ONTABA

The Ontario Association for Behaviour Analysis, Inc.

EVIDENCE-BASED PRACTICES FOR INDIVIDUALS WITH AUTISM SPECTRUM DISORDER:

Recommendations for Caregivers, Practitioners, and Policy Makers

REPORT OF THE ONTARIO SCIENTIFIC EXPERT TASKFORCE FOR THE TREATMENT OF AUTISM SPECTRUM DISORDER

April 2017

Dear Reader,

In the summer of 2016, in response to intense public debate regarding the existing research evidence and best practices for the treatment of autism spectrum disorder (ASD), the Ontario Association for Behaviour Analysis (ONTABA) formed the Ontario Scientific Expert Task Force for the Treatment of Autism Spectrum Disorder (OSETT-ASD). Drawing upon the organization's membership, we assembled a group of behaviour analysts with prominent research and practice expertise. Over the next several months, the Task Force worked diligently to evaluate the current state of evidence that exists for this population in order to answer pertinent questions being posed by caregivers, advocates, policy makers, and practitioners across the province. We hope that this report will serve as a guide in the development of policy and practices in Ontario that are evidence based and result in the best possible outcomes for individuals with ASD and their loved ones. ONTABA would like to thank the many contributors to this report, including the Task Force members, the external reviewers, the subcommittee members, the ONTABA Board of Directors, and the research assistants and volunteers that made it possible.

This report is dedicated to our closest partners - the individuals, families, and caregivers to whom this work is of the utmost importance.

Sincerely,

Louis Busch, BST, M.Ed., BCaBA
President, ONTABA

Julie Koudys, Ph.D., C.Psych., BCBA-D
Chair, OSETT-ASD

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EXECUTIVE SUMMARY

Over its 24 years of existence, the Ontario Association for Behaviour Analysis (ONTABA) has developed into the single largest organization representing behaviour analysts in Canada. During this time, ONTABA has forged partnerships with families, government, and other organizations to advocate for improvements in the accessibility and quality of behaviour analytic services for those in need. As a logical extension of this role, ONTABA identified the need to produce a comprehensive examination of evidence-based practices and to make recommendations for the provision of behaviour analytical services to individuals with ASD in Ontario. This undertaking reflects ONTABA's ongoing commitment to individuals with ASD and their families, and the belief that individuals with ASD have a right to the most effective services, based on the best available evidence.

Despite significant and repeated efforts by government, public and private service providers, and families over the last several decades, the number of children with ASD in Ontario waiting for behaviour analytic services has increased. In March of 2016, the Ontario government announced that a new Ontario Autism Program would be available in June 2017. In response, ONTABA formed the Ontario Scientific Expert Taskforce for the Treatment of Autism Spectrum Disorder (OSETT-ASD) to examine the research evidence and accepted practice guidelines related to effective interventions for individuals with ASD, and to provide recommendations based on a synthesis of these information sources.

Our expert task force began its process of developing this report by first identifying critical questions that needed to be addressed to determine effective treatment and to design its delivery.

- What interventions should be supported for individuals with ASD?
- For what individuals, at what ages, should these interventions be made available?
- Who should supervise and who should deliver these services?
- How much service should be delivered, and for how long?
- How should decisions be made about the nature, intensity, effectiveness, and duration of services for each individual?

First, we identified a transparent and objective process for examining the research literature and accepted practice guidelines. Next, we used expert consensus as the basis for making our recommendations. Through this process, we identified two recent comprehensive research reports which used rigorous selection criteria for the identification of evidence-based practices for children with ASD, one published by the National Autism Center in 2015 and the other by the National Professional Development Center in 2014. We also identified four ABA practice guidelines by three large professional organizations (Association for Behavior Analysis International, the California Association for Behavior Analysis, and the Minnesota Association for Behavior Analysis) and one international credentialing body (the Behavior Analyst Certification Board). These sources formed the basis for the conclusions about evidence-based practices for individuals

with ASD and how behaviour analytic services should be delivered. This process is consistent with commonly accepted definitions of evidence-based practice which integrate the best available evidence with clinical expertise and client values and context (Slocum et al., 2014). It was clear from the comprehensive reports, which considered over 38,000 studies and systematically reviewed more than 2000, that almost all the interventions for ASD determined to be evidence-based were either behaviour analytic interventions or included components derived from behaviour analytic principles. These evidence-based interventions are divided into comprehensive and focused ABA interventions. Comprehensive ABA interventions address multiple targets across developmental domains and typically require a high number of hours of service per week. Focused ABA interventions address one or few targets and typically involve fewer hours of service.

Twenty-six recommendations and a brief commentary for each are provided to address the five questions outlined above. The report and its recommendations include input from some of the most prominent behaviour analysts in the field, the consensus of the OSETT-ASD committee, and ratification by the ONTABA Board of Directors. It is the most comprehensive examination of the research of evidence-based practices and practice guidelines for effective treatment of children with ASD in Ontario to date.

