

The National Autism Center's

National Standards Report



THE NATIONAL STANDARDS PROJECT—
ADDRESSING THE NEED FOR EVIDENCE-
BASED PRACTICE GUIDELINES FOR
AUTISM SPECTRUM DISORDERS





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We have endeavored to build consensus among experts from diverse fields of study and theoretical orientation. We collaboratively determined the strategies used to evaluate the literature on the treatment of Autism Spectrum Disorders. In addition, we jointly determined the intended use of this document. We used a systematic process to provide all of our experts multiple opportunities to provide feedback on both the process and the document. Given the diversity of perspectives held by our experts, the information contained in this report does not necessarily reflect the unique views of each of its contributors on every point. We are pleased with the spirit of collaboration these experts brought to this process.

IN MEMORY OF EDWARD G. CARR, PH.D., BCBA

This report is dedicated to the memory of Dr. Ted Carr, an internationally recognized leader in the treatment of Autism Spectrum Disorders and in the field of Positive Behavior Supports.

From the outset, Ted was a major contributor to the National Standards Project. He played a pivotal role in shaping the methodology used in the Project. Ted understood that the value of the National Standards Project was based not only on the scientific validity of its design and implementation, but also on its social validity within the broader community. We are grateful to Ted for his insightful input, and his persistent focus on ensuring that this document be useful to families, educators, and service providers.

Throughout his career, Ted often led the charge for the intelligent care and compassionate and respectful treatment of individuals with Autism Spectrum Disorders and other developmental disabilities. We at the National Autism Center, along with countless organizations and professionals throughout the world, will miss him and keenly feel his loss.

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1

Introduction

About the National Standards Project

This report provides comprehensive information about the level of scientific evidence that exists in support of the many educational and behavioral treatments currently available for individuals with Autism Spectrum Disorders (ASD).

According to the Centers for Disease Control and Prevention (2007), approximately one in every 150 children has an ASD. As the number of children diagnosed with ASD continues to skyrocket, so do the number of treatment options. Families, educators, and service providers must sift through a massive amount of confusing and often conflicting information about the myriad treatments available. This reality makes treatment selection complicated. Uncertainty about the level of research support associated with different treatments makes the process even more difficult. To make the most informed choices, decision makers must be able to determine which treatments have evidence of effectiveness.¹

The best way to determine if a particular treatment is effective is to look at research that has been conducted. There are a multitude of behavioral or educational treatments currently available for ASD. These interventions differ dramatically in terms of the quantity, quality, and consistency of research studies specific to the ASD population.

¹ Professionals often describe a treatment as “effective” when it has been shown to work in real world settings such as home, school, and community. For the purposes of this report, the word “effective” refers to studies conducted in real world, clinical, and research settings.

In summary, the National Standards Project, a primary initiative of the National Autism Center, seeks to:

- provide the strength of evidence supporting educational and behavioral treatments that target the core characteristics of these neurological disorders
- describe the age, diagnosis, and skills/behaviors targeted for improvement associated with treatment options
- identify the limitations of the current body of research on autism treatment
- offer recommendations for engaging in evidence-based practice for ASD

Who will benefit from national standards?

We believe that parents, caregivers, educators, and service providers who must make complicated decisions about treatment selection will benefit from national standards. These individuals deserve to have current, reliable, and easily accessible information when making important treatment decisions.

Financial Considerations

With the growing numbers of children diagnosed with ASD, families, along with school, medical, and social service systems, are financially overburdened. At the same time, state and federal funding for treatment is often limited. The societal costs for each individual with ASD across the lifespan is estimated at 3.2 million dollars (Ganz, 2007). With effective treatment, the lifetime costs can be reduced by 65% (Jarbrink & Knapp, 2001). In light of these facts, many families, schools, and medical and social service systems are choosing to invest their resources on treatments for autism that have already been scientifically established as effective.

It is not our goal to dictate what choices people make, but to provide enough information to allow them to make informed treatment decisions for themselves.



About the National Autism Center

The National Autism Center is dedicated to serving children and adolescents with Autism Spectrum Disorders (ASD) by providing reliable information, promoting best practices, and offering comprehensive resources for families, practitioners, and communities.

An advocate for evidence-based treatment approaches, the National Autism Center identifies effective programming and shares practical information with families about how to respond to the challenges they face. The Center also conducts applied research as well as develops training and service models for practitioners. Finally, the Center works to shape public policy concerning ASD and its treatment through the development and dissemination of national standards of practice.

Guided by a Professional Advisory Board, the Center brings concerned constituents together to help individuals with ASD and their families pursue a better quality of life.

2

History of Clinical Guidelines

Evidence-based practice has become the standard in the fields of medicine, psychology, education, and allied health. The idea that decision makers should know how much research supports a treatment that is being considered has also been important in the field of Autism Spectrum Disorders (ASD).

For example, in 1999, the New York State Department of Health, Early Intervention Division published clinical practice guidelines concerning the treatment of very young children with ASD. In 2001, the National Research Council's Committee on Educational Interventions for Children with Autism published a report that attempted to identify the best available treatment programs.

The existing clinical guidelines are limited in several ways:

- These previous guidelines are now outdated because reviews were completed before the turn of the 21st century.
- The reviews did not include all educational and behavioral treatment studies for a broad age range or a variety of ASD diagnoses.
- Evidence-based practice guidelines have evolved. It is commonly agreed that greater transparency should occur regarding the process used to identify the level of research support available for different treatment options. In some cases, earlier guidelines did not always specify every detail used to make these determinations. Although less specificity sometimes produces a document that is easier to understand, evidence-based practice guidelines now tend to show each aspect of decision making.

The National Standards Report addresses these limitations in the following ways:

- We have completed a thorough review of the educational and behavioral treatment literature that targets the core characteristics and associated symptoms of ASD; this literature was published between 1957 and the fall of 2007.
- We have provided information about treatment effectiveness based on age, diagnostic groups, and treatment targets.
- We have tried to make the process completely transparent. We have presented information and solicited feedback from parents and professionals at national and international conferences. We have also received input from a cross-disciplinary group of experts in order to maintain the highest levels of transparency with many professional groups who serve children with ASD.

3

Overview of the National Standards Project

What is the Purpose?

The National Standards Project serves three primary purposes:

- 1.** To identify the level of research support currently available for educational and behavioral interventions used with individuals (below 22 years of age)¹ with Autism Spectrum Disorders (ASD). These interventions address the core characteristics of these neurological disorders. Knowing levels of research support is an important component in selecting treatments that are appropriate for individuals on the autism spectrum. We also seek to identify whether or not the favorable outcomes reported are extended to all treatment targets, age groups, and diagnostic groups.
- 2.** To help parents, caregivers, educators, and service providers understand how to integrate critical information in making treatment decisions. Specifically, evidence-based practice involves the integration of research findings with {a} professional judgment and data-based clinical decision making, {b} values and preferences of families, and {c} assessing and improving the capacity of the system to implement the intervention with a high degree of accuracy.
- 3.** To identify limitations of the existing treatment research involving individuals with ASD. Even when a treatment has been established as effective, it may require more investigation in order to extend favorable outcomes to all age groups, diagnostic groups, or skills/behaviors that may be targeted for improvement.

We hope that the National Standards Project will help individuals with ASD, their families, caregivers, educators, and service providers to select treatments that support people on the autism spectrum in reaching their full potential.

¹ For the purpose of this report, we use the phrase “individuals with Autism Spectrum Disorders” to refer to individuals on the autism spectrum who are under 22 years of age.

What was the Process?

Developing the Model

The National Standards Project began with the development of a model for evaluating the scientific literature involving the treatment of ASD by a working group consisting of Pilot Team 1 and outside consultation from methodologists². The process for the initial development of the National Standards Project is outlined in Flowchart 1. We developed a model based on an examination of evidence-based practice guidelines from other health and psychology fields³ as well as from 25 experts (see expert panel) attending planning sessions for the National Standards Project. This model was sent to the original experts as well as an additional 20 experts (see conceptual reviewers) who represent diverse fields of study and theoretical orientations. The model was modified based on their feedback and then served as the foundation for data collection procedures.

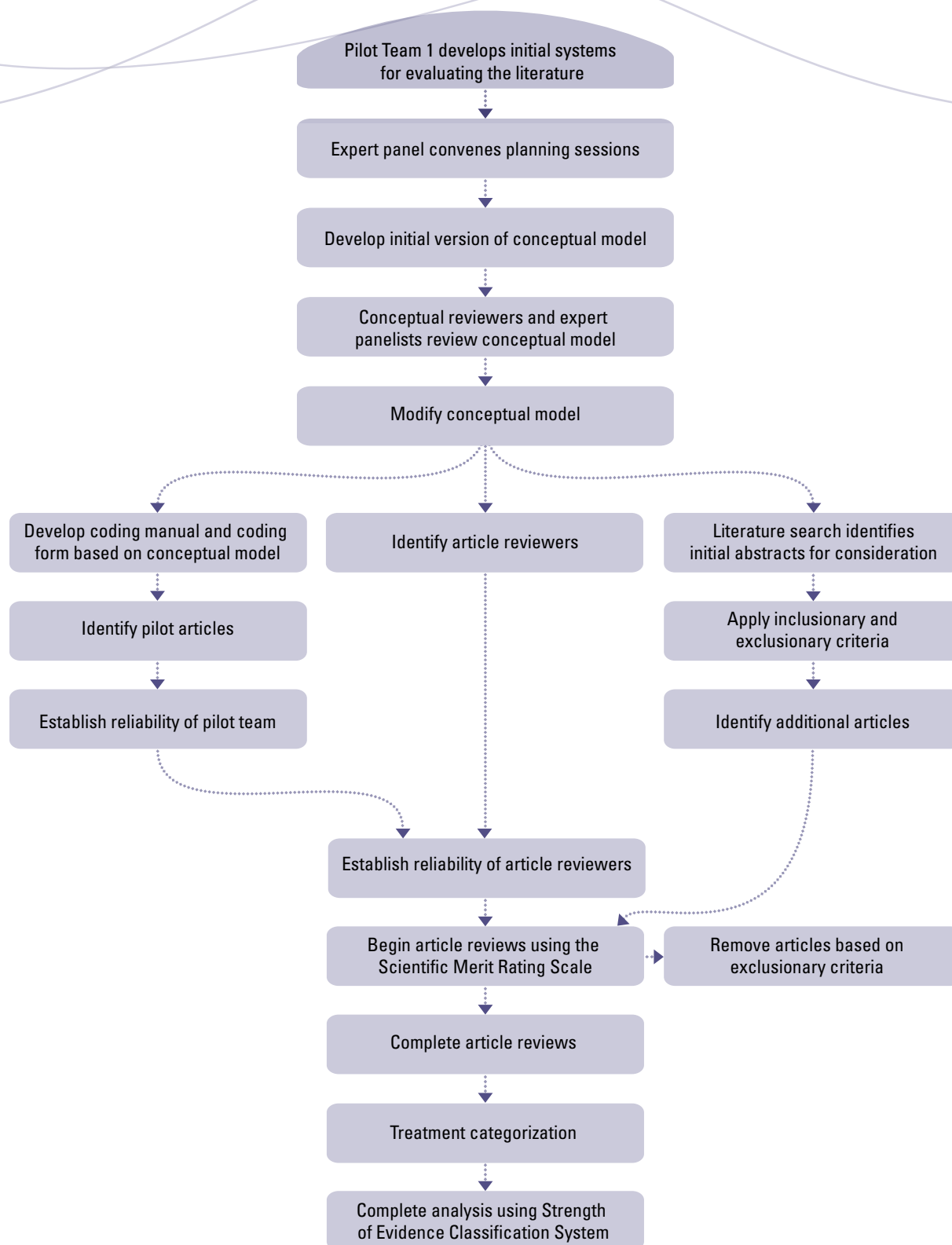
Identifying the Research

We identified a total of 6,463 abstracts through search engines, and 575 additional abstracts were identified by the expert panelists, conceptual reviewers, attendees of national autism conferences, and a review of recent book chapters. Inclusion and exclusion criteria were applied to a total of 7,038 abstracts, resulting in the removal of 5,978 articles from consideration for the National Standards Project. The vast majority of these articles were {a} unrelated to autism, {b} unrelated to the treatment of autism, and/or {c} not empirical articles. Additional reasons for exclusion were related to our inclusionary/exclusionary criteria (see below).

² The pilot team relied on the following sources: Sidman (1960); Johnston & Pennypacker (1993); Kazdin (1982; 1998); New York State Department of Health, Early Intervention Program (1999) and; Task Force on Promotion and Dissemination of Psychological Procedures (1995).

³ These systems were developed based on an examination of previous evidence-based practice guidelines including the Agency for Healthcare Research and Quality (West, King, Carey, Lohr, McKoy et al., 2002), American Psychological Association Presidential Task Force on Evidence-Based Practice (2003), and the Task Force on Evidence-Based Interventions in School Psychology (APA, 2005). These were also based on an examination of publications about evidence-based practice by authors {a} Chambless, Baker, Baucom, Beutler, Calhoun, Crits-Christoph, et al., (1998) and {b} Horner, Carr, Halle, McGehee, Odom, & Wolery (2005).

Flowchart 1} Process of the Initial Development of the National Standards Project



This process yielded a total of 1,060 articles for review by field reviewers. An additional 413 articles were removed after they were examined in greater detail by field reviewers and, in consultation with the chair of the National Standards Project, deemed to fall outside the inclusionary criteria for the National Standards Project. An additional 77 articles were later identified for inclusion by expert panelists, conceptual reviewers, and conference attendees who were asked to review the list. This process resulted in a total of 724 articles. Because more than one study was published in several of these articles, a total of 775 studies were retained for final analyses.

Inclusionary and Exclusionary Criteria

The National Standards Project is a systemic review of the behavioral and educational peer-reviewed⁴ treatment literature involving individuals with ASD under the age of 22. These studies targeted the core characteristics and associated symptoms of ASD. For the purposes of this review, ASD were defined to include Autistic Disorder, Asperger’s Syndrome, and Pervasive Developmental Disorder–Not Otherwise Specified (PDD-NOS). Individuals with Rett’s Disorder and Childhood Disintegrative Disorder were not included because {a} we adopted the criteria for ASD used by the Centers for Disease Control and Prevention, {b} the developmental trajectory is often different for these groups, and {c} there is controversy in the field about whether or not these should be considered in the same category with Autistic Disorder, Asperger’s Syndrome, and PDD-NOS.

Participants who were identified as “at risk” for an ASD were not included in this review. Children who are considered “at risk” do not have a formal diagnosis; we elected to restrict our review only to the literature specifically related to ASD. The results for children who are “at risk” may be very different than those expected for the diagnosed population, so including these studies could skew the results. Individuals described as having “autistic characteristics” or “a suspicion of ASD” were also not

⁴ Peer review is a term describing the scientific process used to publish studies. This means these studies have undergone the scrutiny of experts before publication. These experts identify an article as worthy of publication under two conditions. First, the scientific methods used in the article must meet a minimum criterion for scientific usefulness. Second, articles are sometimes published when the scientific methods are not especially good but the results are thought-provoking enough that it might inspire researchers to conduct better research in the area.

Methodological Implications

It is common practice in guidelines of this nature to focus on a specific population (e.g., ASD). However, there are implications that should be noted when this decision is made. By focusing treatment findings exclusively on ASD, we excluded many treatment studies involving the general population. Had these studies been included in the review, the interpretation of findings specific to individuals with ASD could have been different from the overall conclusions drawn for the autism population. Some examples follow:

- A study involving single-subject research design in which the results are replicated across multiple participants (e.g., multiple baseline across participants design) can be very powerful. However, if only one participant with ASD is identified, our ability to draw firm conclusions about treatment effectiveness for individuals with ASD is greatly reduced. Effectively, the results are interpreted as if an AB design were employed because we can only interpret the outcomes for the individual with ASD. An AB design is a much weaker research design, making study results specific to ASD weak as well. In this case, the study was retained, but

only the portion of the results involving the participant with ASD was analyzed.

- A study involving group design may have been published to show a treatment is not effective. Separate analyses were not available for individuals with ASD. Because the results for individuals with ASD could not be separated from the overall effects, the study was excluded from the National Standards Project. This study did not sufficiently inform us about treatment effectiveness specific to individuals on the autism spectrum. However, it is still extremely important for professionals to be aware of these results. This is a key example of why professionals must be familiar with literature beyond that described in this report.

In each case, studies with potentially important implications were either excluded, or not included in their entirety. It was important for us to follow this procedure to ensure our results apply to individuals with ASD. However, we argue that in some cases, informed users of this document may need to be familiar with both the results identified in this report and a larger literature base to guide them in the selection of treatments (see Evidence-Based Practice chapter).

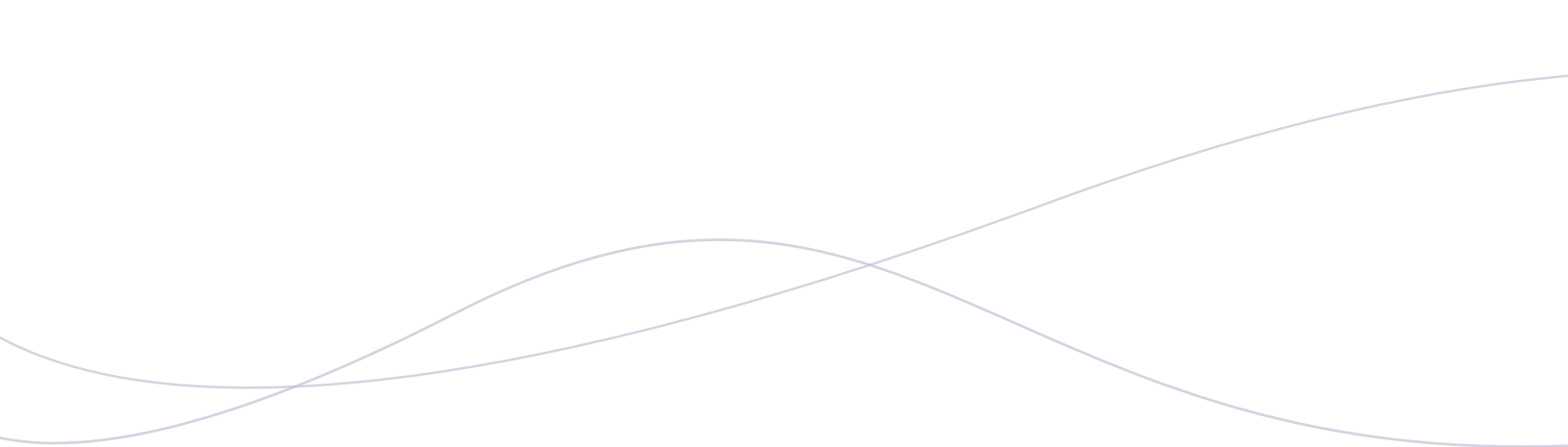
included in this review. Although it is likely that many of these individuals should have been diagnosed with ASD, there is no way to know this with certainty. Individuals with other developmental disabilities may show characteristics of ASD, but a diagnosis is not actually warranted. If the treatment outcomes for individuals described as having “autistic characteristics” or “a suspicion of ASD” are different from those for individuals on the autism spectrum, the results of this review could have been compromised.

