & Stromer, R. (2003). Computer-presented video models to teach generative spelling to a child with an autism spectrum disorder. <i>Journal of Positive Behavior Interventions</i> , 5(1), 22-29.	Other design	1			✓				
	LeBlanc, L. A., Coates, A. M., Daneshvar, S., Charlop-Christy, M. H., Morris, C., & Lancaster, B. M. (2003). Using video modeling and reinforcement to teach perspective-taking skills to children with autism. <i>J Appl Behav Anal</i> , 36(2), 253-257.	Other design	3		✓	✓				
	Nikopoulos, C. K., & Keenan, M. (2007). Using video modeling to teach complex social sequences to children with autism. <i>J Autism Dev Disord</i> , 37(4), 678-693.	Other design	4		✓					
	Paterson, C. R., & Arco, L. (2007). Using video modeling for generalizing toy play in children with autism. <i>Behav Modif</i> , 31(5), 660-681.	Interrupted time series design	2		✓					
	Sherer, M., Pierce, K. L., Paredes, S., Kisacky, K. L., Ingersoll, B., & Schreibman, L. (2001). Enhancing conversation skills in children with autism via video technology. Which is better, "self" or "other" as a model? <i>Behav Modif</i> , 25(1), 140-158.	Other design	5	✓	✓					
Music Therapy	Shipley-Benamou, R., Lutzker, J. R., & Taubman, M. (2002). Teaching Daily Living Skills to Children with Autism Through Instructional Video Modeling. <i>Journal of Positive Behavior Interventions</i> , 4(3), 165.	Other design	3					✓		
	Kaplan, R. S., & Steele, A. L. (2005). An analysis of music therapy program goals and outcomes for clients with diagnoses on the autism spectrum. <i>J Music Ther</i> , 42(1), 2-19.	Other design	40	✓	✓	✓	✓	✓	✓	
	Kim, J., Wigram, T., & Gold, C. (2008). The effects of improvisational music therapy on joint attention behaviors in autistic children: a randomized controlled study. <i>J Autism Dev Disord</i> , 38(9), 1758-1766.	Randomized, controlled trial (including group randomized designs)	10	✓	✓	✓				
Pivotal Response Treatment	Orr, T. J., Myles, B. S., & Carlison, J. K. (1998). The impact of rhythmic entrainment on a person with autism. <i>Focus on Autism and Other Developmental Disabilities</i> , 13(3), 163-166.	Interrupted time series design	1						✓	
	Aldred, C., Green, J., & Adams, C. (2004). A new social communication intervention for children with autism: Pilot randomized controlled treatment study suggesting effectiveness. <i>Journal of Child Psychology and Psychiatry</i> , 45(8), 1420-1430.	Randomized, controlled trial (including group randomized designs)	28	✓	✓					
	Becker-Cottrill, B., McFarland, J., & Anderson, V. (2003). A model of positive behavioral support for individuals with autism and their families: The family focus process. <i>Focus on Autism and Other Developmental Disabilities</i> , 18(2), 113-123.	Other design	1	✓	✓			✓	✓	
	Harper, C. B., Symon, J. B. G., & Frea, W. D. (2008). Recess is time-in: Using peers to improve social skills of children with autism. <i>Journal of Autism and Developmental Disorders</i> , 38(5), 815-826.	Other design	2		✓					
	Martins, M., & Harris, S. (2006). Teaching Children with Autism to Respond to Joint Attention Initiations. <i>Child &amp; Family Behavior Therapy</i> , 28(1), 51-68.	Other design	3		✓					
	Sherer, M. R., & Schreibman, L. (2005). Individual behavioral profiles and predictors of treatment effectiveness for children with autism. <i>J Consult Clin Psychol</i> , 73(3), 525-538.	Other design	6				✓			
Reductive Package	Ferretti, S. J., Tamm, L., & Wier, K. G. (2006). Using food aversion to decrease severe pica by a child with autism. <i>Behavior Modification</i> , 30(4), 456-471.	Other design	1						✓	
	Higbee, T. S., Carr, J. E., & Patel, M. R. (2002). The effects of interpolated reinforcement on resistance to extinction in children diagnosed with autism: a preliminary investigation. <i>Res Dev Disabil</i> , 23(1), 61-78.	Interrupted time series design							✓	
	Magnusson, A. F., & Gould, D. D. (2007). Reduction of automatically-maintained self-injury using contingent equipment removal. <i>Behavioral Interventions</i> , 22(1), 57-68.	Other design	1						✓	
Scripting	Krantz, P. J., & McClannahan, L. E. (1998). Social interaction skills for children with autism: a script-fading procedure for beginning readers. <i>J Appl Behav Anal</i> , 31(2), 191-202.	Other design	3	✓	✓					
	Sarokoff, R. A., Taylor, B. A., & Poulson, C. L. (2001). Teaching children with autism to engage in conversational exchanges: script fading with embedded textual stimuli. <i>Journal of Applied Behavior Analysis</i> , 34(1), 81-84.	Other design	2		✓					
	Stevenson, C. L., Krantz, P. J., & McClannahan, L. E. (2000). Social interaction skills for children with autism: a script-fading procedure for nonreaders. <i>Behavioral Interventions</i> , 15(1), 1-20.	Other design	4		✓					