Our recommendations are based on the following foundational beliefs:

- Individuals with ASD have the right to receive effective, evidence-based treatment across their lifespan.
- ABA is the principal evidence-based approach for individuals with ASD.
- The public needs to be protected from false or misleading claims of effective treatment and from unqualified practitioners.
- Individuals with ASD receiving services and their families should be partners in decision-making when considering behaviour analytic interventions.
- The targets, design, and implementation of behaviour analytic interventions should be individualized to the needs of the individual with ASD.
- The amount of treatment and settings of behaviour analytic interventions should be selected to maximize outcomes for the individual with ASD.
- Goals of treatment should be set in advance, defined in measurable terms, and evaluated by direct and repeated measurement. Data collection systems should be customized to the needs of each unique individual. These data must be applied in the clinical decision-making process.

No one organization has the ability to bring about and sustain the supports needed to significantly improve the quality of life of individuals with ASD and their families. It will be our collective efforts working in concert that will make a difference. To this end, ONTABA adds it's voice to the dialogue about what is needed for the treatment of individuals with ASD. ONTABA remains committed to working with families, practitioners and policy makers to ensure the provision of the most effective treatment; specifically, the ethical and effective application of behaviour analysis in Ontario.

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1. INTRODUCTION AND PURPOSE

Since 1994, the Ontario Association for Behaviour Analysis (ONTABA) has worked to foster a culture of excellence, integrity, and expertise for the advancement and promotion of the science of behaviour analysis in Ontario. ONTABA is the largest professional organization representing behaviour analysts in Canada. As an affiliate chapter of the Association for Behavior Analysis International (ABAI) and an affiliate of the Association of Professional Behavior Analysts (APBA), ONTABA has served as a resource for practitioners and recipients of behaviour analytic services, a respected community partner, and a dedicated advocate for individuals in need of life-changing behaviour analytic services.

Behaviour analysis is a scientific discipline whose subject matter is individual behaviour interacting with environmental events. Like other scientific disciplines, behaviour analysis has theoretical, experimental, and applied branches, journals, scholarly and professional organizations, university training programs, and professional credentials. The applied branch of the discipline (applied behaviour analysis; ABA) involves using scientific principles and procedures discovered through basic and applied research to improve socially significant behaviour to a meaningful degree. The defining features of ABA have been well-specified since 1968 (Baer, Wolf, & Risley, 1968). They are:

- **Applied** – addresses behaviours that are socially significant for the client and his/her significant others.
- **Behavioural** – focuses on the client behaviour(s) in need of improvement and measures those directly.
- **Analytical** – consistently produces change in a measured aspect of the target behaviour(s) when the intervention is in place vs. when it is not.
- **Technological** – described with sufficient detail and clarity that a reader has a reasonable chance of replicating the intervention.
- **Conceptually systematic** – grounded in the conceptualization that behaviour is a function of environmental events and described in terms of behaviour analytic principles.
- **Effective** – improves target behaviours to a clinically meaningful degree.
- **Generalization** – produces changes in target behaviours that last over time, occur in situations other than those in which the interventions were implemented initially, and/or spread to behaviours that were not treated directly.

ONTABA has served as a resource for practitioners and recipients of behaviour analytic services, a respected community partner, and a dedicated advocate for individuals in need of life-changing behaviour analytic services.

Thousands of studies published in peer-reviewed scientific journals have demonstrated the efficacy of a range of ABA procedures – singly and in various combinations – for building skills and reducing problem behaviours in many clinical and non-clinical

populations in a wide range of settings. Almost as soon as that evidence began to emerge in the 1960s, there was great interest in using ABA in a variety of human service settings, and the practice of behaviour analysis was born. It has grown exponentially in recent years with increased demand for ABA services from clients, employers, and policy makers.

The professional practice of behaviour analysis involves the design, implementation, and evaluation of instructional and environmental modifications by a behaviour analyst to produce socially significant improvements in human behaviour. It includes the empirical identification of functional relations between behaviour and environmental factors, known as functional assessment and analysis. Applied behaviour analytic interventions (ABA interventions) are based on scientific research and the direct observation and measurement of behaviour and environment in order to increase or decrease existing behaviours under specific environmental conditions. Typical clients of ABA practitioners include individuals with autism and other developmental disabilities, intellectual disabilities, learning and communication difficulties, brain injuries, physical disabilities, and difficulties associated with aging, as well as typically developing individuals. Practitioners of ABA work in a variety of settings, including private and public clinics, private homes, schools, hospitals, nursing homes, group homes, universities, and business settings.