We included studies if the treatments could be implemented in or by school systems, or early intervention, home-, hospital-, and community-based programs. However, included studies were conducted in a variety of settings. An additional inclusion criterion required that individuals with ASD be the target of the treatment study. Thus, studies were not included in the review when parents, care providers, educators, or service providers were the sole target of treatment. If these adults were one target, but data were also available regarding changes in child behavior or skills, the study was retained, but only those results pertaining to the child’s behavior or skills were included in the review.

In addition to these inclusion criteria, we included articles in the review if they had been published in peer-reviewed journals. Peer review requires that researchers submit

their work for scrutiny by experts in their fields of study. These experts determine if an article makes an important contribution to the literature because {a} the quality of research is sufficient to allow for clear conclusions to be drawn or {b} although the scientific merit of the study may be insufficient, the topic or results are provocative enough to warrant publication to promote future research in the area. It should be noted that all articles published in peer-reviewed journals are not necessarily of equivalent quality. However, peer review increases the likelihood that studies meet the minimum requirements for scientific methodology. Journals that are not peer-reviewed may include articles that are published primarily because the author has paid for this service, thus undermining acceptable standards of scientific publication.

We also established a variety of exclusionary criteria. To begin, the National Standards Project is restricted to reviewing educational and behavioral treatments. Studies examining biomedical interventions were largely excluded. Specifically, medication trials, nutritional supplement studies, and complementary and alternative medical interventions were excluded with the exception of curative diets. We made the decision to include curative diets because professionals across a wide range of settings are often expected to implement curative diets with a high degree of fidelity.



A second exclusionary concern was related to co-morbid conditions. The National Standards Project is intended to review research specifically representing the autism spectrum. Including a review of data for research participants who have co-morbid conditions that do not commonly co-occur with ASD could skew the outcomes. For example, consider the results of a study in which ineffective or adverse treatment effects were reported. If the participants involved in the study were symptomatic of both ASD and a major medical disorder, it would be impossible to determine if the treatment was ineffective or produced adverse effects for {a} individuals with ASD *and* major medical disorders, or {b} individuals with only ASD. Including these results in our review could misrepresent the research for children and adolescents with ASD. For this reason, we included studies involving participants with co-morbid conditions only when they were common co-morbid conditions (e.g., mental retardation, language impairments, depression, anxiety, Obsessive-Compulsive Disorder, Attention Deficit Hyperactivity Disorder). We retained studies that used group research designs if separate analyses were completed for those with and without common co-morbid conditions. We excluded studies that used single-subject research designs when all participants had infrequently diagnosed co-morbid conditions, but we retained single-subject studies if at least one participant met the inclusionary criteria. Only results for

participants meeting inclusionary criteria were analyzed.

A third exclusionary concern involved either the type of study or the data that were produced or presented. Specifically, we excluded articles if they did not include empirical data, if there were no statistical analyses available for studies using group research design, if there was no linear graphical presentation of data for studies using single-case research design, or if the studies relied on qualitative methods. (See the Methodological Implications section on the following page).

A fourth reason for exclusion was if a study's sole purpose was to identify mediating or moderating variables. The primary purpose of the National Standards Project is to identify which treatments have solid research evidence showing that they are effective, as opposed to when treatment effects will hold, or how/why these effects occur.

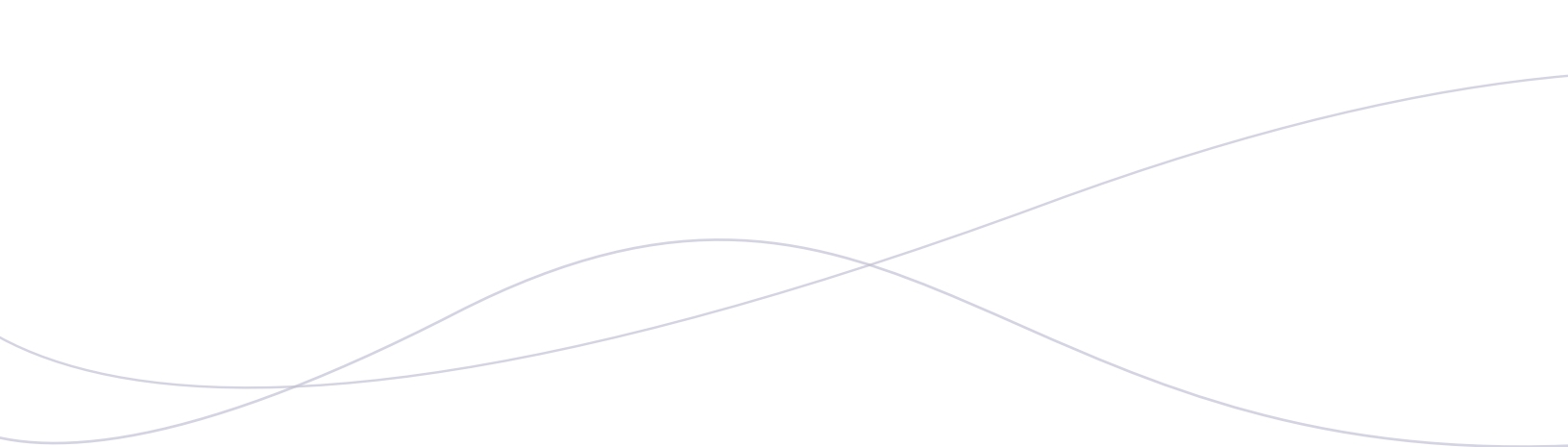
Fifth, the focus of the current version of the National Standards Report is on young individuals (i.e., individuals under 22 years of age). Articles were excluded if all participants were over the age of 22, or if a study included participants both over and under the age of 22 but for which separate analyses were not conducted for individuals under the age of 22. We anticipate the next version of the National Standards Project will expand the focus of the review to include treatments involving participants across the lifespan.

More Methodological Implications

Statistical Analyses: Statistical analysis is a commonly accepted criterion for analyzing data for group research design. If we were to include group design studies that did not use statistical analyses, there would be no generally accepted method for evaluating the scientific merit of the study or the treatment outcomes.

Linear Graphical Presentation: Not all single-subject research involves linear graphical presentation of data. However, strategies for determining treatment effectiveness based on visual analysis of linear graphs are commonly agreed upon. If we were to include single-subject research design studies that did not rely on linear graphical presentation of the data, there would be no generally accepted method for evaluating the scientific merit of the study or the treatment outcomes.

Our decision to exclude studies employing qualitative methods was initially based on consultation with a professional with expertise in qualitative research design. The vast majority of qualitative studies in treatment research focuses on identification of mediating or moderating variables (see discussion on previous page). This was not the focus of this version of the National Standards Project (NSP), so we did not include studies using a qualitative research design. In addition, it was apparent that there were an insufficient number of methodologists who had volunteered for the NSP who had adequate training in qualitative methods to satisfactorily develop an evaluation of qualitative methodology that would be consistent with that developed for single-case and group design. Therefore, we made the decision to exclude qualitative studies for the current version of the NSP, but decided to recruit experts with suitable expertise for the next version of the NSP.



Articles published exclusively in languages other than English were also excluded from the National Standards Project. We made this decision because the volunteer field reviewers did not have sufficient expertise with all non-English languages in which articles may be published. Often, when articles are published in non-English languages, the authors choose to also include them in journals published in English. This reduced the number of studies that have been excluded, but does not eliminate the problem altogether. We are hopeful we can add field reviewers for future versions of the National Standards Project who can address this exclusionary category.

Ensuring Reliability

To ensure the reviews were completed with a high degree of reliability, a pilot team (see Pilot Team 2 in contributors list) reviewed articles and made modifications to the coding manual until they could readily establish an acceptable level of agreement (interobserver agreement $>.80$). This criterion was met for both group and single-case research design studies.

All field reviewers were then “trained to criterion.” That is, they received the coding manual and one pilot article to review. We sent a group research design pilot article to field reviewers who would be reviewing studies employing group research design. We sent a single-subject research design pilot article to field reviewers who would be reviewing studies employing single-subject research design. These pilot articles were among those for which interobserver agreement had been established by the pilot team. After examining the coding manual, field reviewers submitted an article review and established interobserver agreement to criterion (i.e., $IOA >.80$). We offered individuals who did not reach this criterion the opportunity to review another article to establish reliability, but all declined.

Once all articles were reviewed, we calculated interobserver agreement again for at least one randomly selected article for each reviewer. With the exception of four individuals, all field reviewers maintained an acceptable level of interobserver agreement (i.e., $IOA >.80$). We removed the reviews from field reviewers who did not maintain reliability. These were re-reviewed by field reviewers who sustained acceptable reliability.

About the Scientific Merit Rating Scale

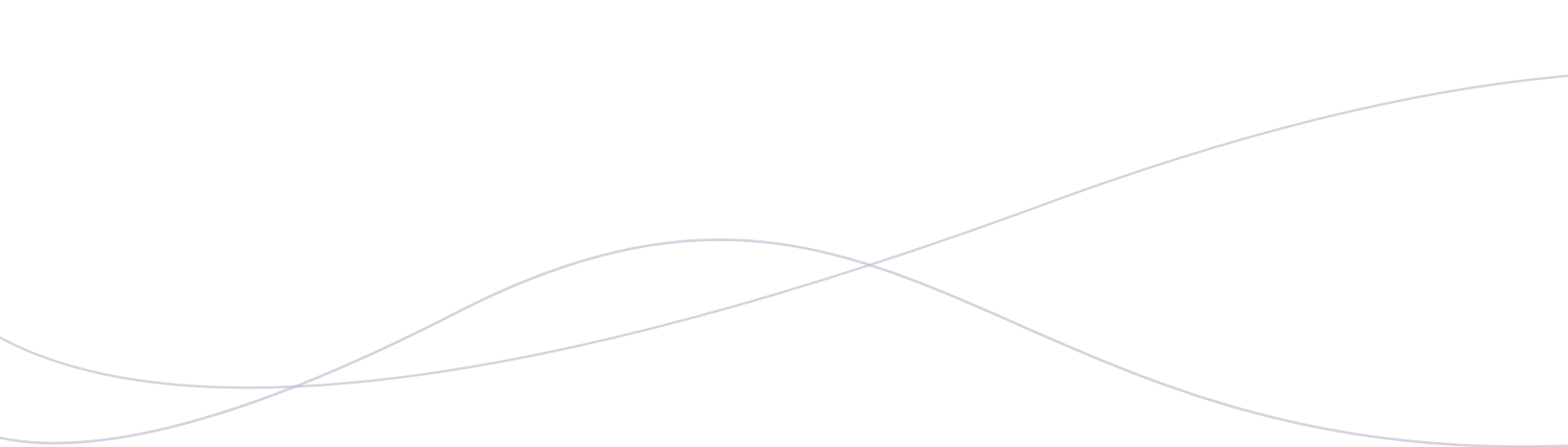
We developed the Scientific Merit Rating Scale (SMRS) as a means of objectively evaluating if the methods used in each study were strong enough to determine whether or not a treatment was effective for participants on the autism spectrum. This information allows us to determine if the results are believable enough that we would expect similar results in other studies that used equal or better research methodologies.

Just because an article has been published does not mean that the outcomes are critically important. Sometimes, poorly controlled studies are published because the results are interesting enough to other scientists and the publication will encourage better-controlled research. But it is important to interpret the outcomes of these studies with a great deal of caution. A study that is very flawed may say a treatment is effective, but no reasonable scientist would be confident the outcomes are useful and accurate.

A study is described as having scientific merit when variables are so well-controlled that independent scholars can draw firm conclusions from the results. For the purposes of the National Standards Project, we applied the SMRS exclusively to individuals diagnosed with Autistic Disorder, Asperger's Syndrome, or PDD-NOS who were under the age of 22 (see inclusionary/exclusionary criteria above).

The SMRS involves five critical dimensions of experimental rigor that can be applied to determine the extent to which interventions are effective. These include: {a} research design, {b} measurement of the dependent variable, {c} measurement of the independent variable or procedural fidelity, {d} participant ascertainment, and {e} generalization.

● **Research design:** reflects the degree to which experimental control was demonstrated. Research design is tied to the number of participants and/or groups involved, the extent to which attrition or treatment disruption occurred, and the type of research design employed.

- 
- **Measurement of the dependent variable:** refers to the extent to which {a} accurate and reliable data were collected and {b} these data represent the most direct and comprehensive sample of the target skill or behavior that is possible. Measurement of the dependent variable is tied to the type of measurement system used, the psychometric support and/or reliability for dependent variables, and the extent to which evaluators were blind and/or independent when tests, scales, or checklists served as the dependent variables.
 - **Measurement of independent variable:** describes the extent to which treatment fidelity was adequately established. Treatment fidelity is tied to implementation accuracy, the percentage and type of sessions during which data were collected, and the extent to which treatment fidelity was reliably measured.
 - **Participant ascertainment:** refers to the degree to which well-established diagnostic tools and procedures were used to determine eligibility for participant inclusion in the study and the extent to which diagnosticians and evaluators were independent and/or blind to the treatment conditions. Participant ascertainment is also tied to the use of Diagnostic and Statistical Manual for Mental Disorders or International Classification of Diseases criteria.
 - **Generalization:** is defined as the extent to which researchers attempted to objectively demonstrate the spread of treatment effects across time, settings, stimuli, responses, or persons. Generalization is also tied to the type of data collected (e.g., objective versus subjective).

The criteria for each rating on the SMRS are outlined in Table 1.

Table 1} Scientific Merit Rating Scale

Research Design		Measurement of Dependent Variable		Measurement of Independent Variable <i>(procedural integrity or treatment fidelity)</i>	Participant Ascertainment	Generalization of Tx Effect(s)
Group	Single-subject ^a	Test, scale, checklist, etc.	Direct behavioral observation			
<p>Number of groups: two or more</p> <p>Design: Random assignment and/or no significant differences pre-Tx</p> <p>Participants: n > 10 per group or sufficient power for lower number of participants</p> <p>Data Loss: no data loss</p>	<p>A minimum of three comparisons of control and treatment conditions</p> <p>Number of data points per condition: > five</p> <p>Number of participants: > three</p> <p>Data loss: no data loss possible</p>	<p>Type of measurement: Observation-based</p> <p>Protocol: standardized</p> <p>Psychometric properties solid instrument</p> <p>Evaluators: blind and independent</p>	<p>Type of measurement: continuous or discontinuous with calibration data showing low levels of error</p> <p>Reliability: IOA \geq 90% or kappa > .75</p> <p>Percentage of sessions: Reliability collected in \geq 25%</p> <p>Type of conditions in which data were collected: all sessions</p>	<p>Implementation accuracy measured at \geq 80%</p> <p>Implementation accuracy measured in 25% of total sessions</p> <p>IOA for treatment fidelity \geq 80%</p>	<p>Diagnosed by a qualified professional</p> <p>Diagnosis confirmed by independent and blind evaluators for research purposes using at least one psychometrically solid instrument</p> <p>DSM or ICD criteria or commonly accepted criteria during the identified time period reported to be met</p>	<p>Objective data</p> <p>Maintenance data collected</p> <p>AND</p> <p>Generalization data collected across at least two of the following: setting, stimuli, persons</p>

SMRS} Rating 5

SMRS} Rating 4

Research Design		Measurement of Dependent Variable		Measurement of Independent Variable <i>(procedural integrity or treatment fidelity)</i>	Participant Ascertainment	Generalization of Tx Effect(s)
Group	Single-subject ^a	Test, scale, checklist, etc.	Direct behavioral observation			
<p>Number of groups: two or more</p> <p>Design: Matched groups; No significant differences pre-Tx; or better design</p> <p>Participants: n > 10 per group or sufficient power for lower number of participants</p> <p>Data Loss: some data loss possible</p>	<p>A minimum of three comparisons of control and treatment conditions</p> <p>Number of data points per condition: > five</p> <p>Number of participants: > three</p> <p>Data loss: some data loss possible</p>	<p>Type of measurement: Observation-based measurement</p> <p>Protocol: standardized</p> <p>Psychometric properties sufficient</p> <p>Evaluators: blind</p> <p>OR</p> <p>independent</p>	<p>Type of measurement: continuous or discontinuous with no calibration data</p> <p>Reliability: IOA \geq 80% or kappa > .75</p> <p>Percentage of sessions: Reliability collected in \geq 25%</p> <p>Type of conditions in which data were collected: all sessions</p>	<p>Implementation accuracy measured at \geq 80%</p> <p>Implementation accuracy measured in 20% of total session for focused interventions only</p> <p>IOA for treatment fidelity: not reported</p>	<p>Diagnosis provided/ confirmed by independent and blind evaluators for research purposes using at least one psychometrically sufficient instrument</p>	<p>Objective data</p> <p>Maintenance data collected</p> <p>AND</p> <p>Generalization data collected across at least one of the following: setting, stimuli, persons</p>