Children, Level 2

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Self-management	Mancina, C., Tankersley, M., Kamps, D., Kravits, T., & Parrett, J. (2000). Brief report: reduction of inappropriate vocalizations for a child with autism using a self-management treatment program. <i>J Autism Dev Disord</i> , 30(6), 599-606.	Other design	1							✓
	Mithaug, D. K., & Mithaug, D. E. (2003). Effects of teacher-directed versus student-directed instruction on self-management of young children with disabilities. <i>J Appl Behav Anal</i> , 36(1), 133-136.	Other design	4		✓	✓				
	Newman, B., Reinecke, D. R., & Meinberg, D. L. (2000). Self-management of varied responding in three students with autism. <i>Behavioral Interventions</i> , 15(2), 145-151.	Other design	3	✓	✓					
	Pelios, L. V., MacDuff, G. S., & Axelrod, S. (2003). The effects of a treatment package in establishing independent academic work skills in children with autism. <i>Education &amp; Treatment of Children</i> , 26(1), 1-21.	Other design	3						✓	
	Shabani, D. B., Wilder, D. A., & Flood, W. A. (2001). Reducing stereotypic behavior through discrimination training, differential reinforcement of other behavior, and self-monitoring. <i>Behavioral Interventions</i> , 16(4), 279-286.	Other design	1		✓	✓				
	Wilkinson, L. A. (2005). Supporting the Inclusion of a Student with Asperger Syndrome: A Case Study using Conjoint Behavioural Consultation and Self-management. <i>Educational Psychology in Practice</i> , 21(4), 307-326.	Other design	1							✓
Theory of Mind Training	Fisher, N., & Happe, F. (2005). A training study of theory of mind and executive function in children with autistic spectrum disorders. <i>Journal of Autism &amp; Developmental Disorders</i> , 35(6), 757-771.	Randomized, controlled trial (including group randomized designs)	27	✓		✓				
	Gevers, C., Clifford, P., Mager, M., & Boer, F. (2006). Brief Report: A Theory-of-Mind-based Social-Cognition Training Program for School-Aged Children with Pervasive Developmental Disorders: An Open Study of its Effectiveness. <i>Journal of Autism &amp; Developmental Disorders</i> , 36(4), 567-571.	Other design	18		✓	✓				

Children, Level 3

Intervention Name	Citation	Design	Sample Size	Target Behaviors					
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior
Exercise	Schilling, D. L., & Schwartz, I. S. (2004). Alternative seating for young children with Autism Spectrum Disorder: effects on classroom behavior. <i>J Autism Dev Disord</i> , 34(4), 423-432.	Other design	4		✓	✓	✓		
Exposure Package	Koegel, R. L., Openden, D., & Koegel, L. K. (2004). A systematic desensitization paradigm to treat hypersensitivity to auditory stimuli in children with autism in family contexts. <i>Research and Practice for Persons with Severe Disabilities</i> , 29(2), 122-134.	Other design	3				✓		