ABA interventions can be helpful for a wide variety of applications and populations. In the past 20 years, there has been an explosion of interest in the use of applied behaviour analysis (ABA) in the treatment of children with autism spectrum disorder (ASD) in Ontario and internationally, including the wide-spread dissemination of early intensive behavioral intervention (EIBI) for young children (e.g., Maurice, Green, & Luce, 1996), although ABA intervention had been used with older individuals much earlier, since the 1950s and 1960s. There have also been some misunderstandings and misconceptions about the nature of ABA (see Appendix B). Those interested in the application of behaviour analysis for this population include clients (e.g., parents, teachers, agencies, schools), practitioners (e.g., behaviour analysts, psychologists), and policy makers.

Timely access to intensive ABA services is estimated to result in long-term cost savings between $656,000 and $3.7 million per individual (Chasson, Harris, & Neely, 2007; Jacobson, Mulick, & Green, 1998; Larsson, 2012a).

In 2000, the Ontario government introduced the Intensive Behavioural Intervention (IBI) program - an intensive and comprehensive form of ABA for young children with ASD. Since then, the funding for IBI services has increased steadily (Auditor General of Ontario, 2015). Improvements in cognitive and adaptive function and reduction in ASD symptom severity have been reported in efficacy studies internationally (e.g., Lovaas, 1987) and in effectiveness studies in Ontario (Flanagan, Perry, & Freeman, 2012; Freeman & Perry, 2010; Perry et al., 2008). In addition, both IBI and the broader range of ABA interventions are considered evidence-based practices in the treatment of ASD as described in detail later in this report.

Given the demonstrated benefits of behaviour analytic interventions, timely access to behaviour analytic services can offset the lifetime cost of caring for and supporting individuals with ASD. These costs are estimated to be between $2-$5.5 million per individual

(California Association for Behavior Analysis, 2011; Dudley & Emery, 2016). In contrast, timely access to intensive ABA services is estimated to result in long-term cost savings between $656,000 and $3.7 million per individual (Chasson, Harris, & Neely, 2007; Jacobson, Mulick, & Green, 1998; Larsson, 2012a). These cost savings may be related to a variety of factors including but not limited to increased independence, decreased dependency on caregivers, decreased challenging behaviours and thus decreased psychiatric hospitalizations (e.g., Mandell, 2008; Motiwala et al., 2006), Further, immediate cost savings have also been associated with access to ABA services. In particular, Larsson (2012b) reported that access to ABA services has been linked to a decrease in caregivers' absenteeism and work limitations and an increase in children's compliance with medical routines, self-care routines, and dental routines.

Given the substantial investment in ASD services by the province of Ontario, and the potential for long-term cost savings, it is essential that these services be based on the best available evidence. To this end, ONTABA formed the Ontario Scientific Expert Task Force for the Treatment of Autism Spectrum Disorder (OSETT-ASD). The Task Force worked for 8 months to synthesize the research literature on evidence-based interventions for individuals with ASD as well as compile and combine professional Practice Guidelines from several authoritative international bodies. The results of this synthesis form the foundation of this document and lead directly to our recommendations, which are designed to inform caregivers, practitioners, and policy makers.

A BRIEF HISTORY OF SERVICES FOR INDIVIDUALS WITH AUTISM SPECTRUM DISORDER IN ONTARIO

Not unlike most jurisdictions in North America at the time, up until the 1960s, treatment of persons with ASD in Ontario was almost nonexistent. Children with moderate or severe ASD (who often also had intellectual disabilities) tended to be placed in large residential facilities that were either directly operated by the Province (Schedule I facilities), or by a not-for-profit board (Schedule II facilities; Martin & Ashworth, 2010). The prognosis for children with ASD in Ontario (and elsewhere) tended to be very pessimistic. A sample of children with ASD seen at the Child and Parent Resource Institute (CPRI) in London between 1960 and 1973 was followed for 8 to 24 years. Sadly, most of these children were placed within long-term institutional care due to the lack of effective therapeutic and habilitative services (Wolf & Goldberg, 1986).

At that time, there were essentially no community-based services available for children with ASD, and services at the residential facilities were based on a custodial model of care and funded through the Ontario Ministry of Health. This model assumed that children with developmental disabilities, including ASD, did not have the capacity to make substantial gains in intellectual development and, as a result, very little effort was devoted to producing improvements in children's adaptive, communication, social, or cognitive skills. In the Ontario education system at the time, children who were deemed not able to be educated, including many children with ASD, were excluded from public education altogether. Some were placed in segregated schools for the hearing-impaired or special education schools or classrooms (Dunn, 1968).

In the 1970s, new social movements for social and educational inclusion and "normalization," prompted changes in the model of services for children with developmental disabilities.