SMRS} Rating 3

Research Design		Measurement of Dependent Variable		Measurement of Independent Variable <i>(procedural integrity or treatment fidelity)</i>	Participant Ascertainment	Generalization of Tx Effect(s)
Group	Single-subject ^a	Test, scale, checklist, etc.	Direct behavioral observation			
<p>Number of groups: two or more</p> <p>Design: Pre-Tx differences controlled statistically or better design</p> <p>Data loss: some data loss possible</p>	<p>A minimum of two comparisons of control and treatment conditions</p> <p>Number of data points per condition: > three</p> <p>Number of participants: > two</p> <p>Data loss: some data loss possible</p>	<p>Type of measurement: Observation-based measurement</p> <p>Protocol: non-standardized or standardized</p> <p>Psychometric properties adequate</p> <p>Evaluators: neither blind nor independent required</p>	<p>Type of measurement: continuous or discontinuous with no calibration data</p> <p>Reliability: IOA \geq 80% or kappa > .4</p> <p>Percentage of sessions: Reliability collected in \geq 20%</p> <p>Type of conditions in which data were collected: all or experimental sessions only</p>	<p>Implementation accuracy measured at \geq 80%</p> <p>Implementation accuracy measured in 20% of partial session for focused interventions only</p> <p>IOA for treatment fidelity: not reported</p>	<p>Diagnosis provided/confirmed by independent</p> <p>OR</p> <p>Blind evaluator for research purposes using at least one psychometrically adequate instrument</p> <p>OR</p> <p>DSM criteria confirmed by a qualified diagnostician or independent and/or blind evaluator</p>	<p>Objective data</p> <p>Maintenance data collected</p> <p>OR</p> <p>Generalization data collected across at least one of the following: setting, stimuli, persons</p>

SMRS} Rating 2

Research Design		Measurement of Dependent Variable		Measurement of Independent Variable <i>(procedural integrity or treatment fidelity)</i>	Participant Ascertainment	Generalization of Tx Effect(s)
Group	Single-subject ^a	Test, scale, checklist, etc.	Direct behavioral observation			
<p>Number of groups and Design: If two groups, pre-Tx difference not controlled or better research design</p> <p>OR</p> <p>A one group repeated measures pre-test/post-test design</p> <p>Data Loss: significant data loss possible</p>	<p>A minimum of two comparisons of control and treatment conditions</p> <p>Number of data points per Tx condition: > three</p> <p>Number of participants: > two</p> <p>Data loss: significant data loss possible</p>	<p>Type of measurement: Observation-based or subjective</p> <p>Protocol: non-standardized or standardized</p> <p>Psychometric properties modest</p> <p>Evaluators: neither blind nor independent required</p>	<p>Type of measurement: continuous or discontinuous with no calibration data</p> <p>Reliability: IOA \geq 80% or kappa > .4</p> <p>Percentage of sessions: Not reported</p> <p>Type of conditions in which data were collected: not necessarily reported</p> <p>Operational definitions are extensive or rudimentary</p>	<p>Control condition is operationally defined at an inadequate level or better</p> <p>Experimental (Tx) procedures are operationally defined at a rudimentary level or better</p> <p>Implementation accuracy measured at \geq 80%</p> <p>Implementation accuracy regarding percentage of total or partial sessions: not reported</p> <p>IOA for treatment fidelity: not reported</p>	<p>Diagnosis with at least one psychometrically modest instrument</p> <p>OR</p> <p>Diagnosis provided by a qualified diagnostician or blind and/or independent evaluator with no reference to psychometric properties of instrument</p>	<p>Subjective data</p> <p>Maintenance data collected</p> <p>AND</p> <p>Generalization data collected across at least 1 of the following: setting, stimuli, persons</p>

SMRS} Rating 1

Research Design		Measurement of Dependent Variable		Measurement of Independent Variable <i>(procedural integrity or treatment fidelity)</i>	Participant Ascertainment	Generalization of Tx Effect(s)
Group	Single-subject ^a	Test, scale, checklist, etc.	Direct behavioral observation			
Number of groups and Design: two group, post-test only or better research design OR retrospective comparison of one or more matched groups Data loss: significant data loss possible	A minimum of two comparisons of control and treatment conditions Number of participants: > one Data loss: significant data loss possible	Type of measurement: Observation-based or subjective Protocol: non-standardized or standardized Psychometric properties weak Evaluators: Neither blind nor independent required	Type of measurement: continuous or discontinuous with no calibration data Type of conditions in which data were collected: not necessarily reported Operational definitions are extensive or rudimentary	Control condition is operationally defined at an inadequate level or better Experimental (Tx) procedures are operationally defined at a rudimentary level or better IOA and procedural fidelity data are unreported	Diagnosis provided by {a} review of records OR {b} instrument with weak psychometric support	Subjective or subjective supplemented with objective data Maintenance data collected OR Generalization data collected across at least one of the following: setting, stimuli, persons

SMRS} Rating 0

Does not meet criterion for a score of 1	Does not meet criterion for a score of 1	Does not meet criterion for a score of 1	Does not meet criterion for a score of 1	Does not meet criterion for a score of 1	Does not meet criterion for a score of 1	Does not meet criterion for a score of 1
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^a For all designs except alternating treatments design (ATD). For an ATD, the following rules apply:

{5} Comparison of baseline and experimental condition; ≥ five data points per experimental condition, follow-up data collected, carryover effects minimized through counterbalancing of key variables (e.g., time of day), and condition discriminability; n ≥ three; no data loss

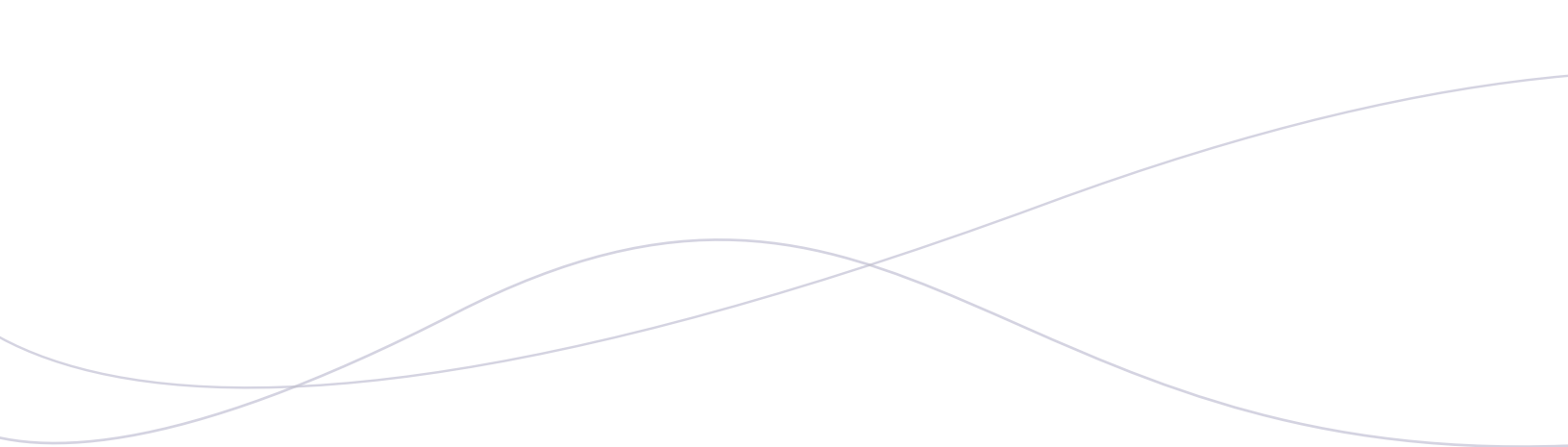
{4} Comparison of baseline and experimental condition; ≥ five data points per experimental condition; carryover effects minimized through counterbalancing of key variables (e.g., time of day), OR condition discriminability; n ≥ three; some data loss possible

{3} ≥ five data points per condition, carryover effects minimized counterbalancing of key variables OR condition discriminability; n ≥ two; some data loss possible

{2} ≥ five data points per condition; n ≥ two; significant data loss possible

{1} ≥ five data points per condition; n ≥ one; significant data loss possible

{0} Does not meet criterion for a score 1



For each of the five dimensions of scientific merit, a score between zero and five (0-5) was assigned with 0 representing a poor score and 5 representing a strong score. The dimension scores were combined to yield a composite score that was rounded to the nearest whole number; this was called the SMRS score. The formula for combining these dimensions is as follows: Research Design (.30) + Dependent Variable (.25) + Participant Ascertainment (.20) + Procedural Integrity (.15) + Generalization (.10).

- SMRS scores of 3, 4, or 5 indicate that sufficient scientific rigor has been applied. We can therefore draw firm conclusions about the treatment effects specific to participants with ASD that were demonstrated in the study. These scores suggest that similar results would likely be obtained in a study that used equal or better research methods.
- SMRS scores of 2 provide initial evidence about treatment effects. However, more rigorous research must be conducted to confirm these same effects would likely occur when more rigorous procedures are applied to other individuals with ASD.
- SMRS scores of 0 or 1 indicate that insufficient scientific rigor has been applied to the population of individuals with ASD.

There is insufficient evidence to even suggest whether a treatment may or may not have beneficial, ineffective, or harmful effects.

Note that the scores reported in this document are specific to ASD. This is important because a study may, in fact, have a much higher SMRS score if a broader category of participants involved in the study was considered. That is, a well-designed study that used adequate dependent variables, provided evidence of procedural integrity, and involved maintenance and/or generalization data may actually receive a lower score in this report if most of the participants were described only as having “developmental disabilities” and only one participant was described as having a diagnosis of autism without reporting rigorous participant ascertainment procedures.

We encourage researchers and practitioners to be aware of the data supporting or failing to support the effectiveness of the treatments beyond the ASD literature to supplement their decision making. The purpose of this document, however, is restricted to the ASD population so families, educators, and service providers may gain a better sense of the level of research support specific to the ASD population.

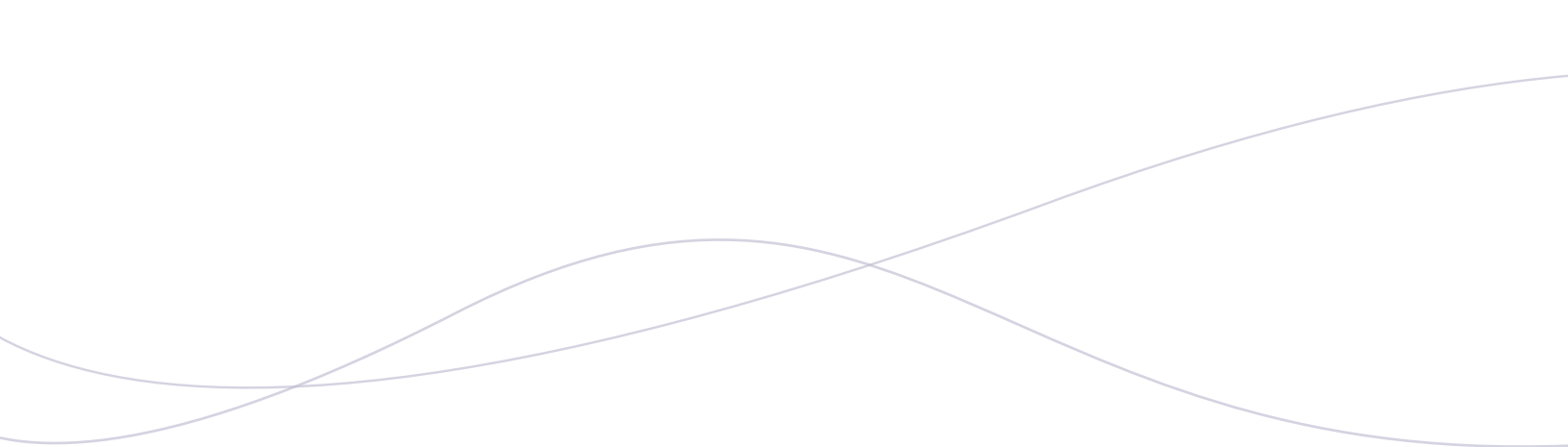
Treatment Effects Ratings

In addition, each study was examined to determine if the treatment effects were: {a} beneficial, {b} ineffective, {c} adverse, or {d} unknown.

- Beneficial is identified when there is sufficient evidence that we can be confident favorable outcomes resulted from the treatment.
- Unknown is identified when there is not enough information to allow us to confidently determine the treatment effects.
- Ineffective is identified when there is sufficient evidence that we can be confident favorable outcomes did not result from the treatment.
- Adverse is identified when there is sufficient evidence that the treatment was associated with harmful effects.

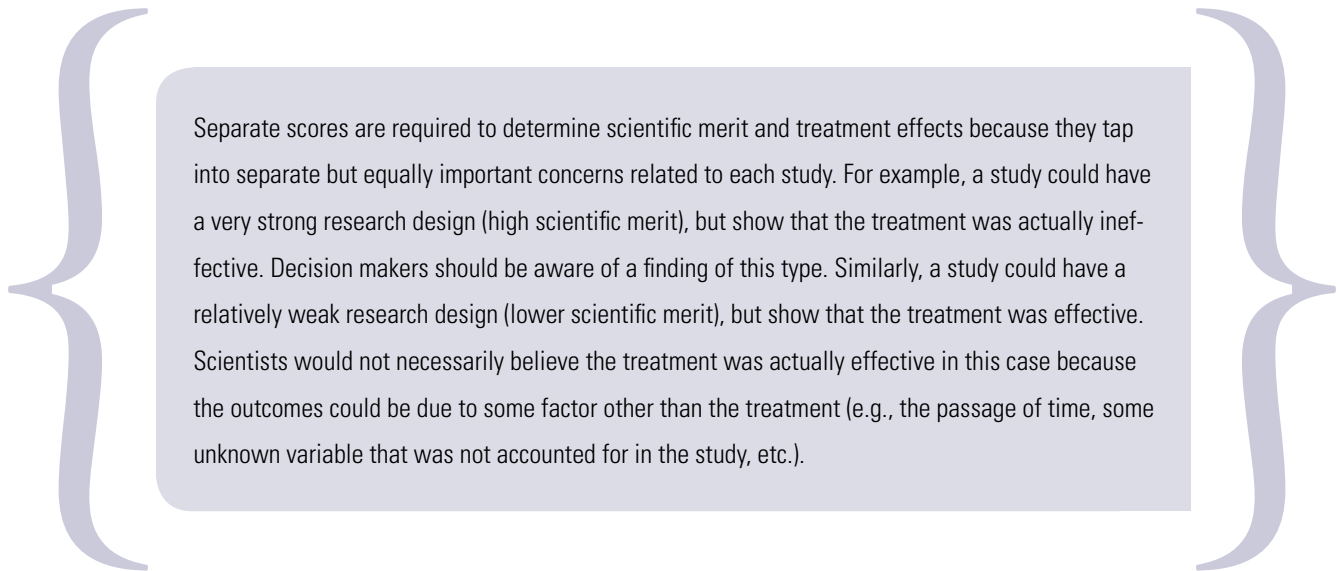
Separate criteria were developed for group research design, single-subject research design, and alternating treatments design (a type of single-subject research design).

- For group research design, we classified treatment effects based on whether or not statistically significant differences were reported. If statistically significant results were not reported, we evaluated if the research design increased the likelihood that an effect would be found.
- For single-subject research design, we classified treatment effects based on whether or not a functional relationship was established, as well as on the number of treatment effects that were attempted and demonstrated. In the case of Ineffective treatment effects, we determined that additional criteria must be met (e.g., a sufficient number of data points and participants, the extent to which comparison conditions sufficiently demonstrated a steady state or appropriate trend line to allow for comparison, etc.). In order to be classified as having Adverse treatment effects, we determined that sufficient rigor must have been employed to identify an effect, and a negative relationship had to be shown.
- For alternating treatments design (ATD), which is a special type of single-subject research design, we classified treatment effects based on the extent to which



separation was reported, carryover effects were minimized, and number of data points was sufficient. In the case of Ineffective treatment effects, we determined that additional criteria had to be met (e.g., baseline data were collected and a change from baseline to intervention was not evidenced for most participants). In order to be classified as having Adverse treatment effects, we determined that sufficient rigor must have been employed to identify an effect, and a negative relationship had to be shown in relation to baseline data.

See Table 2 for details of the Treatment Effects Ratings.



Separate scores are required to determine scientific merit and treatment effects because they tap into separate but equally important concerns related to each study. For example, a study could have a very strong research design (high scientific merit), but show that the treatment was actually ineffective. Decision makers should be aware of a finding of this type. Similarly, a study could have a relatively weak research design (lower scientific merit), but show that the treatment was effective. Scientists would not necessarily believe the treatment was actually effective in this case because the outcomes could be due to some factor other than the treatment (e.g., the passage of time, some unknown variable that was not accounted for in the study, etc.).