**Transitioning Youth, Level 1**

Intervention Name	Citation	Design	Sample Size	Target Behaviors					
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior
Antecedent Package	Romano, J. P., & Roll, D. (2000). Expanding the utility of behavioral momentum for youth with developmental disabilities. <i>Behavioral Interventions</i> , 15(2), 99-111.	Interrupted time series design	3					✓	✓

Transitioning Youth, Level 2

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Behavioral Package	Kern, L., Starosta, K., & Adelman, B. E. (2006). Reducing pica by teaching children to exchange inedible items for edibles. <i>Behav Modif</i> , 30(2), 135-158.	Interrupted time series design	2							✓
	O'Neill, R. E., & Sweetland-Baker, M. (2001). Brief report: An assessment of stimulus generalization and contingency effects in functional communication training with two students with autism. <i>J Autism Dev Disord</i> , 31(2), 235-240.	Other design	2							✓
Social Skills Package	Barnhill, G. P., Cook, K. T., Tebbenkamp, K., & Myles, B. S. (2002). The Effectiveness of Social Skills Intervention Targeting Nonverbal Communication for Adolescents with Asperger Syndrome and Related Pervasive Developmental Delays. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 17(2), 112.	Other design	8	✓	✓					
	LeGoff, D. B. (2004). Use of LEGO as a therapeutic medium for improving social competence. <i>J Autism Dev Disord</i> , 34(5), 557-571.	Pretest-posttest non-equivalent comparison group design	47		✓					
	Palmen, A., Didden, R., & Arts, M. (2008). Improving question asking in high-functioning adolescents with autism spectrum disorders: effectiveness of small-group training. <i>Autism</i> , 12(1), 83-98.	Other design	9	✓	✓					
	Provencal, S. L. (2003). The efficacy of a social skills training program for adolescents with autism spectrum disorders. Provençal, Sherri L : U Utah, US.	Pretest-posttest non-equivalent comparison group design	20		✓					✓
	Tse, J., Strulovitch, J., Tagalakis, V., Meng, L., & Fombonne, E. (2007). Social skills training for adolescents with Asperger syndrome and high-functioning autism. <i>J Autism Dev Disord</i> , 37(10), 1960-1968.	Other design	46		✓					✓
	Webb, B. J., Miller, S. P., Pierce, T. B., Strawser, S., & Jones, W. P. (2004). Effects of Social Skill Instruction for High-Functioning Adolescents with Autism Spectrum Disorders. <i>Focus on Autism &amp; Other Developmental Disabilities</i> , 19(1), 53-62.	Other design	10		✓					
Technology-based Treatment	Silver, M., & Oakes, P. (2001). Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognize and predict emotions in others. <i>Autism</i> , 5(3), 299-316.	Randomized, controlled trial (including group randomized designs)	22		✓					
	Taylor, B. A., Hughes, C. E., Richard, E., Hoch, H., & Rodriguez Coello, A. (2004). Teaching teenagers with autism to seek assistance when lost. <i>Journal of Applied Behavior Analysis</i> , 37(1), 79-82.	Other design	3							✓