Within a few years, services shifted from a largely segregated care model to a community and integrated model of care (http://www.mcss.gov.on.ca/en/dshistory/). A five-year plan was introduced to close institutional settings, first for children with developmental disabilities and then for adults with developmental disabilities (Welch, 1973). In their place, a network of community services was introduced to support children with developmental disabilities and their families at home. Assessment and diagnostic services, infant stimulation, and "behaviour management" services were introduced. Associated with this movement in residential care was a shift in the model of education with Bill 82, the Education Amendment Act (1980), which meant that, for the first time in Ontario, all children with disabilities (who were now likely to be living in the community with their families) had access to publicly funded education. Children with "exceptionalities" were to be identified and receive an appropriate special education placement. Subsequently, school systems in Ontario began to reduce the number of segregated special education classrooms and increase access to models of special education that included the exceptional student with peers in regular classrooms (Dworet, 2002). Further, each student with an exceptionality received an Individual Education Plan (Ontario Ministry of Education, 2000).

In the late 1980s and early 1990s long-term outcomes for children with ASD were quite pessimistic. At that time, almost no clinical intervention was provided to children with ASD, let alone interventions demonstrated empirically to improve the cognitive, communication, and social development of these children; with the exception of a few agencies such as the Child and Parent Resource Institute (CPRI), Thistletown Regional Centre, and Surrey Place Centre. Significantly, a research study conducted at Thistletown in the 1980s showed that outpatient and home-based ABA intervention was more effective than residential care (Sherman, Barker, Lorimer, Swinson, & Factor, 1988).

Around the same time, there was a growing shift in the field with the publication of research that demonstrated that very early (beginning at age 2), and very intensive (35-40 hours a week) intervention using ABA with systematic supervision could, in some cases, dramatically improve the developmental trajectory of young children with ASD (Lovaas, 1987). This initial finding from the University of California, Los Angeles was subsequently replicated in a number of well-controlled studies (e.g., Cohen, Amerine-Dickens, & Smith, 2006; Howard, Stanislaw, Green, Sparkman, & Cohen, 2014; Sallows & Graupner, 2005; Smith, Groen, & Wynn, 2000). There was, by that time, also a substantial body of research on focused ABA interventions for individuals of various ages. At about the same time, several international organizations interested in effective interventions for children with ASD formed expert panels to identify evidence-based practices for children with ASD, such as the New York State Department of Health (NYSDOH, 1999).

These encouraging research findings, coupled with effective lobbying by parents of children with ASD as well as professionals, resulted in the Ontario government ministry - now called the Ministry of Children and Youth Services (MCYS) - developing the Ontario Early Autism Initiative in 1999/2000 to provide intensive behavioural intervention (IBI) to young children with ASD. A description of the research and other background to the IBI program in Ontario can be found in Perry (2002). Prior to this, there were virtually no publicly funded ABA interventions available. Some families brought in ABA consultants from the United States, but the majority of families could not afford such services or were unaware of them.

Since the inception of the IBI program in 2000, the program has been expanded multiple times. Thousands of children with ASD have received services across nine regions in the province, in both English and French. In 2011, to complement the IBI program, the Ontario government introduced a program called ABA Supports and Services (Office of the Auditor General of Ontario, 2013). These services are described as "ABA-based services" designed to target specific areas of skill deficit and/or behaviour excess.

The MCYS also devoted resources to enhancing capacity within the school system, via the School Support Program, which provided training and resources to educational personnel. In 2007, the Ministry of Education issued Policy/Program Memorandum No. 140 directing school boards to offer students with ASD "special education programs and services including, where appropriate, special education programs using ABA methods" (http://www.edu.gov.on.ca/extra/eng/ppm/140.html).

Over the past 15 years, the Ontario government has demonstrated its commitment to effective behavioural services for children with ASD and their families by increasing their annualized funding of the program substantially (Office of the Auditor General of Ontario, 2013). Most recently, in 2016, the Ontario government announced that existing services would be significantly altered in an attempt to "make it easier for families to access services for their children by reducing wait times, providing more flexible services at a level of intensity that meets each child's individual needs, and increasing the number of treatment spaces available to serve more children and youth and accommodate the rising prevalence of autism diagnoses" (http://www.children.gov.on.ca/htdocs/English/specialneeds/autism/ontario-autism-program.aspx).

PURPOSE OF THIS REPORT AND PROCESS UNDERTAKEN

In the development of social policy and decision-making regarding mechanisms for the delivery of interventions[1] for individuals with ASD, there are many questions that need to be answered, including:

- What interventions should be supported for individuals with ASD?
- For what children, at what ages, should these interventions be made available?
- Who should supervise and who should deliver these services?
- How much service should be delivered, and for how long?
- How should decisions be made about the nature, intensity, effectiveness, and duration of services for individuals with ASD?