Table 2} Treatment Effects Ratings

Beneficial Treatment Effects Reported	Unknown Treatment Effects Reported	Ineffective Effects Reported	Adverse Treatment Effects Reported
<p>Single: A functional relation is established and is replicated at least two times</p>	<p>For all research designs: The nature of the data does not allow for firm conclusions about whether the treatment effects are beneficial, ineffective, or adverse</p>	<p>Single: A functional relation was not established and {a} results were not replicated but at least two replications were attempted {b} a minimum of five data points were collected in baseline and treatment conditions {c} a minimum of two participants were included {d} a fair or good point of comparison (e.g., steady state) existed</p>	<p>Single: A functional relation is established and is replicated at least two times The treatment resulted in greater deficit or harm on the dependent variable based on a comparison to baseline conditions</p>
<p>ATD: Moderate or strong separation between at least two data series for most participants Carryover effects were minimized A minimum of five data points per condition</p>		<p>ATD: No separation was reported and baseline data show a stable pattern of responding during baseline and treatment conditions for most participants</p>	<p>ATD: Moderate or strong separation between at least two data series for most participants Carryover effects were minimized A minimum of five data points per condition Treatment conditions showed the treatment produced greater deficit or harm for most or all participants when compared to baseline</p>
<p>Group: Statistically significant effects reported in favor of the treatment</p>		<p>Group: No statistically significant effects were reported with sufficient evidence an effect would likely have been found* *The criterion includes: {a} there was sufficient power to detect a small effect {b} the type I error rate was liberal, {c} no efforts were made to control for experiment-wise Type I error rate, and {d} participants were engaged in treatment</p>	<p>Group: Statistically significant finding reported indicating a treatment resulted in greater deficit or harm on any of the dependent variables</p>



Identifying and Describing Treatments

Once field reviewers coded all the studies, we combined the results of the SMRS and the Treatment Effects Ratings to identify the level of research support currently available for each educational and behavioral intervention we examined. We identified 38 treatments. The term “treatment” may represent either intervention strategies (i.e., therapeutic techniques that may be used in isolation) or intervention classes (i.e., a combination of different intervention strategies that hold core characteristics in common). Whenever possible, we combined intervention strategies into intervention classes to lend clarity regarding the effectiveness of the treatment. When this was not possible, we reported results on isolated intervention strategies.

Treatment Classification

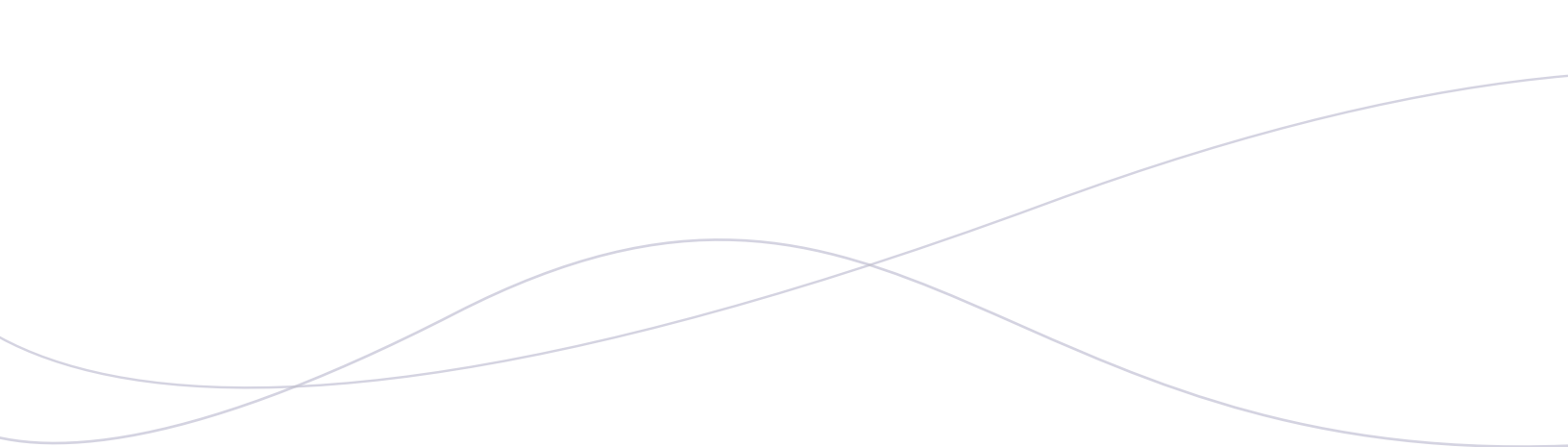
Treatments can be classified in many ways. For example, a treatment could have a name that appears in the research literature, or a treatment could have a name that is used in popular media. Many treatments do not easily lend themselves to a simple label. Often, different components of interventions are combined to make a new composite intervention, but no label is ever given to the composite. This can make communicating about these interventions complicated and very challenging. Further, there are instances in which two interventions are very similar or are regulated by the same mechanism, but have different names. To best understand how much research support is available for the treatment approach, it would be best to find a way to combine the two interventions. But again, what label should be applied?

We tried to satisfactorily combine intervention strategies into treatment categories so parents, educators, and service providers could have a better understanding of the level of research support available for different treatment approaches specific to the ASD population. We developed these categories so, wherever reasonable, we could combine treatment approaches that were substantially similar or held core characteristics in common.

- In some cases, we could combine only a small number of intervention articles. If we were to expand the category to add more articles, the treatment category would no longer make sense.
- In other cases, we could combine a large number of intervention articles. If we were to shrink the category so all categories were approximately the same size, the treatment category would no longer make sense.
- In some cases, the treatment category targets a small number of skills or behaviors (e.g., personal responsibility or academics) because the purpose of the treatment is very focused or targeted.
- In other cases, the treatment category targets a large number of skills or behaviors and draws from research published by comprehensive treatment programs.

We strove to combine interventions into treatment categories so they would make the most sense (see Treatment Classification Example on page 30). The chair of the National Standards Project began by examining all of the article reviews completed by field reviewers and identifying if the studies could reasonably be clustered together. That is, she examined how they could be arranged so the interventions contained within the category represented a treatment approach that did not overlap with other treatment categories. If treatment categories overlapped, it would lead to an inflated representation of the scientific literature published to date⁵. The chair sent the treatment categories to the expert panel and the conceptual reviewers in the context of a first draft of this report. A total of 71 treatment categories were proposed in that draft. These scholars provided feedback on how to reorganize the treatment categories. The

⁵ Even choosing to have non-overlapping categories presented a challenge. As one example, Pivotal Response Treatments (PRT) is an Established Treatment. We placed studies in this category only when the term ‘pivotal response’ or ‘natural language paradigm’ appeared in the article. However, the originators of this approach have conducted research that is consistent with PRT that was classified elsewhere in the report (e.g., antecedent package, behavioral package, naturalistic teaching strategies, and self-management). It would likely be an impossible task to accurately identify each of the possible ways different literature bases might be tied together (as in the PRT example). Instead we offer this single example to illustrate that, despite the fact that we have categorized these treatments, additional meaningful relationships between these treatments may exist.



second draft of this report contained 41 treatment categories. Feedback delivered after the second draft suggested a few of the treatment categories could be further combined in a meaningful way. Thus, the final draft of the National Standards Report includes a total of 38 treatments. A listing of the articles associated with each of these 38 treatments can be found in Appendix 1.

Although these 38 treatment categories represent unique approaches to treatment, we understand that more details may be desirable to some readers. It is our goal to break these treatment categories down into even further detail in future documents.

After developing definitions for the treatment categories, the chair of the National Standards Project classified all treatment studies. The methodology for articles representing treatments that did not fit perfectly into one of the existing categories was examined by more than one of our experts to derive consensus on treatment categorization. A research assistant classified approximately five percent of the total number of studies that were randomly selected to establish reliability. Reliability in the form of interobserver agreement was .92 for treatment categorization.

The names we provided for these treatment categories may be unfamiliar to some individuals. This may require the reader to look closely at the definitions we have applied to see how our categories relate to terms with which s/he is familiar. Wherever possible, we have included a popular or research term associated with a treatment in the categories of treatments we have identified. We have also listed these terms in the index.

There are several reasons some familiar treatment names may not appear in this table. First, we grouped similar treatments together, so the name that is most familiar to the reader may appear only in the definition of the larger category. Please read each description carefully. Second, many educational and behavioral treatments may be well-known but still lack scientific evidence. In this case, the name would not appear because, as of September 2007, no studies had been published in peer-reviewed journals. If no treatment studies have been published in peer-reviewed journals, it means that the scientific process that is used in all scientific fields has not been followed. This means it would fall into the “Unestablished” category of the Strength of Evidence Classification System.

Treatment Classification Example

We hope the following example illustrates the complexities and challenges of the decision-making process regarding treatment categorization.

Throughout this process, many of our experts (expert panelists and conceptual reviewers) forwarded a number of conflicting suggestions regarding treatment categorization. Some of our experts believe that, in some cases, treatments should be broken down into somewhat smaller units; others believe they should be further combined into larger units. We look forward to continued feedback from these experts and from the autism community as we prepare to write the next version of the National Standards Project.

There is no absolute scientific process for determining if treatment categories “make sense.” We made the first decisions based on similarity of treatment procedures. However, we also had to make a second set of decisions. Specifically, did the treatment categories lead to an accurate representation of the literature?

For example, imagine a case in which we have a separate category for an intervention (let’s call it “Intervention V”). There are over 50 studies on Intervention V, but most of these studies involved Intervention V plus at least one other intervention strategy. We cannot put all of these studies in the analysis and call it Intervention V because we do not know if the outcomes of the research

are due to Intervention V, or Intervention V plus other treatment components. If we analyze only the “pure” examples of Intervention V, we would say that the treatment is Unestablished (because there are not enough studies to qualify as anything else). This does not seem to accurately represent this treatment because there are over 50 studies that show the treatment is effective when combined with other components. We might then reexamine all of our treatment categories and determine if Intervention V is actually a reasonable subcategory of a larger treatment category. This decision would require deliberation and feedback from our experts to ensure that Intervention V should reasonably be combined into this larger treatment category. Once we determine that the combined category is reasonable, the 50+ studies on Intervention V are included in the larger category. The subsequent analyses better represent the treatment literature than the alternate solutions. Finally, we endeavored to organize the treatments based on information that is often available to parents, educators, and service providers. In most cases, we categorized treatments by intervention strategies. However, in rare cases, the factor that distinguished the category was not related to the specific intervention strategies (e.g., skills or behaviors that were targeted or use of technology).

Strength of Evidence Classification System

After we identified the treatments, we applied the Strength of Evidence Classification System criteria. The Strength of Evidence Classification System can be used to determine how confident we should be about the effectiveness of a treatment. Ratings reflect the quality, quantity, and consistency of research findings for each type of intervention.

There are four categories in the Strength of Evidence Classification System.⁶ Table 3 identifies the criteria associated with each of the ratings.

Strength of Evidence ratings reflect the quality, quantity, and consistency of research findings that have been applied specifically to individuals with ASD. As stated previously, the “quality” of a study is important because some research designs do not actually shed much light on whether or not a treatment is effective. “Quantity” is important because a single study, no matter how well-designed, will never be able to tell us absolutely if a treatment is truly effective. “Consistency” is important because, if a treatment is truly effective, we would expect it to consistently show beneficial effects. Of course, even interventions that are truly effective may occasionally appear to be ineffective in a study just by chance—so we have built this chance into the Strength of Evidence Classification System. See the footnote in Table 3 for details.

⁶ The Strength of Evidence Classification System was modified to its current four-point format to ease interpretation of outcomes for the general public. Although the Strength of Evidence Classification System was modified from a six-point format, the interpretation of outcomes remains identical across formats. For example, all treatments that were previously identified as having sufficient evidence of effectiveness did not vary across the two systems.

Table 3} Strength of Evidence Classification System

Established	Emerging	Unestablished	Ineffective/Harmful
<p>Several^a published, peer-reviewed studies</p> <ul style="list-style-type: none"> • SMRS scores of 3, 4, or 5 • Beneficial treatment effects for a specific target <p>These may be supplemented by studies with lower scores on the Scientific Merit Rating Scale.</p>	<p>Few^b published, peer-reviewed studies</p> <ul style="list-style-type: none"> • SMRS scores of 2 • Beneficial treatment effects reported for one dependent variable for a specific target <p>These may be supplemented by studies with higher or lower scores on the Scientific Merit Rating Scale.</p>	<p>May or may not be based on research</p> <ul style="list-style-type: none"> • Beneficial treatment effects reported based on very poorly controlled studies (scores of 0 or 1 on the Scientific Merit Rating Scale) • Claims based on testimonials, unverified clinical observations, opinions, or speculation • Ineffective, unknown, or adverse treatment effects reported based on poorly controlled studies 	<p>Several^a published, peer-reviewed studies</p> <ul style="list-style-type: none"> • SMRS scores of 3 • No beneficial treatment effects reported for one dependent measure for a specific target (Ineffective) <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> • Adverse treatment effects reported for one dependent variable for a specific target (Harmful) <p>Note: Ineffective treatments are indicated with an "I" and Harmful treatments are indicated with an "H"</p>

^a Several is defined as 2 group design or 4 single-subject design studies with a minimum of 12 participants for which there are no conflicting results or at least 3 group design or 6 single-subject design studies with a minimum of 18 participants with no more than 1 study reporting conflicting results. Group and single-subject design methodologies may be combined.

^b Few is defined as a minimum of 1 group design study or 2 single-subject design studies with a minimum of 6 participants for which no conflicting results are reported.* Group and single-subject design methodologies may be combined.

*Conflicting results are reported when a better or equally controlled study that is assigned a score of at least 3 reports either {a} ineffective treatment effects or {b} adverse treatment effects.

These general guidelines can be used to interpret each of these categories:

- Established.** Sufficient evidence is available to confidently determine that a treatment produces beneficial treatment effects for individuals on the autism spectrum. That is, these treatments are established as effective.
- Emerging.** Although one or more studies suggest that a treatment produces beneficial treatment effects for individuals with ASD, additional high quality studies must consistently show this outcome before we can draw firm conclusions about treatment effectiveness.
- Unestablished.** There is little or no evidence to allow us to draw firm conclusions about treatment effectiveness with individuals with ASD. Additional research may show the treatment to be effective, ineffective, or harmful.
- Ineffective/Harmful.** Sufficient evidence is available to determine that a treatment is ineffective or harmful for individuals on the autism spectrum.

Treatment Subclassification

Process

Beyond identifying if a treatment is effective, the research community seeks to answer additional questions that could potentially impact treatment selection.

- “Have favorable outcomes been demonstrated when a specific skill or behavior is targeted for improvement with individuals on the autism spectrum?”
- “Have favorable outcomes been demonstrated with a particular age group of individuals with ASD?”
- “Have favorable outcomes been demonstrated with a specific diagnostic group (e.g., Autistic Disorder, Asperger’s Syndrome, PDD-NOS)?”

The purpose of subclassifying treatments and identifying which ones are associated with favorable outcomes is to identify which relevant variables (treatment target, age group, and diagnostic group) have been the focus of treatment studies to date. This is important for two reasons. First, decision makers feel even more confident when a treatment has been associated with favorable outcomes for the treatment target, age group, or diagnostic group of interest for a specific child. Second, it identifies areas in which the existing literature might be extended by the research community. By identifying the limitations of the existing research, we hope to motivate scholars to extend our knowledge about treatments by conducting high-quality research for each of these relevant variables.

We used the following process to subclassify treatments:

- 1.** Identify all studies associated with a given treatment.
- 2.** Identify relevant variables in each of the studies.
 - a.** What was the target of the treatment? Was the goal to increase a skill or decrease a behavior?
 - b.** What were the ages of the participants?
 - c.** To what diagnostic group (Autistic Disorder, Asperger’s Syndrome, or PDD-NOS) did the participants belong?

3. Identify the SMRS Score and the Treatment Effects Ratings for each of the relevant variables for each of the studies.
4. For each relevant variable (treatment target, age group, and diagnostic group), identify the quality, quantity, and consistency of research findings across all studies for a given treatment.
5. For each relevant variable, determine if there is evidence suggesting the treatment produces favorable outcomes. We defined favorable outcomes as meeting the following criterion: a few studies with SMRS Scores of 2, 3, 4, or 5 showing beneficial treatment effects. This criterion was selected to increase the chances we would identify any variables associated with favorable outcomes.

Subcategories

Treatment Targets

There are many different skills or behaviors that are targeted for improvement when treating individuals on the autism spectrum. Some of the treatment targets seek to improve skills by increasing developmentally appropriate skills. Other treatment targets are intended to improve life functioning by decreasing behaviors. We broke down 14 treatment targets into two categories: skills increased and behaviors decreased.

Skills Increased

It is always essential for treatment providers to implement interventions to increase developmentally appropriate skills. We have identified 10 developmental skills that treatment providers may target to increase.

- ▶ **Academic.** This category represents tasks that are precursors or required for success with school activities. Dependent variables associated with these tasks include but are not restricted to preschool activities (e.g., sequencing, color, letter, number identification, etc.), fluency, latency, reading, writing, mathematics, science, history, or skills required to study or perform well on exams.

The Place of “Favorable Outcomes” in Treatment Selection

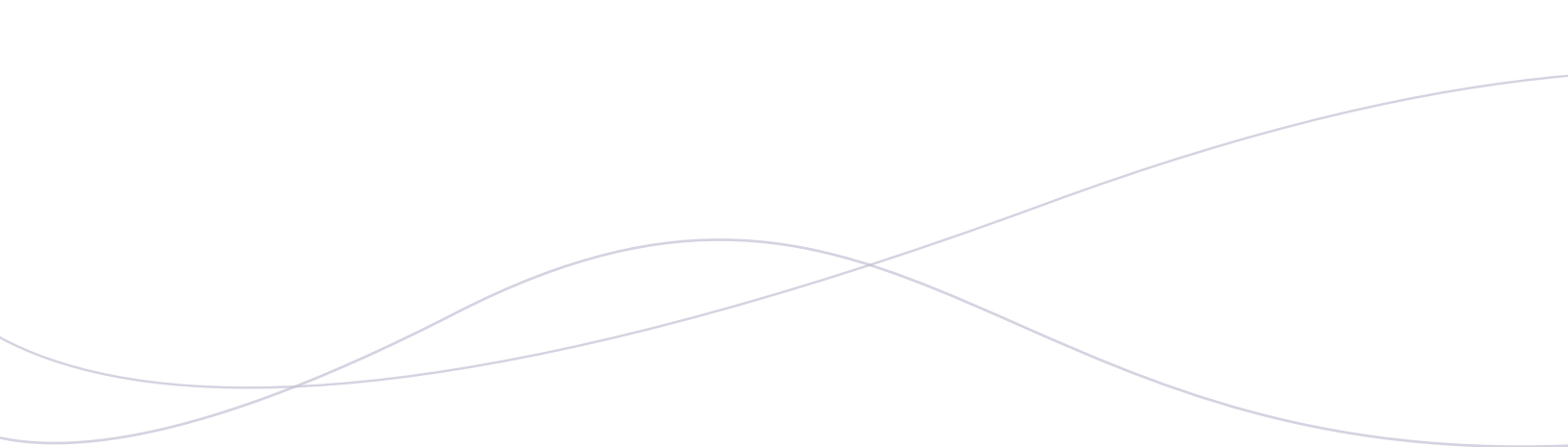
When we assign Strength of Evidence Classification ratings, it involves adding up the results of every study for each treatment. In contrast, when we subclassify studies, it involves dividing the available studies into small units based on all relevant variables. For example, for each treatment, we sub-divided the studies into small units based on 14 treatment targets, six age groups, and three diagnostic groups. When you divide studies in this many ways, the number of studies falling into each relevant variable will tend to be low. This is one reason that a treatment may be an Established Treatment but still not be associated with favorable outcomes for any specific treatment target, age group, or diagnostic group. This highlights the importance of looking at research support at two different levels. A clear hierarchy exists between these two levels with the Strength of

Evidence Classification ratings being given greater importance.