Transitioning Youth, Level 3

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
<b>Cognitive Behavioral Intervention Package</b>	Bauminger, N. (2002). The facilitation of social-emotional understanding and social interaction in high-functioning children with autism: intervention outcomes. <i>J Autism Dev Disord</i> , 32(4), 283-298.	Other design	15		✓	✓				
<b>Exercise</b>	Pitetti, K. H., Rendoff, A. D., Grover, T., & Beets, M. W. (2007). The efficacy of a 9-month treadmill walking program on the exercise capacity and weight reduction for adolescents with severe autism. <i>Journal of Autism and Developmental Disorders</i> , 37(6), 997-1006.	Pretest-posttest non-equivalent comparison group design	10				✓			
<b>Initiation Training</b>	McDonald, M. E., & Hemmes, N. S. (2003). Increases in social initiation toward an adolescent with autism: reciprocity effects. <i>Research in Developmental Disabilities</i> , 24(6), 453-465.	Other design	1		✓					
<b>Modeling</b>	Bouxsein, K. J., Tiger, J. H., & Fisher, W. W. (2008). A comparison of general and specific instructions to promote task engagement and completion by a young man with Asperger syndrome. <i>J Appl Behav Anal</i> , 41(1), 113-116.	Other design	1			✓				
	Delano, M. E. (2007). Improving written language performance of adolescents with Asperger syndrome. <i>J Appl Behav Anal</i> , 40(2), 345-351.	Other design	3			✓				
<b>Multi-component Package</b>	Kay, S., Harchik, A. F., & Luiselli, J. K. (2006). Elimination of drooling by an adolescent student with autism attending public high school. <i>Journal of Positive Behavior Interventions</i> , 8(1), 24-28.	Other design	1					✓	✓	
<b>Music Therapy</b>	Kaplan, R. S., & Steele, A. L. (2005). An analysis of music therapy program goals and outcomes for clients with diagnoses on the autism spectrum. <i>J Music Ther</i> , 42(1), 2-19.	Other design	40	✓	✓	✓	✓	✓	✓	
<b>Naturalistic Teaching Strategies</b>	Jewell, J. D., Grippi, A., Hupp, S. D., & Krohn, E. J. (2007). The effects of a rotating classroom schedule on classroom crisis events in a school for autism. <i>North American Journal of Psychology</i> , 9(1), 37-52.	Other design	81						✓	
	Talebi, J. L. (2008). Using a motivational extracurricular activity to improve the social interactions of adolescents with Asperger syndrome or high-functioning autism. Talebi, Jane Lacy: U California, Santa Barbara, US.	Other design	3		✓					
<b>Self-management</b>	Ferguson, H., Myles, B. S., & Hagiwara, T. (2005). Using a Personal Digital Assistant to Enhance the Independence of an Adolescent with Asperger Syndrome. <i>Education and Training in Developmental Disabilities</i> , 40(1), 60-67.	Other design	1					✓		
	Mancina, C., Tankersley, M., Kamps, D., Kravits, T., & Parrett, J. (2000). Brief report: reduction of inappropriate vocalizations for a child with autism using a self-management treatment program. <i>J Autism Dev Disord</i> , 30(6), 599-606.	Other design	1						✓	
	Myles, B. S., Ferguson, H., & Hagiwara, T. (2007). Using a personal digital assistant to improve the recording homework assignments by an adolescent with Asperger syndrome. <i>Focus on Autism and Other Developmental Disabilities</i> , 22(2), 96-99.	Other design	1					✓		
<b>Social Communication Intervention</b>	Fullerton, A., & Coyne, P. (1999). Developing skills and concepts for self-determination in young adults with autism. <i>Focus on Autism and Other Developmental Disabilities</i> , 14(1), 42-52.	Other design	23	✓	✓	✓	✓			
<b>Structured Teaching</b>	Van Bourgondien, M. E., Reichle, N. C., & Schopler, E. (2003). Effects of a model treatment approach on adults with autism. <i>Journal of Autism and Developmental Disorders</i> , 33(2), 131-140.	Group randomized trial with discrepant units of analysis, or with an inadequate number of aggregate units assigned to condition	32	✓	✓	✓		✓	✓	