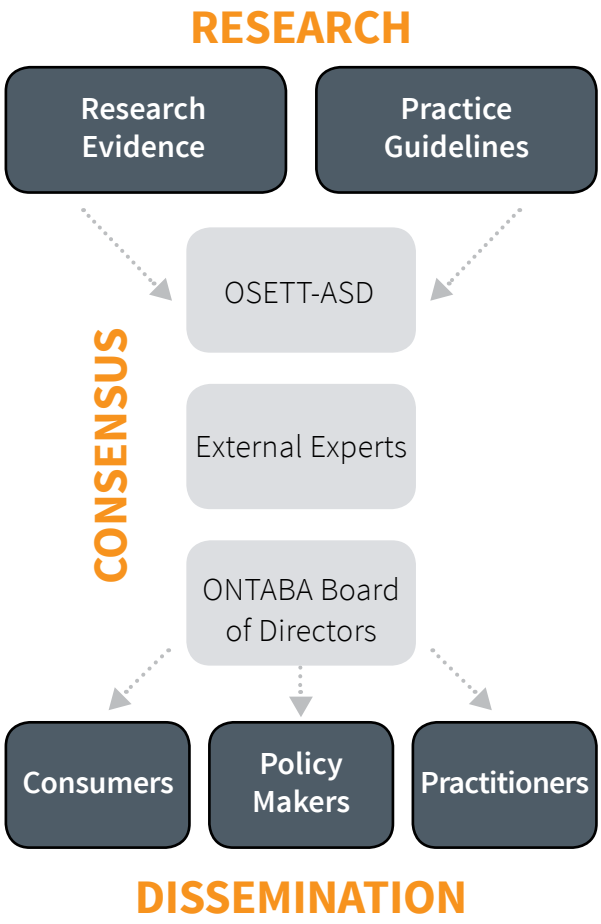
It is ONTABA's position that, to the extent possible, social policy should be informed by the most current research available on evidence-based interventions in the field. Given that applied behaviour

1 The Task Force members adopted the term "intervention" as opposed to "treatment" or "practice." This term is consistent with the terminology used by the NAC (2015), which makes a distinction between "evidence-based interventions and the larger framework of evidence-based practice" (p. 29).

analysis is the principal evidence-based approach for this population and ONTABA is the largest professional organization advocating for behaviour analytic services in Canada, we believe that ONTABA has a responsibility to (a) develop a clear position on these issues (based on the most current research, available practice guidelines, and expert judgement), and (b) contribute our expertise to helping address these difficult questions.

The purpose of this undertaking is for ONTABA to provide accurate information about behaviour analysis and evidence-based practices for individuals with ASD in the hopes that this information will aid clients and other service recipients, practitioners, and policy makers during a time of significant provincial change in ASD services. To this end, ONTABA was faced with numerous decisions related to the scope and breadth of the undertaking, as well as the requirements for intellectual rigour, transparency, and the practical realities of time and resource constraints.

Figure 1. OSETT-ASD Process and Timeline



The Task Force was formed to produce a timely report and recommendations based on a synthesis of two bodies of information: (a) the best available research on evidence-based interventions for persons with ASD (see Section III) and (b) recently published, scientifically derived practice guidelines produced by organizations representing behaviour analysis (see Section IV). We set out to examine these two diverse sources of information to inform our recommendations for ABA service recipients, practitioners, and policy makers. Once the breadth and scope of the report were identified, Task Force members worked on sub-committees to review all relevant documents and synthesize information into tables for review by the Task Force. Inter-rater reliability of all decisions pertaining to rating, synthesizing and reporting of information was ensured. A more specific description of the methodology used to develop this report can be found in subsequent sections of this report.

The synthesis of these two sources of information then formed the basis for the recommendations found in the Recommendation section (see Section V). A consensus process was used to ensure that each recommendation had the unanimous agreement of each member of the Task Force and the ONTABA Board of Directors unanimously approved these recommendations. In addition, external experts were consulted throughout the process and several experts external to the Task Force reviewed the entire document and provided feedback. Figure 1 depicts the process undertaken.

2. BACKGROUND AND KEY CONCEPTS

WHAT IS EVIDENCE-BASED PRACTICE?

The concept of evidence-based practice was first introduced in the field of medicine in the United Kingdom, and involved a major paradigm shift from reliance on clinical judgement to a reliance on scientific research to inform treatment decisions (Cochrane, 1972). This trend has since spread to many other professions and fields, including behavioural, educational, and psychosocial services for individuals with ASD.