- The primary question that should be asked is, “Is there evidence this treatment is effective?” This question should be answered irrespective of which, if any, variables are associated with favorable outcomes. This question is answered by the Strength of Evidence Classification System rating.
- The secondary question that can be asked is, “Is there evidence this treatment produces favorable outcomes for a specific treatment target, age group, or diagnostic group?”

It takes a large number of highly focused research studies to extend the treatment literature into each relevant variable (target of treatment, age, diagnostic group). We look forward to the scientific contributions that expand our knowledge about these relevant variables in the future.

- ▶ **Communication.** Communication tasks involve verbal or nonverbal signaling to a social partner regarding content of sharing of experiences, emotions, information, or affecting the partner’s behavior, and behaviors that involve understanding a partner’s intentional signals for the same purposes. This systematic means of communication involves the use of sounds or symbols. Dependent variables associated with these tasks include but are not restricted to requesting, labeling, receptive, conversation, greetings, nonverbal, expressive, syntax, speech, articulation, discourse, vocabulary, and pragmatics.
- ▶ **Higher Cognitive Functions.** These tasks require complex problem-solving skills outside the social domain. Dependent variables associated with these tasks include but are not restricted to critical thinking, IQ, problem-solving, working memory, executive functions, organizational skills, and theory of mind tasks.
- ▶ **Interpersonal.** The tasks comprising this category require social interaction with one or more individuals. Dependent variables associated with these tasks include but are not limited to joint attention, friendship, social and pretend play, social skills, social engagement, social problem solving, and appropriate participation in group activities. The area of pragmatics is not included in this list because it will be addressed in the communication section.
- ▶ **Learning Readiness.** Learning readiness tasks serve as the foundation for successful mastery of complex skills in other domains identified. Dependent variables associated with these tasks include but are not restricted to imitation, following instructions, sitting skills, and attending to environmental sounds.
- ▶ **Motor Skills.** Motor skills involve tasks that require coordination of muscle systems to produce a specific goal involving either fine motor or gross motor skills or visual-motor coordination. Fine motor skills require manipulation of objects using precise movements to produce the desired outcome. Examples of fine motor skills include but are not restricted to cutting, coloring, writing, typing, and threading beads. Gross motor skills involve larger muscle movements and include but are not restricted to sitting, standing, walking, and throwing/catching balls.

- 
- ▶ **Personal Responsibility.** This category targets tasks that involve activities embedded in everyday routines. Dependent variables associated with these tasks include but are not restricted to feeding, sleeping, dressing, toileting, cleaning, family and/or community activities, health and fitness, phone skills, time and money management, and self-advocacy.
 - ▶ **Placement.** Placement was coded whenever the dependent variable involves level of restriction in placement in school, home, or community settings. Examples include but are not restricted to placement in general education classroom and placement back into the home setting. Although placement is not a “skill,” it represents an important accomplishment toward which treatment programs strive.
 - ▶ **Play.** Play tasks involve non-academic and non-work-related activities that do not involve self-stimulatory behavior or require interaction with other persons. Dependent variables associated with these tasks may include but are not restricted to functional independent play (i.e., manipulation of toys to determine how they “work” or appropriate use of toys that do not involve pretense, games). Whenever social play was targeted (independently or in conjunction with make-believe play), it was placed in the “interpersonal” categories.
 - ▶ **Self-Regulation.** Self-regulation tasks involve the management of one’s own behaviors in order to meet a goal. Dependent variables associated with these tasks include but are not limited to persistence, effort, task fluency, transfer of attention, being “on schedule,” self-management, self-monitoring, self-advocacy, remaining in seat (or its opposite of “out of seat”), time management, or adapting to changes in the environment.

In our outcomes section, we present information about favorable outcomes in tables. Developmentally appropriate skills that parents, educators, and service providers are likely to want to increase are listed in the “Skills Increased” section of each table (see Table 4). If favorable outcomes are identified in the literature, an “X” will appear in the box below the skill. For example, in Table 4, Treatment Z is associated with favorable outcomes when addressing both communication and interpersonal skills.

Table 4} Examples of Favorable Outcomes Based on Treatment Target to Increase Skills

Evidence Level} Strength of Evidence Classification Rating appears here									
Treatment Z									
Treatments definition appears hear.									
Skills Increased									
Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						
Behaviors Decreased									
Problem Behaviors			RRN		SER		General Symptoms		
X									
Ages									
0-2	3-5	6-9		10-14		15-18		19-21	
X	X	X							
Diagnostic Classification									
Autistic Disorder			Asperger's Syndrome			PDD-NOS			
X			X			X			

Behaviors Decreased

For some individuals on the autism spectrum, treatment providers may need to implement treatments to decrease behaviors that interfere with life functioning. We have identified four areas of challenge that treatment providers may target to decrease.

These include:

- ▶ **General Symptoms.** General symptoms involve a combination of symptoms that may be directly associated with ASD or may be a result of psychoeducational needs that are sometimes associated with ASD.
- ▶ **Problem Behaviors.** These behaviors can harm the individual or others OR result in damage to objects OR interfere with the expected routines in the community. Problem behaviors may include but are not restricted to self-injury, aggression, disruption, destruction of property, or hazardous or sexually inappropriate behaviors.
- ▶ **Restricted, Repetitive, Nonfunctional Patterns of Behavior, Interests, or Activity (RRN).** This category is reserved for limited, frequently repeated, maladaptive patterns of motor, speech, and thoughts. The following is a list of representative

behaviors: stereotypic and compulsive behaviors, inappropriate speech, or restricted interest.

- Sensory or Emotional Regulation (SER).** Sensory and emotional regulation involves the extent to which an individual can flexibly modify his or her level of arousal or response in order to function effectively in the environment. Examples of behaviors that fall into this category include stimulus refusal, sleep disturbance, anxiety, and depression.

Behaviors that parents, educators, and service providers are likely to want to decrease are listed in the “Behaviors Decreased” section of each table (see Table 5). If favorable outcomes are identified in the literature, an “X” will appear in the box below the behavior. For example, in Table 5, Treatment Z is associated with favorable outcomes for addressing problem behaviors.

Table 5} Examples of Favorable Outcomes Based on Treatment Target to Decrease Behaviors

Evidence Level} Strength of Evidence Classification Rating appears here									
Treatment Z									
Treatments definition appears hear.									
Skills Increased									
Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						
Behaviors Decreased									
Problem Behaviors		RRN			SER		General Symptoms		
X									
Ages									
0-2	3-5	6-9		10-14		15-18		19-21	
X	X	X							
Diagnostic Classification									
Autistic Disorder			Asperger's Syndrome			PDD-NOS			
X			X			X			

Age

Individuals of all different age groups are affected by ASD. Increasingly, parents and professionals are asking whether or not favorable outcomes are reported for specific age groups. Information about ASD treatments based on age can be found below the “Behaviors Decreased” row for each treatment (see example below). Specific age categories include infant/toddlers (ages 0-3), preschool (ages 3-5), elementary (ages 6-9), middle school (ages 10-14), high school (ages 15-18), and early adult (ages 19-21). If favorable outcomes are reported for any of these age groups, an “X” will appear in the box below the age group. For example, in Table 6, Treatment Z is associated with favorable outcomes for children under the age of 10.

Table 6} Examples of Favorable Outcomes Based on Age

Evidence Level} Strength of Evidence Classification Rating appears here									
Treatment Z									
Treatments definition appears hear.									
Skills Increased									
Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						
Behaviors Decreased									
Problem Behaviors			RRN	SER			General Symptoms		
X									
Ages									
0-2	3-5	6-9	10-14	15-18		19-21			
X	X	X							
Diagnostic Classification									
Autistic Disorder			Asperger’s Syndrome			PDD-NOS			
X			X			X			

Diagnostic Group

Individuals representing different diagnostic groups are affected by ASD. Increasingly, parents and professionals are asking whether or not favorable outcomes are reported for specific diagnostic groups. Information about ASD treatments based on diagnosis can be found below the “Ages” row for each treatment (see example below). Specific diagnostic categories include Autistic Disorder (AD), Asperger’s Syndrome (AS), and PDD-NOS. If favorable outcomes are reported for any of these diagnostic groups, an “X” will appear in the box below the age group. For example, in Table 7, Treatment Z is associated with favorable outcomes for children diagnosed with Autistic Disorder, Asperger’s Syndrome, and PDD-NOS.

Table 7} Examples of Favorable Outcomes Based on Diagnosis

Evidence Level} Strength of Evidence Classification Rating appears here									
Treatments definition appears hear.									
Skills Increased									
Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						
Behaviors Decreased									
Problem Behaviors			RRN		SER		General Symptoms		
X									
Ages									
0-2	3-5	6-9		10-14		15-18		19-21	
X	X	X							
Diagnostic Classification									
Autistic Disorder			Asperger’s Syndrome			PDD-NOS			
X			X			X			

4

Outcomes

Established Treatments

We identified 11 treatments as Established (i.e., they were established as effective) for individuals with Autism Spectrum Disorders (ASD). Established Treatments are those for which several well-controlled studies have shown the intervention to produce beneficial effects. There is compelling scientific evidence to show these treatments are effective; however, even among Established Treatments, universal improvements cannot be expected to occur for all individuals on the autism spectrum.

The following interventions are Established Treatments:

- Antecedent Package
- Behavioral Package
- Comprehensive Behavioral Treatment for Young Children
- Joint Attention Intervention
- Modeling
- Naturalistic Teaching Strategies
- Peer Training Package
- Pivotal Response Treatment
- Schedules
- Self-management
- Story-based Intervention Package

Each of these treatments is defined in the tables that follow. Whenever possible, we provided examples of treatment strategies associated with each Established Treatment. The number of studies conducted that contributed to this rating is listed in parentheses after the treatment name. These examples should be considered Established Treatments for individuals with ASD.

Antecedent Package {99 studies}										Evidence Level} Established	
<p>These interventions involve the modification of situational 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. Treatments falling into this category reflect research representing the fields of applied behavior analysis (ABA), behavioral psychology, and positive behavior supports.</p> <p>Examples include but are not restricted to: behavior chain interruption (for increasing behaviors); behavioral momentum; choice; contriving motivational operations; cueing and prompting/prompt fading procedures; environmental enrichment; environmental modification of task demands, social comments, adult presence, intertrial interval, seating, familiarity with stimuli; errorless learning; errorless compliance; habit reversal; incorporating echolalia, special interests, thematic activities, or ritualistic/obsessional activities into tasks; maintenance interspersal; noncontingent access; noncontingent reinforcement; priming; stimulus variation; and time delay.</p>											
Skills Increased											
Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation		
	X		X	X		X		X	X		
Behaviors Decreased											
Problem Behaviors			RRN			SER			General Symptoms		
X						X					
Ages											
0-2	3-5	6-9		10-14		15-18		19-21			
	X	X		X		X					
Diagnostic Classification											
Autistic Disorder				Asperger's Syndrome				PDD-NOS			
X											

Behavioral Package {231 studies}

Evidence Level} Established

These interventions are designed to reduce problem behavior and teach functional alternative behaviors or skills through the application of basic principles of behavior change. Treatments falling into this category reflect research representing the fields of applied behavior analysis, behavioral psychology, and positive behavior supports.

Examples include but are not restricted to: behavioral sleep package; behavioral toilet training/dry bed training; chaining; contingency contracting; contingency mapping; delayed contingencies; differential reinforcement strategies; discrete trial teaching; functional communication training; generalization training; mand training; noncontingent escape with instructional fading; progressive relaxation; reinforcement; scheduled awakenings; shaping; stimulus-stimulus pairing with reinforcement; successive approximation; task analysis; and token economy.

Treatments involving a complex combination of behavioral procedures that may be listed elsewhere in this document are also included in the behavioral package category. Examples include but are not restricted to: choice + embedding + functional communication training + reinforcement; task interspersal with differential reinforcement; tokens + reinforcement + choice + contingent exercise + overcorrection; noncontingent reinforcement + differential reinforcement; modeling + contingency management; and schedules + reinforcement + redirection + response prevention. Studies targeting verbal operants also fall into this category.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
X	X		X	X		X		X	X

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
X	X	X	

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X	X	X	X	X

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Comprehensive Behavioral Treatment for Young Children {22 studies}

Evidence Level} Established

This treatment reflects research from comprehensive treatment programs that involve a combination of applied behavior analytic procedures (e.g., discrete trial, incidental teaching, etc.) which are delivered to young children (generally under the age of 8). These treatments may be delivered in a variety of settings (e.g., home, self-contained classroom, inclusive classroom, community) and involve a low student-to-teacher ratio (e.g., 1:1). All of the studies falling into this category met the strict criteria of: {a} targeting the defining symptoms of ASD, {b} having treatment manuals, {c} providing treatment with a high degree of intensity, and {d} measuring the overall effectiveness of the program (i.e., studies that measure subcomponents of the program are listed elsewhere in this report).

These treatment programs may also be referred to as ABA programs or behavioral inclusive program and early intensive behavioral intervention.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X	X	X		X	X	X	X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
X			X

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Joint Attention Intervention {6 studies}

Evidence Level} Established

These interventions involve building foundational skills involved in regulating the behaviors of others. Joint attention often involves teaching a child to respond to the nonverbal social bids of others or to initiate joint attention interactions. Examples include pointing to objects, showing items/activities to another person, and following eye gaze.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X				

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Modeling {50 studies}

Evidence Level} Established

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. Modeling can include simple and complex behaviors. This intervention is often combined with other strategies such as prompting and reinforcement. Examples include live modeling and video modeling.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X	X	X			X		X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
X		X	

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X	X	X	

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X	X	X

Naturalistic Teaching Strategies {32 studies}

Evidence Level} Established

These interventions involve using primarily child-directed interactions to teach functional skills in the natural environment. These interventions often involve providing a stimulating environment, modeling how to play, encouraging conversation, providing choices and direct/natural reinforcers, and rewarding reasonable attempts. Examples of this type of approach include but are not limited to focused stimulation, incidental teaching, milieu teaching, embedded teaching, and responsive education and prelinguistic milieu teaching.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X	X				X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Peer Training Package {33 studies}

Evidence Level} Established

These interventions involve teaching children without disabilities strategies for facilitating play and social interactions with children on the autism spectrum. Peers may often include classmates or siblings. When both initiation training and peer training were components of treatment in a study, the study was coded as "peer training package." These interventions may include components of other treatment packages (e.g., self-management for peers, prompting, reinforcement, etc.). Common names for intervention strategies include peer networks, circle of friends, buddy skills package, Integrated Play Groups™, peer initiation training, and peer-mediated social interactions.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X					X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
	X		

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Pivotal Response Treatment {14 studies}

Evidence Level} Established

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 the development of these areas having the goal of very widespread and fluently integrated collateral improvements. Key aspects of PRT intervention delivery also focus on parent involvement in the intervention delivery, and on intervention in the natural environment such as homes and schools with the goal of producing naturalized behavioral improvements. This treatment is an expansion of Natural Language Paradigm which is also included in this category.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X					X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Schedules {12 studies}

Evidence Level} Established

These interventions involve the presentation of a task list that communicates a series of activities or steps required to complete a specific activity. Schedules are often supplemented by other interventions such as reinforcement. Schedules can take several forms including written words, pictures or photographs, or work stations.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
									X

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Self-management {21 studies}

Evidence Level} Established

These interventions involve promoting 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. In addition, reinforcement is a component of this intervention with the individual with ASD independently seeking and/or delivering reinforcers. Examples include the use of checklists (using checks, smiley/frowning faces), wrist counters, visual prompts, and tokens.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
			X						X

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
X			

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X	X	X	

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Story-based Intervention Package {21 studies}

Evidence Level} Established

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.). Social Stories™ are the most well-known story-based interventions and they seek to answer the "who," "what," "when," "where," and "why" in order to improve perspective-taking.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
			X						X

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
		X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X	X	

Detailed Summary of Established Treatments

Most treatments are not intended to address every treatment target (i.e., skills to be increased or behaviors to be decreased). Similarly, they may not be developed with the expectation that they will target every age or diagnostic group. For example, joint attention is a skill set that typically develops in very young children. Knowing this, we would expect to see most of the research on joint attention conducted with infants, toddlers, or preschool-aged children. In fact, this is exactly what our review shows. However, whenever a treatment could reasonably be effective for different treatment targets, age groups, or diagnostic groups, researchers should set as a goal to extend research into these different targets or groups.

Table 8 shows which Established Treatments have demonstrated favorable outcomes for each treatment target, age group, or diagnostic group. Although not all Established Treatments should be expected to apply to each of these areas, many of these interventions could be applied to a broader array of treatments. A brief summary follows.

Treatment Targets

Established Treatments have demonstrated favorable outcomes for many treatment targets.

- Antecedent Package, Behavioral Package, and Comprehensive Behavioral Treatment for Young Children have demonstrated favorable outcomes with more than half of the skills that are often targeted to be increased (see Table 8 for examples).
- Behavioral Package has demonstrated favorable outcomes with three-quarters of the behaviors that are often targeted to decrease (see Table 8 for examples).
- Other Established Treatments have demonstrated favorable outcomes with a smaller range of treatment targets. In many cases, this provides a rich opportunity to extend research findings.