Adults, Level 1

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Behavioral Package	Bird, F. L., & Luiselli, J. K. (2000). Positive behavioral support of adults with developmental disabilities: assessment of long-term adjustment and habilitation following restrictive treatment histories. <i>J Behav Ther Exp Psychiatry</i> , 31(1), 5-19.	Other design	5	✓	✓				✓	
	Britton, L. N., Carr, J. E., Kellum, K. K., Dozier, C. L., & Weil, T. M. (2000). A variation of noncontingent reinforcement in the treatment of aberrant behavior. <i>Res Dev Disabil</i> , 21(6), 425-435.	Other design	3						✓	
	Reese, R. M., Sherman, J. A., & Sheldon, J. B. (1998). Reducing disruptive behavior of a group-home resident with autism and mental retardation. <i>J Autism Dev Disord</i> , 28(2), 159-165.	Interrupted time series design	1		✓				✓	
	Rehfeldt, R. A., & Chambers, M. R. (2003). Functional analysis and treatment of verbal perseverations displayed by an adult with autism. <i>J Appl Behav Anal</i> , 36(2), 259-261.	Other design	1	✓						
Structured Teaching	Gerber, F., Baud, M. A., Giroud, M., & Galli Carminati, G. (2008). Quality of life of adults with pervasive developmental disorders and intellectual disabilities. <i>J Autism Dev Disord</i> , 38(9), 1654-1665.	Pretest-posttest non-equivalent comparison group design	30	✓	✓			✓	✓	
	Persson, B. (2000). Brief report: A longitudinal study of quality of life and independence among adult men with autism. <i>Journal of Autism and Developmental Disorders</i> , 30(1), 61-66.	Other design	8	✓	✓			✓		
	Van Bourgondien, M. E., Reichle, N. C., & Schopler, E. (2003). Effects of a model treatment approach on adults with autism. <i>Journal of Autism and Developmental Disorders</i> , 33(2), 131-140.	Group randomized trial with discrepant units of analysis, or with an inadequate number of aggregate units assigned to condition	32	✓	✓	✓		✓	✓	
Supported Employment	Garcia-Villamisar, D., & Hughes, C. (2007). Supported employment improves cognitive performance in adults with Autism. <i>Journal of Intellectual Disability Research</i> , 51(2), 142-150.	Randomized, controlled trial (including group randomized designs)	44	✓		✓		✓		
	Lattimore, L. P., Parsons, M. B., & Reid, D. H. (2006). Enhancing job-site training of supported workers with autism: a reemphasis on simulation. <i>J Appl Behav Anal</i> , 39(1), 91-102.	Other design	4	✓	✓	✓		✓		
	Mawhood, L., & Howlin, P. (1999). The outcome of a supported employment scheme for high-functioning adults with autism or Asperger syndrome. <i>Autism</i> , 3(3), 229-254.	Pretest-posttest non-equivalent comparison group design	30	✓	✓	✓		✓		

Adults, Level 2

Intervention Name	Citation	Design	Sample Size	Target Behaviors						
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior	
Schedules	Watanabe, M., & Sturmev, P. (2003). The effect of choice-making opportunities during activity schedules on task engagement of adults with autism. <i>Journal of Autism and Developmental Disorders</i> , 33(5), 535-538.	Other design	3							✓

Adults, Level 3

Intervention Name	Citation	Design	Sample Size	Target Behaviors					
				Communication	Social Development	Cognitive Development	Sensory and Motor Development	Adaptive Behavior	Problem Behavior
Music Therapy	Boso, M., Emanuele, E., Minazzi, V., Abbamonte, M., & Politi, P. (2007). Effect of long-term interactive music therapy on behavior profile and musical skills in young adults with severe autism. <i>J Altern Complement Med</i> , 13(7), 709-712.	Other design	8	✓		✓	✓		✓
	Kaplan, R. S., & Steele, A. L. (2005). An analysis of music therapy program goals and outcomes for clients with diagnoses on the autism spectrum. <i>J Music Ther</i> , 42(1), 2-19.	Other design	40	✓	✓	✓	✓	✓	✓
Naturalistic Teaching Strategies	McClannahan, L. E., MacDuff, G. S., & Krantz, P. J. (2002). Behavior analysis and intervention for adults with autism. <i>Behavior Modification</i> , 26(1), 9-26.	Other design	15	✓	✓			✓	✓
Social Communication Intervention	Fullerton, A., & Coyne, P. (1999). Developing skills and concepts for self-determination in young adults with autism. <i>Focus on Autism and Other Developmental Disabilities</i> , 14(1), 42-52.	Other design	23	✓	✓	✓	✓		
Social Skills Package	Howlin, P., & Yates, P. (1999). The potential effectiveness of social skills groups for adults with autism. <i>Autism</i> , 3(3), 299-307.	Other design	10	✓	✓			✓	
	Palmen, A., Didden, R., & Arts, M. (2008). Improving question asking in high-functioning adolescents with autism spectrum disorders: effectiveness of small-group training. <i>Autism</i> , 12(1), 83-98.	Other design	9	✓	✓				

# **Appendix C**

## **Autism Spectrum Disorders**

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