Evidence-based *medicine* is often defined as: *"the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research"* (Sackett et al.,1996). In the field of psychology, evidence-based practice (EBP) is defined by the American Psychological Association as *"... the integration of the best available research with clinical expertise in the context of patient characteristics, culture, and preferences... to promote effective psychological practice and enhance public health by applying empirically supported principles ..."* (APA Presidential Task Force on Evidence-Based Practice, 2006). According to the American Speech-Language-Hearing Association (ASHA), *"The goal of EBP is the integration of: (a) clinical expertise/expert opinion, (b) external scientific evidence, and (c) client/patient/caregiver values to provide high-quality services reflecting the interests, values, needs, and choices of the individuals we serve"* (ASHA, 2004). Similar definitions may be found in many other professions and fields. Of particular relevance to the current report, some behaviour analysts have defined evidence-based practice as "... a decision-making process that integrates (a) the best available evidence with (b) clinical expertise and (c) client values and context" (Slocum et al., 2014).

Some behaviour analysts have defined evidence-based practice as "... a decision-making process that integrates (a) the best available evidence with (b) clinical expertise and (c) client values and context" (Slocum et al., 2014).

Evidence-based practice includes components of expert clinical judgment and client values and context, but the heart of it is the fundamental assumption that decisions about use or non-use of particular treatments/interventions/practices should be based on the best available research evidence. This is the case whether the intervention being considered is a particular medication to reduce high blood pressure, a behavioural teaching method to increase meaningful communication, a structured educational approach to teach reading, or a multi-component behavioural intervention package to reduce problem behaviour and replace it with appropriate behaviour.

Different organizations or review panels have used slightly different terminology and definitions such as "evidence based," "established," "empirically validated,"

"empirically supported," and so on. Some include a classification of "promising," "emerging," or "probably efficacious" whereby the quantity, quality, or both the quantity and the quality of evidence is weaker but somewhat positive. In the future, additional research may determine whether such interventions are evidence based. In the meantime, they should either not be used, or be used only if other evidence-based interventions have not worked or cannot be provided, and only with careful data-based monitoring of effectiveness and possible side effects.

Many types of interventions fall into a category called "unestablished" or "not evidence based." There are two completely different reasons for this classification. In some cases, there is simply insufficient evidence (in terms of amount, quality, or both) on the intervention to draw any conclusions. These interventions should not be recommended and further research on the effectiveness of these interventions is strongly encouraged. In a few cases, interventions have been well studied (good quality and quantity of research) but found not to work (or potentially to be harmful). These interventions, obviously, should never be used with clients.

Some of the various terms and the implications for use of the methods are summarized in the table below.

Table 1

Different Terminology Used in Different Sources

EVIDENCE BASED Good Evidence Showing Effective	EMERGING Some (weaker) Positive Evidence	NOT EVIDENCE BASED Insufficient Evidence To Inform Decision-Making	NOT EVIDENCE BASED Good Evidence Showing Ineffective/Harmful
(Well) Established	Emerging	Unestablished	Ineffective
Empirically validated	Evidence informed		Not recommended
Empirically supported treatment	Probably efficacious		
	Practices with some support		Non-evidence based
Definitely Use	**Use Only with Caution**	**Do Not Use**	**Definitely Do Not Use**

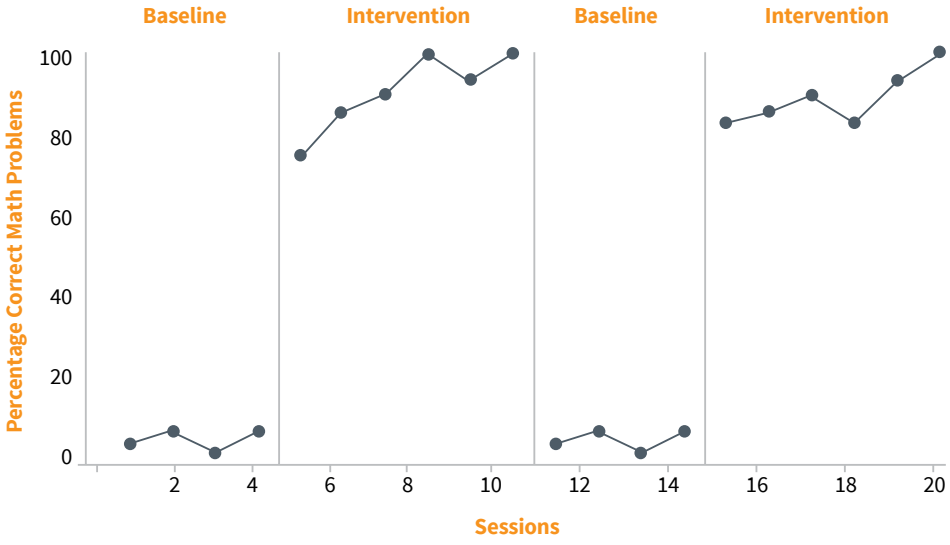
WHAT RESEARCH METHODS AND TYPES OF EVIDENCE ARE IMPORTANT TO UNDERSTAND IN ASD RESEARCH?