The Established

Treatments identified in this document arise from diverse theoretical orientations or fields of study. However, certain trends emerged from an examination of these Established Treatments. Approximately two-thirds of the Established Treatments were developed exclusively from the behavioral literature (e.g., applied behavior analysis, behavioral psychology, and positive behavioral supports). Of the remaining one-third, 75% represent treatments for which research support comes predominantly from the behavioral literature. Additional contributions were made from the non-behavioral literature emanating from the fields of speech-language pathology and special education. These researchers often gave strong emphasis to developmental considerations. Less than 10% (i.e., Story-based Intervention

Package) of the total number of Established Treatments arose from the theory of mind perspective. Interestingly, even these interventions often included a behavioral component. This pattern of findings suggests that treatments from the behavioral literature have the strongest research support at this time. Yet it is important to recognize that treatments based on alternative theories, in isolation or combined with behavioral interventions, should continue to be examined empirically. Further, it demonstrates that all treatment studies can be compared against a common methodological standard and show evidence of effectiveness. Despite the preponderance of evidence associated with the behavioral literature, it is important to acknowledge the important contributions non-behavioral approaches are making at present, and to fund research examining both the behavioral and non-behavioral literature as we move forward.

Age Groups

Established Treatments have demonstrated favorable outcomes with many age groups.

- Behavioral Package has demonstrated favorable outcomes with all age groups.
- Antecedent Package, Comprehensive Behavioral Treatment for Young Children, Modeling, and Self-management have demonstrated favorable outcomes with two-thirds of all age groups.
- Naturalistic Teaching Strategies have demonstrated favorable outcomes with one-half of all age groups.
- Only one Established Treatment has been associated with favorable outcomes for the early adult age group. Further investigation is necessary for this age group.
- Other Established Treatments have demonstrated favorable outcomes with a small range of age groups. In many cases, this provides a rich opportunity to extend research findings.

Diagnostic Groups

Established Treatments have demonstrated favorable outcomes with many diagnostic groups.

- Behavioral Package, Comprehensive Behavioral Treatment for Young Children, Joint Attention Intervention, Modeling, Naturalistic Teaching Strategies, and Peer Training Package have demonstrated favorable outcomes with most diagnostic groups.
- A few Established Treatments (i.e., Modeling and Story-based Intervention Package) have been associated with favorable outcomes for Asperger's Syndrome. Further investigation is necessary for this diagnostic group.
- Other Established Treatments have demonstrated favorable outcomes with a smaller range of diagnostic groups. In many cases, this provides a rich opportunity to extend research findings.

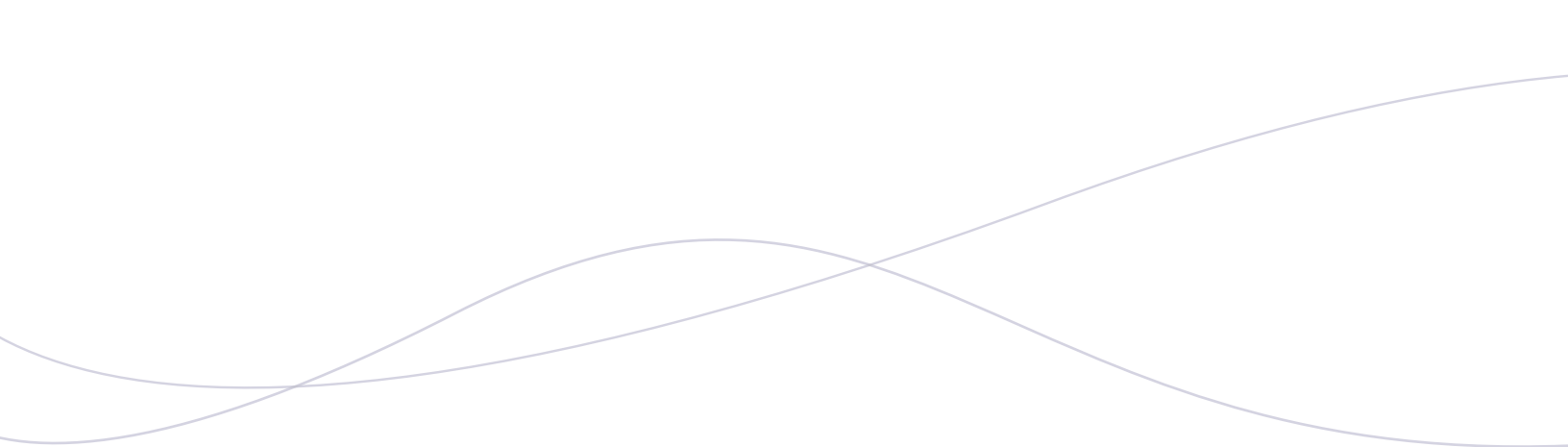
Understanding Favorable Outcomes in Established Treatments

All of the interventions listed in Table 8 on the following page are Established Treatments. This means that there is sufficient evidence to confidently state that each of these treatments produces beneficial effects. The quality, quantity, and consistency of outcomes indicate that these treatments work with individuals on the autism spectrum.

Despite the fact that these Established Treatments have been shown to be effective in studies, we know that they will not be effective for all individuals with ASD. As is the case with other diseases, there are patients who do not respond favorably to a treatment that is shown to be effective. Similarly, the same treatment may be effective for certain symptoms but not others. More research is necessary to further pinpoint which individuals with ASD will respond when specific symptoms are targeted for improvement.

Scientists can clarify which individuals with ASD are likely to respond to treatments in two ways. First, they can identify variables that predict which individuals are likely to respond to treatment in general. For example, initial communication skills and IQ are two variables that predict response to treatment (in this case, favorably). However, even when these predictors are identified, it does not mean that everyone with a higher IQ or better initial communication skills will respond to treatment, and vice versa. These variables are important, but not perfect, predictors. For this reason, treatment should not be denied to individuals with lower IQs or poorer initial communication skills.

A second way to identify who might respond to treatment is to examine the scientific literature and determine who has responded favorably to treatments in the past. For example, have individuals who are members of different age or diagnostic groups responded favorably to treatment?



We developed Table 8 as a way to begin addressing this second strategy. We applied the following criterion to identify favorable outcomes: all treatments for which a few⁷ studies with a minimum SMRS score of 2 that showed beneficial treatment effects were identified as having favorable outcomes. We selected this criterion as our lower anchor to increase the chances we would detect any variables that might predict specific responsivity to treatment within subgroups (age, diagnosis) of individuals with ASD.

In addition to subgroups that might be responsive to treatment, we applied the same procedures to begin identifying which specific symptoms may be responsive to each of the Established Treatments. These symptoms cut across specific subgroups (age, diagnosis). This was based on the current state of the literature; additional research will be necessary to better clarify which symptoms may be most responsive to each of these Established Treatments.

As noted in the Evidence-based Practice section, treatment selection is complicated. The information in Table 8 can be helpful to families, educators, and service providers because it may make them even more confident to learn that an Established Treatment has produced favorable outcomes for specific treatment targets, age groups, or diagnostic populations. It may make the process of selecting from among the 11 Established Treatments easier.

However, Established Treatments should not be avoided for specific treatment targets, age groups, or diagnostic populations simply because favorable outcomes have not yet been extended to those areas. When considering *all* of the ASD treatment research, these treatments have sufficient evidence to show that they can produce beneficial treatment effects for individuals on the autism spectrum.

⁷ Few is defined in the Table 3 describing the Strength of Evidence Classification System. The number of studies required differ for group and single-subject research designs.

Table 8} Established Treatments with Favorable Outcomes Reported

Skills Increased					
Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	
Behavioral Package	Antecedent Package Behavioral Package CBTYC Joint Attention Modeling NTS Peer Training PRT	CBTYC Modeling	Antecedent Package Behavioral Package CBTYC Joint Attention Modeling NTS Peer Training PRT Self-management Story-based	Antecedent Package Behavioral Package NTS	
Motor	Personal Responsibility	Placement	Play	Self-Regulation	
CBTYC	Antecedent Package Behavioral Package CBTYC Modeling	CBTYC	Antecedent Package Behavioral Package CBTYC Modeling NTS Peer Training PRT	Antecedent Package Behavioral Package Schedules Self-management Story-based	
Behaviors Decreased					
Problem Behaviors	Restricted, Repetitive, Nonfunctional Behavior, Interests, or Activities		Sensory/Emotional Regulation	General Symptoms	
Antecedent Package Behavioral Package CBTYC Modeling Self-management	Behavioral Package Peer Training		Antecedent Package Behavioral Package Modeling	CBTYC	
Ages					
0-2	3-5	6-9	10-14	15-18	19-21
Behavioral CBTYC Joint Attention NTS	Antecedent Behavioral CBTYC Joint Attention Modeling NTS Peer Training PRT Schedules Self-management	Antecedent Behavioral CBTYC Modeling NTS Peer Training PRT Schedules Self-management Story-based	Antecedent Behavioral Modeling Peer Training Schedules Self-management Story-based	Antecedent Behavioral Modeling Self-management	Behavioral
Diagnostic Classification					
Autistic Disorder		Asperger's Syndrome		PDD-NOS	
Antecedent Behavioral CBTYC Joint Attention Modeling NTS		Peer Training PRT Schedules Self-management Story-based		Modeling Story-based	
				Behavioral Package CBTYC Joint Attention Modeling NTS Peer Training	

Antecedent=Antecedent Package; Behavioral=Behavioral Package; CBTYC=Comprehensive Behavioral Treatment for Young Children; Joint Attention=Joint Attention Intervention; NTS=Naturalistic Teaching Strategies; Peer Training=Peer Training Package; PRT=Pivotal Response Treatment; Story-based=Story-based Intervention Package



Emerging Treatments

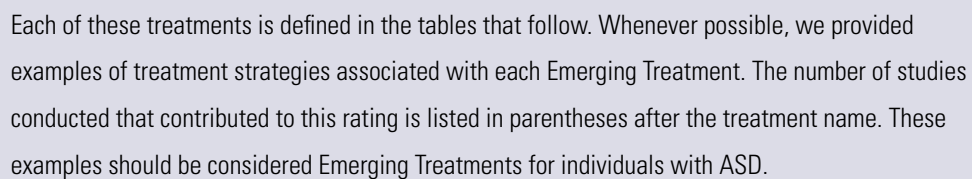
Emerging Treatments are those for which one or more studies suggest the intervention may produce favorable outcomes. However, additional high quality studies that consistently show these treatments to be effective for individuals with ASD are needed before we can be fully confident that the treatments are effective. Based on the available evidence, we are not yet in a position to rule out the possibility that Emerging Treatments are, in fact, not effective.

A large number of studies fall into the “Emerging” level of evidence. We believe scientists should find fertile ground for further research in these areas. The number of studies conducted that contributed to this rating is listed in parentheses after the treatment name.

The following treatments have been identified as falling into the Emerging level of evidence:

- Augmentative and Alternative Communication Device {14 studies}
- Cognitive Behavioral Intervention Package {3 studies}
- Developmental Relationship-based Treatment {7 studies}
- Exercise {4 studies}
- Exposure Package {4 studies}
- Imitation-based Interaction {6 studies}
- Initiation Training {7 studies}
- Language Training (Production) {13 studies}
- Language Training (Production & Understanding) {7 studies}
- Massage/Touch Therapy {2 studies}

- Multi-component Package {10 studies}
- Music Therapy {6 studies}
- Peer-mediated Instructional Arrangement {11 studies}
- Picture Exchange Communication System {13 studies}
- Reductive Package {33 studies}
- Scripting {6 studies}
- Sign Instruction {11 studies}
- Social Communication Intervention {5 studies}
- Social Skills Package {16 studies}
- Structured Teaching {4 studies}
- Technology-based Treatment {19 studies}
- Theory of Mind Training {4 studies}



Each of these treatments is defined in the tables that follow. Whenever possible, we provided examples of treatment strategies associated with each Emerging Treatment. The number of studies conducted that contributed to this rating is listed in parentheses after the treatment name. These examples should be considered Emerging Treatments for individuals with ASD.

Augmentative and Alternative Communication (AAC) Device {14 studies}

Evidence Level} Emerging

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.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X								

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Cognitive Behavioral Intervention Package {3 studies}

Evidence Level} Emerging

These interventions focus on changing everyday negative or unrealistic thought patterns and behaviors with the aim of positively influencing emotions and/or life functioning.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
			X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
	X	X	

Ages

0-2	3-5	6-9	10-14	15-18	19-21
		X	X	X	

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X	X	

Developmental Relationship-based Treatment {7 studies}

Evidence Level} Emerging

These treatments involve a combination of procedures that are based on developmental theory and emphasize the importance of building social relationships. These treatments may be delivered in a variety of settings (e.g., home, classroom, community). All of the studies falling into this category met the strict criteria of: {a} targeting the defining symptoms of ASD, {b} having treatment manuals, {c} providing treatment with a high degree of intensity, and {d} measuring the overall effectiveness of the program (i.e., studies that measure subcomponents of the program are listed elsewhere in this report). These treatment programs may also be referred to as the Denver Model, DIR (Developmental, Individual Differences, Relationship-based)/Floortime, Relationship Development Intervention, or Responsive Teaching.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X	X	X		X			X	X

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
		X	X

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X				

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Exercise {4 studies}

Evidence Level} Emerging

These interventions involve an increase in physical exertion as a means of reducing problems behaviors or increasing appropriate behavior.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
								X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Exposure Package {4 studies}

Evidence Level} Emerging

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.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X				

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Imitation-based Interaction {6 studies}

Evidence Level} Emerging

These interventions rely on adults imitating the actions of a child.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
			X	X				X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X	X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Initiation Training {7 studies}

Evidence Level} Emerging

These interventions involve directly teaching individuals with ASD to initiate interactions with their peers.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
		X	X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
X		X	

Ages

0-2	3-5	6-9	10-14	15-18	19-21
		X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X	X	X

Language Training (Production) {13 studies}

Evidence Level} Emerging

These interventions have as their primary goal to increase speech production. Examples include but are not restricted to: echo relevant word training, oral communication training, oral verbal communication training, structured discourse, simultaneous communication, and individualized language remediation.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X					X	

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Language Training (Production & Understanding) {7 studies}

Evidence Level} Emerging

These interventions have as their primary goals to increase both speech production and understanding of communicative acts. Examples include but are not restricted to: total communication training, position object training, position self-training, and language programming strategies.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X								

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Massage/Touch Therapy {2 studies}

Evidence Level} Emerging

These interventions involve the provision of deep tissue stimulation.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
			X						X

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
	X	X	X

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X				

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Multi-component Package {10 studies}

Evidence Level} Emerging

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.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
X			

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X	X	X

Music Therapy {6 studies}

Evidence Level} Emerging

These interventions seek to teach individual skills or goals through music. A targeted skill (e.g., counting, learning colors, taking turns, etc.) is first presented through song or rhythmic cuing and music is eventually faded.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Peer-mediated Instructional Arrangement {11 studies}

Evidence Level} Emerging

These interventions involve targeting academic skills by involving same-aged peers in the learning process. This approach is also described as peer tutoring.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
			X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
		X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Picture Exchange Communication System {13 studies}

Evidence Level} Emerging

This treatment 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.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Reductive Package {33 studies}

Evidence Level} Emerging

These interventions rely on strategies designed to reduce problem behaviors in the absence of increasing alternative appropriate behaviors. Examples include but are not restricted to water mist, behavior chain interruption (without attempting to increase an appropriate behavior), protective equipment, and ammonia.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
	X		

Ages

0-2	3-5	6-9	10-14	15-18	19-21

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Scripting {6 studies}

Evidence Level} Emerging

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.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
		X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Sign Instruction {11 studies}

Evidence Level} Emerging

These interventions involve the direct teaching of sign language as a means of communicating with other individuals in the environment.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X								

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
		X	

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X			

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Social Communication Intervention {5 studies}

Evidence Level} Emerging

These psychosocial interventions involve targeting some combination of social communication impairments such as pragmatic communication skills, and the inability to successfully read social situations. These treatments may also be referred to as social pragmatic interventions.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X		X		X	X			

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X				

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Social Skills Package {16 studies}

Evidence Level} Emerging

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).

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
			X						

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
	X	X	X	X	

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X	X	X

Structured Teaching {4 studies}

Evidence Level} Emerging

Based on neuropsychological characteristics of individuals with autism, this intervention involves a combination of procedures that rely heavily on the physical organization of a setting, predictable schedules, and individualized use of teaching methods. These procedures assume that modifications in the environment, materials, and presentation of information can make thinking, learning, and understanding easier for people with ASD if they are adapted to individual learning styles of autism and individual learning characteristics. All of the studies falling into this category met the strict criteria of: {a} targeting the defining symptoms of ASD; {b} having treatment manuals; {c} providing treatment with a high degree of intensity; and {d} measuring the overall effectiveness of the program (i.e., studies that measure subcomponents of the program are listed elsewhere in this report). These treatment programs may also be referred to as TEACCH (Treatment and Education of Autistic and related Communication-handicapped CHILDren).

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
	X	X	X	X	X	X			

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
X	X	X	X	X	

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		X

Technology-based Treatment {19 studies}

Evidence Level} Emerging

These interventions require the presentation of instructional materials using the medium of computers or related technologies. Examples include but are not restricted to Alpha Program, Delta Messages, the Emotion Trainer Computer Program, pager, robot, or a PDA (Personal Digital Assistant). The theories behind Technology-based Treatments may vary but they are unique in their use of technology.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
X	X					X			X

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms
		X	

Ages

0-2	3-5	6-9	10-14	15-18	19-21
		X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X		

Theory of Mind Training {4 studies}

Evidence Level} Emerging

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.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation
		X							

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21
		X	X		

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS
X	X	

Unestablished Treatments

Unestablished Treatments are those for which there is little or no evidence in the scientific literature that allows us to draw firm conclusions about the effectiveness of these interventions with individuals with ASD. There is no reason to assume these treatments are effective. Further, there is no way to rule out the possibility these treatments are ineffective or harmful.