There are two quite different types of research methodologies used in research evaluating various interventions for individuals with ASD and it is important to understand the difference between them, as they cannot be easily equated. Despite this, both are considered valid research methods (Christensen, Johnson, & Turner, 2014; Kratochwill & Levin, 2014) and each has standards for what is considered a strong research design and accepted analytic procedures.

Single Case Research Design Studies (also called single-subject designs; Johnston & Pennypacker, 2009; Kazdin, 2011). A single case research design (SCRD) is not simply a descriptive case study. This type of research design involves within-subject manipulations, across one or, more often, several individuals, using experimental designs that ensure experimental control. This research approach is particularly well suited to the heterogeneity of presenting problems among individuals with ASD and can identify interventions, or aspects of interventions, that are effective at the individual level. Common examples include reversal designs and multiple baseline designs. These designs typically rely on direct observational measures (e.g., number of verbal initiations to peers per hour, duration of time without self-injury), and rely upon visual inspection of graphed data to compare the level of the skill or target behaviour at baseline to that in the intervention phase(s). If the skill or target behaviour changes when (and only when) the intervention is in effect, and this pattern is repeated at least three times, then it can be concluded that the intervention is causing the behaviour change.

For example, in an ABAB Reversal Design, as shown in Figure 2, a child struggling in math is given an intervention using a method called direct instruction. During the baseline (A) phase, the child consistently answered very few math problems correctly. After the intervention (B) was implemented, there was a clear change in the number of correct math problems. That is, following the introduction of the intervention, the child began to answer more and more math problems correctly across the phase. In order to determine if the intervention rather than some extraneous variable produced the increase in correct math problems, the intervention was withdrawn (or "reversed" back to baseline [A]). Once the intervention was removed, a corresponding decrease in correct math problems was observed, providing further support that the intervention produced the increase in correct math problems observed in the previous phase. However, in order to be able to conclusively assert that the intervention caused the increase in correct math problems, the intervention must be reintroduced. Once the intervention (B) was reintroduced, the number of correct math problems increased again. Taken together, these data demonstrate that when, and only when, the intervention (B) was in effect did the number of correct math problems increase. That is, the intervention (and not something else) caused the increase in correct math problems. Future phases would likely include a tapering of the intervention to ensure that the child was able to perform math problems

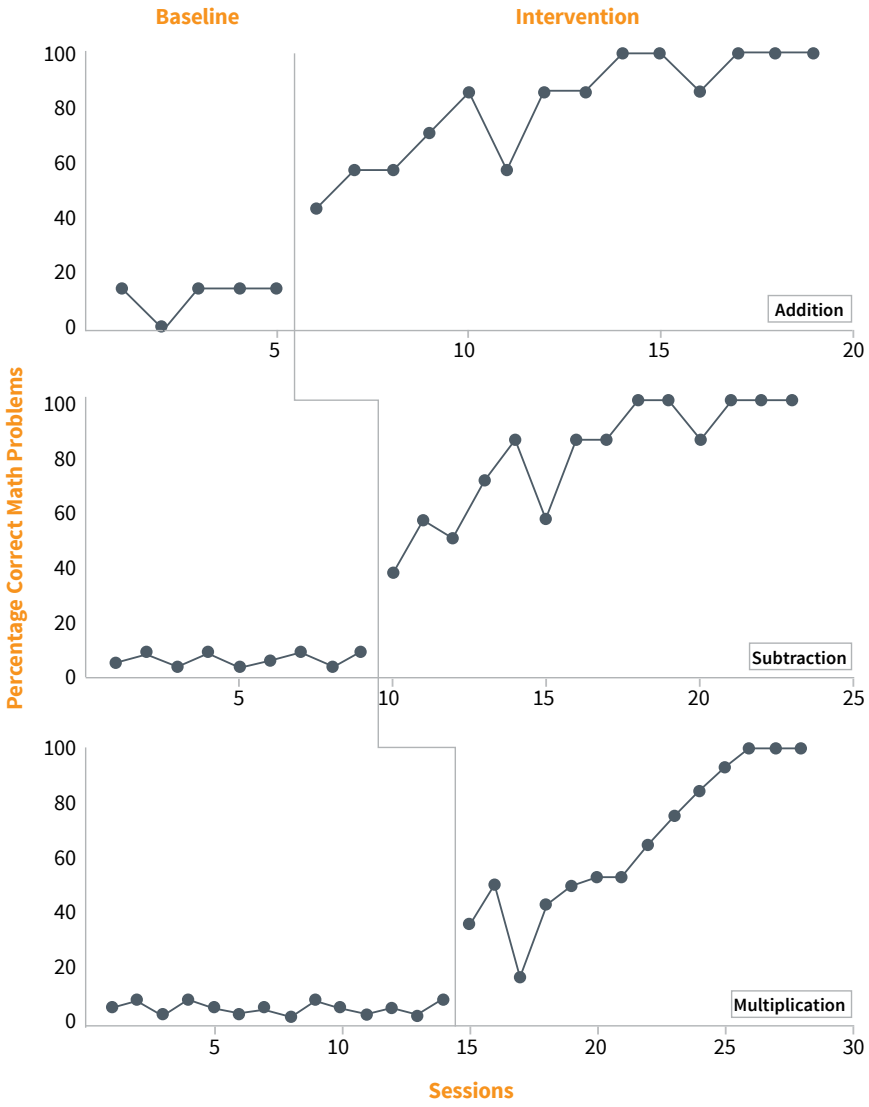
Figure 2. Example of an ABAB reversal design