The following treatments have been identified as falling into the Unestablished level of evidence:

- Academic Interventions
- Auditory Integration Training
- Facilitated Communication
- Gluten- and Casein-Free Diet
- Sensory Integrative Package

Research has been conducted on these five treatments. However, the quality, quantity, and consistency of research findings have generally been poor or do not apply to individuals with ASD, so we cannot be confident about what the effects of treatment might be. Whenever possible, we have provided supplementary information that might assist readers in their decision making regarding these treatments.

There are likely many more treatments that fall into this category. That is, there are many treatments for which no research has been conducted or, if studies have been published, the accepted process for publishing scientific work was not followed. There are a growing number of treatments that have not yet been investigated scientifically. These would all be Unestablished Treatments. Further, any treatments for which studies were published exclusively in non-peer-reviewed journals would be Unestablished Treatments.

Each of these treatments is defined in the tables that follow. Whenever possible, we provided examples of treatment strategies associated with each Unestablished Treatment. The number of studies conducted that contributed to this rating is listed in parentheses after the treatment name. These examples should be considered Unestablished Treatments for individuals with ASD.

Academic Interventions {10 studies}

Evidence Level} Unestablished

These interventions involve the use of traditional teaching methods to improve academic performance. Examples include but are not restricted to: “personal instruction”; paired associate; picture-to-text matching; The Expression Connection; answering pre-reading questions; completing cloze sentences; resolving anaphora; sentence combining; “special education;” speech output and orthographic feedback; and handwriting training.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21

Diagnostic Classification

Autistic Disorder	Asperger’s Syndrome	PDD-NOS

Auditory Integration Training {3 studies}

Evidence Level} Unestablished

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.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS

Facilitated Communication {5 studies}

Evidence Level} Unestablished

This intervention involves having a facilitator support the hand or arm of an individual with limited communication skills, helping the individual express words, sentences, or complete thoughts by using a keyboard of words or pictures or typing device.

The National Standards Project followed strict inclusionary/exclusionary criteria. As a result, we eliminated a large number of studies on the treatment of Facilitated Communication that {a} involved adults 22 years of age or older, {b} involved individuals with infrequently occurring co-morbid conditions, and {c} focused on the adult facilitators (as opposed to the individuals with ASD). Although our results indicate Facilitated Communication is an "Unestablished Treatment," we believe it is necessary to make readers aware that a number of professional organizations have adopted resolutions advising against the use of facilitated communication. These resolutions are often related to concerns regarding "immediate threats to the individual civil and human rights of the person with autism..." (American Psychological Association, 1994).

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS

Gluten- and Casein-Free Diet {2 studies}

Evidence Level} Unestablished

These interventions involve elimination of an individual's intake of naturally occurring proteins gluten and casein.

Early studies suggested that the Gluten- and Casein-Free diet may produce favorable outcomes but did not have strong scientific designs. Better controlled research published since 2006 suggests there may be no educational or behavioral benefits for these diets. Further, potential medically harmful effects have begun to be reported in the literature. We recommend reading the following studies before considering this option:

1. Arnold, G. L., Hyman, S. L., Mooney, R. A., & Kirby, R. S. (2003). Plasma amino acids profiles in children with autism: Potential risk of nutritional deficiencies. *Journal of Autism and Developmental Disabilities*, 33, 449-454.
2. Heiger, M. L., England, L. J., Molloy, C. A., Yu, K. F., Manning-Courtney, P., & Mills, J. L. (2008). Reduced bone cortical thickness in boys with autism or autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 38, 848-856.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS

Sensory Integrative Package {7 studies}

Evidence Level} Unestablished

These treatments involve establishing an environment that stimulates or challenges the individual to effectively use all of their senses as a means of addressing overstimulation or understimulation from the environment.

Skills Increased

Academic	Communication	Higher Cognitive Functions	Interpersonal	Learning Readiness	Motor	Personal Responsibility	Placement	Play	Self-Regulation

Behaviors Decreased

Problem Behaviors	RRN	SER	General Symptoms

Ages

0-2	3-5	6-9	10-14	15-18	19-21

Diagnostic Classification

Autistic Disorder	Asperger's Syndrome	PDD-NOS

Ineffective/Harmful Treatments

Ineffective or Harmful Treatments are those for which several well-controlled studies have shown the intervention to be ineffective or to produce harmful outcomes, respectively. At this time, there are no treatments that have sufficient evidence specific to the ASD population that meet these criteria.

This outcome is not entirely unexpected. When preliminary research findings suggest a treatment is ineffective or harmful, researchers tend to change the focus of their scientific inquiries into treatments that may be effective. That is, research often stops once there is a suggestion that the treatment does not work or that it is harmful. Further, research showing a treatment to be ineffective or harmful may be available with different populations (e.g., developmental disabilities, general populations, etc.). Ethical researchers are not going to then apply these ineffective or harmful treatments specifically to children or adolescents on the autism spectrum just to show that the treatment is equally ineffective or harmful with individuals with ASD.

See the Evidence-based Practice section to learn how practitioners' knowledge of interventions outside the ASD population should be integrated into the decision-making process.

5

Recommendations for Treatment Selection

Treatment selection is complicated and should be made by a team of individuals who can consider the unique needs and history of the individual with Autism Spectrum Disorder (ASD) along with the environments in which he or she lives. We do not intend for this document to dictate which treatments can or cannot be used for individuals on the autism spectrum.

Having stated this, we have been asked by families, educators, and service providers to recommend how our results might be helpful to them in their decision making. As an effort to meet this request, we provide suggestions regarding the interpretation of our outcomes. In all cases, we strongly encourage decision makers to select an evidence-based practice approach.

Research findings are not the sole factor that should be considered when treatments are selected. The suggestions we make here refer only to the “research findings” component of evidence-based practice and should be only one factor considered when selecting treatments.

Recommendations based on research findings:

- Established Treatments have sufficient evidence of effectiveness. We recommend the decision-making team give serious consideration to these treatments because {a} these treatments have produced beneficial effects for individuals involved in the research studies published in the scientific literature, {b} access to treatments that work can be expected to produce more positive long-term outcomes, and {c} there is no evidence of harmful effects. However, it should not be assumed that these treatments will universally produce favorable outcomes for all individuals on the autism spectrum.
- Given the limited research support for Emerging Treatments, we generally do not recommend *beginning* with these treatments. However, Emerging Treatments should be considered promising and warrant serious consideration if Established Treatments are deemed inappropriate by the decision-making team. There are several very legitimate reasons this might be the case (see examples in the Professional Judgment or Values and Preferences sections of Chapter 6).
- Unestablished Treatments either have no research support or the research that has been conducted does not allow us to draw firm conclusions about treatment effectiveness for individuals with ASD. When this is the case, decision-makers simply do not know if this treatment is effective, ineffective, or harmful because researchers have not conducted any or enough high quality research. Given how little is known about these treatments, we would recommend considering these treatments *only* after additional research has been conducted and this research shows them to produce favorable outcomes for individuals with ASD.

These recommendations should be considered along with other sources of critical information when selecting treatments (see Chapter 6).

6

Evidence-based Practice

One of the primary objectives of this document is to identify evidence-based treatments. We are not alone in this activity. The National Standards Project is a natural extension of the efforts of the National Research Council {2001}, the New York State Department of Health, Early Intervention Division {1999}, and other related documents produced at state and national levels.

Knowing which treatments have sufficient evidence of effectiveness is likely to—and should—influence treatment selection. Evidence-based practice, however, is more complicated than simply knowing which treatments are effective. Although we argue that knowing which treatments have evidence of effectiveness is essential, other critical factors must also be taken into consideration.

We have identified the following four factors of evidence-based practice:

- **Research Findings.** The strength of evidence ratings for all treatments being considered must be known. Serious consideration should be given to Established Treatments because there is sufficient evidence that {a} the treatment produced beneficial effects and {b} they are not associated with unfavorable outcomes (i.e., there is no evidence that they are ineffective or harmful) for individuals on the autism spectrum.

Ideally, treatment selection decisions should involve discussing the benefits of various Established Treatments. Despite the fact there is compelling evidence to suggest these treatments generally produce beneficial effects for individuals on the autism spectrum, there are reasons alternative treatments (e.g., Emerging Treatments) might be considered. A number of these factors are listed below.

- **Professional Judgment.** The judgment of the professionals with expertise in Autism Spectrum Disorders (ASD) must be taken into consideration. Once treatments are selected, these professionals have the responsibility to collect data to determine if a treatment is effective. Professional judgment may play a particularly important role in decision-making when:
 - A treatment has been correctly implemented in the past and was not effective or had harmful side effects. Even Established Treatments are not expected to produce favorable outcomes for all individuals with ASD.

- ▶ The treatment is contraindicated based on other information (e.g., the use of extra-stimulus prompts for a child with a prompt dependency history).
 - ▶ A great deal of research support might be available beyond the ASD literature and should be considered when required. For example, if an adolescent with ASD presents with anxiety or depression, it might be necessary to identify what treatments are effective for anxiety or depression for the general population. The decision to incorporate outside literature into decision-making should only be made after practitioners are familiar with the ASD-specific treatments. Research that has not been specifically demonstrated to be effective with individuals with ASD should be given consideration along with the ASD-specific treatments only if compelling data support their use and the ASD-specific literature has not fully investigated the treatment. See Appendix 2 for examples of systematic or meta-analytic reviews with broader populations.
 - ▶ The professional may be aware of well-controlled studies that support the effectiveness of a treatment that were not available when the National Standards Project terminated its literature search.
- **Values and Preferences.** The values and preferences of parents, care providers, and the individual with ASD should be considered. Stakeholder values and preference may play a particularly important role in decision-making when:
- ▶ A treatment has been correctly implemented in the past and was not effective or had harmful side effects.
 - ▶ A treatment is contrary to the values of family members.
 - ▶ The individual with ASD indicates that he or she does not want a specific treatment.
- **Capacity.** Treatment providers should be well positioned to correctly implement the intervention. Developing capacity and sustainability may take a great deal of time and effort, but all people involved in treatment should have proper training, adequate resources, and ongoing feedback about treatment fidelity. Capacity may play a particularly important role in decision-making when:
- ▶ A service delivery system has never implemented the intervention before. Many of these treatments are very complex and require precise use of techniques that can only be developed over time.
 - ▶ A professional is considered the “local expert” for a given treatment but he or she actually has limited formal training in the technique.
 - ▶ A service delivery system has implemented a system for years without a process in place to ensure the treatment is still being implemented correctly.

7

Limitations

Like other projects of this nature, there are limitations to the National Standards Project. Readers should be familiar with these limitations in order to use this document most effectively.

We have identified the following limitations:

- This document focuses exclusively on research involving individuals with Autism Spectrum Disorders (ASD) who are under 22 years of age.
 - This document does not include a review of the literature for children “at risk” for ASD. New evidence suggests that very young children who are eventually diagnosed with autism have a genetic predisposition that alters their interactions with the typical learning environment.⁸ This area is especially important because providing effective interventions (e.g., behavioral interventions) to these infants may be the first critical step to altering early brain development⁹ so that the neural circuitry regulating social and communication functions more effectively.
 - This document does not include a review of the adult ASD literature.
 - This document is not an exhaustive review of all treatments for all individuals. There are treatments that might have solid research support for related populations (e.g., developmental disabilities, anxiety, depression, etc.) but have limited or no evidence of research support for individuals with ASD in the National Standards Report. See Chapter 5 for how this might influence treatment selection.
- As noted in the treatment classification section of this report, determining the categories for treatments presents a real challenge. This is equally true whenever comprehensive reviews of the literature are completed for any diagnostic group. Some of our experts suggested making the unit of analysis larger for some

⁸ Klin, A., Lin, D.J., Gorrindo, P., Ramsay, G., & Jones, W. (2009). Two-year-olds with autism orient to non-social contingencies rather than biological motion. *Nature*, 1-7. doi:10.1038/nature07868.

⁹ Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorders. *Development and Psychopathology*, 20, 775-803.

categories; others suggested making the unit of analysis smaller for most categories. In the end, we attempted to develop categories that “made sense.” We expect that many readers may be interested in more detailed analysis using a smaller unit of analysis, or data using on a different arrangement of treatment categories based on a larger unit of analysis. We look forward to your feedback to guide the next version of the National Standards Project.

- This review included an examination of most group and single-subject research design studies but did not include every type of study.
 - ▶ For this report, we only looked at research that was designed to answer questions about the measurable effectiveness of an intervention based on quantifiable data. We did not look at research that was designed to explore questions about the perceived quality of an intervention or the experiences of the children based on qualitative data.
 - ▶ There are studies relying on single-case or group design methods that were not included in this review because they fell outside the commonly agreed-upon criteria for evaluating the effectiveness of study outcomes. The experts involved in the development of these Standards made the decision to include only those methodologies that are generally agreed-upon by scientists as sufficient for answering the question, “Is this treatment effective?”
 - ▶ We only included studies that have been published in professional journals. It is likely that some researchers conducted studies that provided different or additional data that have not been published. This could influence the reported quality, quantity, or consistency of research findings.
- When establishing interobserver agreement (IOA), field reviewers were asked to examine the coding manual and rate the pilot article they received. Ideally, we would have conducted a training session before they began rating the articles. Also, the pilot articles were selected randomly. Now that we have identified articles with the highest, moderate, and lowest ratings for both single-subject and group research designs, we will use these articles for establishing IOA in future versions of the National Standards Project.

- We did not include articles reviewed in languages other than English. This has the potential to influence the ratings reported in this document. For example, a study that was not included in this review was published in French on Integrated Play Groups™ (Richard & Goupil, 2005). We hope to include volunteer field reviewers from across the world who can effectively review the non-English literature in the next version of the National Standards Project.
- The National Standards Project did not evaluate the extent to which treatment approaches have been studied in “real world” versus laboratory settings. We hope to shed light on this issue in future versions of the National Standards Project.
- One of the primary purposes of the National Standards Project was to identify the level of research support currently available for a range of educational and behavioral interventions. We did not set as our goal the determination of the level of intensity required for delivery of these interventions. The next version of the National Standards Project may provide further analysis in this area. In the interim, we believe treatment providers should continue to follow the recommendations for intensity of services provided by the National Research Council regarding children less than 8 years of age. Specifically,

“ The committee recommends that educational services begin as soon as a child is suspected of having an autistic spectrum disorder. Those services should include a minimum of 25 hours a week, 12 months a year, in which the child is engaged in systematically planned, and developmentally appropriate educational activity toward identified objectives. What constitutes these hours, however, will vary according to a child’s chronological age, developmental level, specific strengths and weaknesses, and family needs. Each child must receive sufficient individualized attention on a daily basis so that adequate implementation of objectives can be carried out effectively. The priorities of focus include functional spontaneous communication, social instruction delivered throughout the day in various settings, cognitive development and play skills, and proactive approaches to behavior problems. To the extent that it leads to the acquisition of children’s educational goals, young children with an autistic spectrum disorder should receive specialized instruction in a setting in which ongoing interactions occur with typically developing children. ”

We argue that unless compelling reasons exist to do otherwise, intervention services should be comprised of Established Treatments and they should be delivered following the specifications outlined in the literature (e.g., appropriate use of resources, staff to student ratio, following the prescribed procedures, etc.).

- Writing a report of this type can be quite time-consuming. The National Standards Project terminated the literature review phase in September of 2007. Additional studies have been published in the interim that are not reflected in the current report. This means that if a review were conducted today, the strength of evidence ratings for a given treatment may have improved or be altered. We intend to regularly update this document to assist decision-makers in their selection of treatments. In the meantime, professionals should familiarize themselves with the literature published since the fall of 2007.
- Ideally, research answers important questions beyond treatment effectiveness. This report does not review the following areas that may be important in selecting treatments:
 - ▶ Cost-effectiveness;
 - ▶ Social validity;
 - ▶ Studies examining mediating or moderating variables. Mediating variables can help explain why a treatment is effective. Moderating variables can make a difference in the likelihood a treatment is effective for a given subpopulation; and
 - ▶ Research supporting Established Treatments may have been developed in analog settings (e.g., highly structured research settings), which may not reflect real world settings accurately.

Despite its limitations, we sincerely hope this document is useful to you. We also recognize that even more information might be helpful. For example, there may be new or different ways of organizing information that you believe could be useful. If you would like to help shape the direction of the next version of the National Standards Project, please provide feedback to the National Autism Center at info@nationalautismcenter.org.

8

Future Directions

Future Directions for the Scientific Community

One of the goals of the National Standards Project is to identify limitations of the existing literature base. We believe we have done so in two ways: {a} we have identified areas benefiting from or requiring future investigation and {b} we have developed the Scientific Merit Rating Scale and Strength of Evidence Classification System, against which future research can be compared. We expand on these issues below.

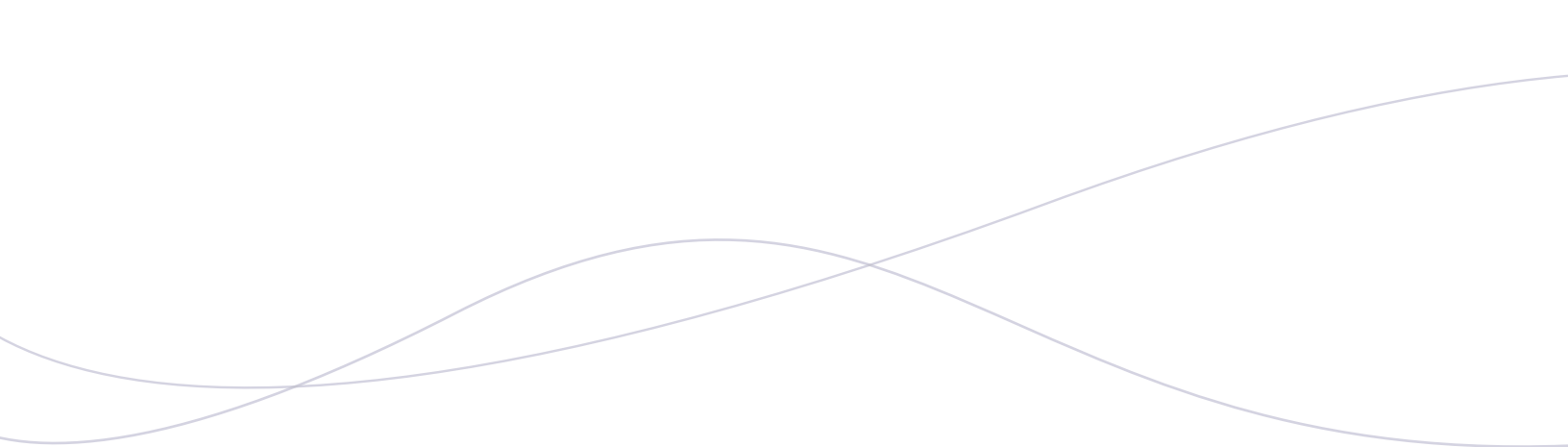
There is room for additional research for all treatments. It will be important to extend the current research base for Established Treatments to all reasonable treatment goals, age groups, and diagnostic groups. Additional research must be conducted for treatments falling in the Emerging and Unestablished Treatment categories to determine if {a} the treatments are effective and {b} the treatments are ineffective or harmful. High quality research is perhaps most important for treatments falling into the Unestablished Treatments category.

Future Directions with Methodology

Five dimensions were identified for the Scientific Merit Rating Scale: {a} research design, {b} dependent variable, {c} treatment fidelity, {d} participant ascertainment, and {e} generalization (see Table 3). We identified these dimensions based on the most recent scientific standards that are being advocated in behavioral and social science research. However, scientific standards change over time.

For example, there were no psychometrically sound instruments specifically designed to diagnose Autism Spectrum Disorders (ASD) available when the earliest studies included in this review were conducted. If there had been, the instruments would look very different today based on changes in the diagnostic criteria over the years. For this reason, it is not surprising that many older studies did not achieve the highest possible ratings in this area.

Similarly, it is only recently that evidence of treatment fidelity has been consistently emphasized by the scientific community. This means that although many studies may do an excellent job of describing the procedures used, they still received low ratings on their ability to provide evidence that they completed all procedures exactly as prescribed. This leaves room for improvement in the scientific literature in either the research design or the extent to which scientists report on these important variables.



We encourage researchers to strive to meet the most rigorous standards of scientific merit in future research. We hope the Scientific Merit Rating Scale will assist them in doing so. But it is also essential that journal editors recognize the importance of the five dimensions of scientific merit identified in this report. Important information may sometimes be cut from articles due to space limitations. We hope that researchers will be able to point to the Scientific Merit Rating Scale as an example of critical information that should never be removed from scholarly work.

The Strength of Evidence Classification System may be expanded over time to reflect additional scientific lines of inquiry. For example, it is reasonable to use alternate criteria for different research designs, which is why we did so in the current version of the Strength of Evidence Classification System. However, if qualitative research is included in the next version of the National Standards Project, the current version of the Strength of Evidence Classification System would be insufficient to accurately evaluate these studies.

Future Directions for the National Standards Report

We aim to address many of the limitations of the current National Standards Report in future documents.

For example, we expect:

- To review literature covering the lifespan. This will include a special section on children “at risk” for ASD.
- To reconsider the inclusion of qualitative studies or other types of peer-reviewed studies that are currently excluded.
- To modify treatment classification based on feedback from the many experts in the autism community.
- To examine the extent to which treatments have been studied in “real world” versus laboratory settings.
- To add reviewers who can accurately interpret peer-reviewed articles published in non-English journals.

With additional funding, we hope to help address questions related to cost effectiveness, social validity, studies examining mediating variables, and effectiveness of treatments in real world settings.

We suspect that this report will raise additional questions that we hope to address in future publications. Our ultimate goal is to answer relevant questions related to evidence-based practice in response to the changing expectations of professionals and General Questions

9

Frequently Asked Questions

General Questions

Q } What is the best way to look up information if I want to know if a treatment works?

Information about each of the interventions can be found in Chapter 4. It may be easiest to look up the name of the treatment in the index. More than one table identifying levels of research support may appear on the same page. Read the definitions and examples to find the research support for the treatment in which you are interested.

People are often interested in knowing how much research supports a treatment for a specific goal and/or with a specific age or diagnostic group. This information is provided below the overall Strength of Evidence Rating.

Q } What does it mean if a treatment isn't listed in the National Standards Report?

There are two reasons a treatment might not be listed in this report. First, we developed names and definitions for treatment categories. These treatment categories often include a combination of multiple, similar treatment strategies. It is possible that a treatment clearly fits the definition of one of our treatment categories but we neglected to include it in our index. Please carefully read the definition of the treatment categories to determine if the treatment should reasonably fit in one of the categories. If you believe an intervention strategy should have been listed in our index, please contact the National Autism Center to confirm (info@nationalautismcenter.org). If the treatment should appear in our index, we will correct this in future versions of the National Standards Project and we will post the information on our website.

The second most common reason an intervention strategy may not appear in our index is because it has either not been scientifically studied or studies were not published in a peer-reviewed journal. Peer review is the process scientists use in

all fields to make sure a study meets an agreed-upon minimum requirement for usefulness. Unfortunately, there are many intervention strategies that are marketed today that have not been submitted to rigorous scientific investigation.

Q } If the National Standards Report identifies an Established Treatment, does that mean I should start using that treatment immediately?

Not necessarily. Please read Chapter 6 about Evidence-based Practice for further clarification. In general, you should begin with an understanding of the research outcomes described in this report and then consider the following factors:

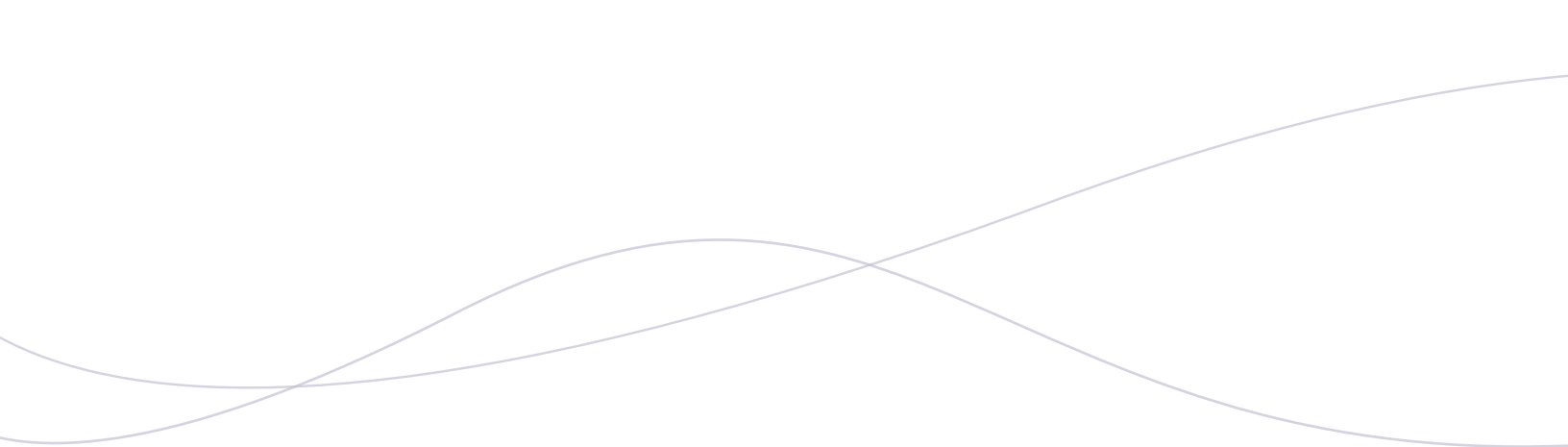
- The judgment and data-based clinical decision making of professionals working with the individual with ASD
- The values and preferences of family members and the individual with ASD
- The capacity of the treatment program, school, or professional serving the child with ASD to implement the treatment with a high degree of accuracy

Q } You have described the treatments you reviewed as “educational or behavioral.” What does that mean?

We have used the terms “educational or behavioral,” but we could have just as easily used other terms like “psychosocial.” These treatments involve the modification of the environment to reduce the severity and/or alter the course of a disease or disorder. In contrast, “biomedical” interventions often involve the introduction of biochemicals that are not naturally produced by the body.

These terms are sometimes used to promote an overly simplistic view of treatment. Most physicians and health professionals adopt a “biopsychosocial” model of treatment for disease or disorders. This means that both “biomedical” and “educational and behavioral” treatments must be integrated to sufficiently treat a disorder or disease.

For example, if a primary care physician determines that your adolescent daughter has diabetes, he might recommend a consultation with an endocrinologist, a nutritionist, and a



behavioral specialist. After a thorough assessment, the endocrinologist might recommend daily injections of insulin. The nutritionist might recommend changes in diet to control blood sugar levels. The behavior specialist might provide treatment to increase adherence to insulin injections and changes in lifestyle. The modifications to your daughter's environment must be applied on a daily basis and must be maintained over a long period of time to truly treat the disease. These environmental modifications are often not adopted or cannot be sustained without support from qualified specialists, such as mental health professionals. The biopsychosocial model argues that both components are essential for treating diabetes. The biopsychosocial model can also be applied to Autism Spectrum Disorders (ASD). Although there are no medications that currently target most of the core symptoms of ASD, they can be used to reduce stereotypy (repetitive movements) and to target associated features such as aggression, self-injury, or hyperactivity. When children demonstrate these specific symptoms, a biomedical intervention should be considered in conjunction with educational or behavioral treatments. As you can see in Table 8 in the Outcomes section of this report, Established Treatments target the core symptoms of ASD as well as associated features. Just as the endocrinologist would not recommend insulin shots without environmental modifications, an ASD specialist would not recommend medication without environmental modifications. In each case, a biopsychosocial model to treatment is endorsed.

Research Questions

Q } **Why is research important to decision making?**

Without research, we do not really know if a treatment is effective or not. If we pick a treatment that is not effective, it can have very negative outcomes. This is true for any medical, neurological, or mental health concern. For ASD, if we select treatments that are not effective, we can lose critical time, money, and/or energy — this can mean an individual with ASD may not reach his or her greatest potential.

More research related to ASD needs to be conducted. We do not have all of the answers we need yet. This does not mean that we should ignore research outcomes. It just means we need to recognize that the scope of the research is limited and that we need researchers to publish more high-quality research.

Q } **Isn't all research the same?**

No. Some scientists set up their studies so well that the results are accepted by other scientists as accurate. But other scientists set up their studies in ways that are flawed, so that even other scientists cannot really interpret the outcomes — even if the authors, or others, claim that the treatment is effective.



Why were many articles excluded from the National Standards Project?

The first reason is that computer searches often identify a large number of inappropriate articles. This was the case with the initial search for articles for the NSP. The vast majority of the excluded articles were unrelated to ASD, unrelated to treatment of ASD, or did not involve research.

The second reason articles were excluded was related to the goal of this project. Our goal was to tell you how much evidence there was for treatments targeting the core or associated symptoms of ASD for individuals under the age of 22. This means many studies had to be eliminated. Treatments that did not focus on individuals with ASD, or involved adults, were all eliminated. Many studies include some individuals with ASD as well as participants with other disabilities. If the studies were not set up so that we could interpret how effective the treatment was specifically for individuals with ASD, we had to exclude the study altogether. Also, if the researchers set up their studies using methods that are not commonly accepted by most scientists for analyzing outcomes, we had to remove these studies.

These are the most common reasons for the exclusion of studies from the NSP. See Inclusionary and Exclusionary criteria identified in Chapter 3 for a detailed list of why studies were excluded.

Strength of Evidence Ratings Questions

Why is it important to have more than one study that shows a treatment is effective?

Sometimes we hear conflicting reports about research in the media. One of the biggest reasons this happens is that, no matter how well the study was done, a single study can make a mistake. Replication is the basis for science. More than one study must show the same outcome before we can be truly confident that a treatment is effective, ineffective, or has harmful effects.

What is the difference between “Established Treatments,” “Emerging Treatments,” “Unestablished Treatments,” and “Ineffective/Harmful Treatments?”

Established Treatments require more studies with high Scientific Merit Rating Scale scores and must be shown to be effective. In contrast, Emerging Treatments require fewer studies with moderate Scientific Merit Rating Scale scores. Like Established Treatments, Emerging Treatments must show beneficial treatment outcomes. They differ primarily in that Emerging Treatments have a lower criterion in terms of the number and quality of studies that contribute to this rating. Unestablished Treatments may not have any research supporting them or the studies that have been conducted have very low scientific merit scores. Ineffective/Harmful Treatments require more studies with high scientific merit scores but must show that treatment effects are either ineffective or harmful.

Outcomes Questions



What treatments have the best evidence at this time?

There are eleven Established Treatments. These include: antecedent package, behavioral package, early intensive behavioral intervention, joint attention intervention, modeling, naturalistic teaching strategies, peer training package, pivotal response treatment, schedules, self-management, and story-based interventions.

The Established Treatments identified in this document arise from diverse theoretical orientations or fields of study. However, certain trends emerged from an examination of these Established Treatments. Approximately two-thirds of the Established Treatments were developed exclusively from the behavioral literature (e.g., applied behavior analysis, behavioral psychology, and positive behavioral supports). Of the remaining one-third, 75% represent treatments for which research support comes predominantly from the behavioral literature. Additional contributions were made from the non-behavioral literature emanating from the fields of speech-language pathology and special education. These researchers often gave strong emphasis to developmental considerations. Less than 10% (i.e., Story-based Intervention Package) of the total number of Established Treatments arose from the theory of mind perspective. Interestingly, even these interventions often included a behavioral component.

This pattern of findings suggests that treatments from the behavioral literature have the strongest research support at this time. Yet it is important to recognize that treatments based on alternative theories, in isolation or combined with behavioral interventions, should continue to be examined empirically. Further, it demonstrates that all treatment studies can be compared against a common methodological standard and show evidence of effectiveness. Despite the preponderance of evidence associated with the behavioral literature, it is important to acknowledge the important contributions non-behavioral approaches are making at present, and to fund research examining both the behavioral and non-behavioral literature as we move forward.

Q } Overall, is there more research support when we target certain skills or behaviors rather than others?

Yes. A review of the Established Treatments shows significant differences in research support for treatment targets. For example:

- The majority of Established Treatments are associated with favorable outcomes when communication, interpersonal, and play skills are targeted.
- Nearly half of the Established Treatments are associated with favorable outcomes when self-regulation or problem behaviors are targeted.
- Few Established Treatments (between one and four) are associated with favorable outcomes for all remaining treatment targets.

It is not surprising that all of the Established Treatments are not associated with favorable outcomes for all treatment targets. Some Established Treatments are not intended to target every skill we want to increase or behavior we want to decrease. However, the research on many Established Treatments could be extended to additional treatment targets.

Q } Overall, are there differences in the level of research support across different age groups?

Yes. A review of the Established Treatments shows significant differences in research support for different age groups. For example:

- Most Established Treatments are associated with favorable outcomes for preschoolers and elementary school-aged children.
- The majority of these Established Treatments are also associated with favorable outcomes for middle school-aged children.
- More than one-third (36%) of the Established Treatments is associated with favorable outcomes for very young children (ages 0–2) or high school-aged students (ages 15–18).
- Only one of the Established Treatments is associated with favorable outcomes for young adults (ages 19–21).

The pattern of identifying fewer interventions with the youngest children is not surprising. A large percentage of the ASD population has not been identified before two years of age. Although we hope earlier identification will lead to additional treatments being identified with this age group, we understand why it is so difficult to show that treatments are effective with this age group. On the other hand, there is no easy explanation for why few interventions have been studied with young adults on the autism spectrum. Clearly, additional research is necessary in this area.

Q } Overall, is there more research with some diagnostic populations than others?

Yes. A review of the Established Treatments shows significant differences in research support for different diagnostic groups. For example:

- All of the Established Treatments are associated with favorable outcomes for individuals with Autistic Disorder.
- More than half of the Established Treatments are associated with favorable outcomes for individuals with PDD-NOS.
- Only two (18%) Established Treatments are associated with favorable outcomes for individuals with Asperger's Syndrome.

To some degree, it is not surprising that the research on the Established Treatments has not yet been fully extended to individuals with Asperger's Syndrome. For example, Asperger's Syndrome is less likely to be diagnosed during the time frame in which joint attention interventions are likely to be implemented, so this treatment may not become extended to the Asperger's Syndrome population for quite some time. In addition, Asperger's Syndrome is a more recent addition to the Diagnostic and Statistical Manual used to diagnose individuals on the autism spectrum. Given the fact that we have reviewed studies published over a 50-year time frame, it is not surprising that this more recent addition to the diagnostic nomenclature is not as well-represented. On the other hand, Asperger's Syndrome has been included in the DSM-IV since 1994. This means that we have had well more than a decade in which research could have been conducted. Clearly, additional research is necessary in this area.



Why were no Ineffective/Harmful Treatments identified?

This outcome is not entirely unexpected. When preliminary research findings suggest a treatment is ineffective or harmful, researchers tend to change the focus of their scientific inquiries into treatments that may be effective. That is, research often stops once there is a suggestion that the treatment does not work or that it is harmful. Further, research showing a treatment to be ineffective or harmful may be available with different populations (e.g., developmental disabilities, general populations, etc.). Ethical researchers are not going to then apply these ineffective or harmful treatments specifically to children or adolescents on the autism spectrum just to show that the treatment is equally ineffective or harmful with individuals with ASD.

See the Evidence-based Practice section to learn how practitioners' knowledge of interventions outside the ASD population should be integrated into the decision-making process.

Appendix}

Academic Interventions

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Antecedent Package

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Auditory Integration Training

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Augmentative and Alternative Communication Device (AAC)

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