independent of the intervention and monitoring the maintenance of these intervention effects over time. Although this is a school-related example, the target behaviour could just as easily be appropriate social initiations, correct labelling of pictures, or neatly clearing the table.

Another example of a commonly used SCRD is the multiple baseline design. There are many variations of the multiple baseline design. For example, these can be implemented across several participants, settings, or target behaviours in the same individual, as shown in Figure 3. In this example, a reinforcement procedure was introduced sequentially in three different academic areas for the same individual (multiple-baseline across behaviours) but each at a different time. Note that the baselines all begin at the same time and remain stable and that the skill level change occurs in each case, only after the intervention is implemented. Thus, the change in skill level can be attributed to the intervention rather than extraneous factors. Note that the same type of design could be used to examine the impact of a social skills intervention for three different children or an individual's rate of appropriate greetings at school, in the community, and on the school bus.

Figure 3. Example of a multiple baseline design



Group design studies (Christensen et al., 2014). This type of research design involves one or more groups of participants who receive a form of intervention and are compared to a group who receive no intervention or a different intervention. Randomized controlled trials (RCTs), usually regarded as the strongest design, involve randomly assigning participants to either the intervention or the control group, which is intended to ensure that there are no significant differences between

the groups at the outset. One group receives the intervention; the other does not. If the intervention group improves substantially and the control group does not, then the intervention is said to be efficacious. Group research designs are excellent for certain interventions such as drug studies, where relevant people in the child's life can be kept "blind" as to whether the child is receiving the actual drug or the placebo. However, they are often impractical, or even unethical, in ASD research on behavioural or educational interventions as parents cannot be kept uninformed about the child's group assignment, may not agree to the 50/50 chance of receiving no intervention, and so on.

Other common examples of group designs include: comparing "found groups" such as comparing two groups of children whose parents have opted for two different interventions; comparing the approach being studied to a "treatment-as-usual" group; or comparing the approach being studied to a wait list comparison group (e.g., children waiting to access the service). These designs are often more practical and ethically acceptable, although there may be problems in interpreting findings. These designs are strengthened when the groups are shown empirically to be substantially similar when the study begins and when the characteristics of the intervention(s) are specified as closely as possible.

Group design studies typically have relatively large numbers of participants, use indirect measures such as questionnaires, rating scales or standardized tests (rather than direct observational data typically used in SCRD designs such as frequency of behaviour), and rely upon statistical analyses (e.g., ANOVA, t tests) to interpret group differences (e.g., intervention group mean score was significantly lower than the mean of the control group on anxiety symptoms on a parent questionnaire). Graphs may be used but results are often presented in tables such as the one shown in Table 2 from an Ontario study of IBI.

Table 2

Example Results Displayed in Table Format from a Group Design Study

Autism Severity Scores Pre- and Post-IBI Intervention or Waitlist

IBI Group (n=61)		Waitlist Group (n=61)		
Time 1	Time 2	Time 1	Time 2	p=.033
M (SD)	M (SD)	M (SD)	M (SD)	
32.83 (3.99)	30.20 (4.97)	32.62 (3.74)	32.57 (5.55)	Cohen's d=.53

Note. Adapted from "Effectiveness of large-scale community-based Intensive Behavioral Intervention: A waitlist comparison study exploring outcomes and predictors," by Flanagan, Perry, and Freeman (2012).

As Table 2 shows, the two groups had virtually equal mean scores initially (the two Time 1 scores are virtually the same) but, at Time 2, the IBI group had, on average, significantly milder autism severity (lower score) and the waitlist control group did not change. This result is unlikely to have occurred by chance (p=.033) and a difference of this magnitude is considered a strong effect size (d=.53). It is important to note that statistical analyses like this only document that the intervention is effective, on average, for the group, but do not necessarily indicate how many individuals in the group actually benefitted to a meaningful degree. Group

changes can be driven by a few individuals making very large changes, whereas other individuals may not change. Measures of clinical significance (e.g., what proportion of the sample improved to what degree or changed categories) are increasingly being reported in such studies and are very useful when interpreting the results.

Validity and Utility of Types of Research Designs. Within both research traditions, there are standards for what is considered a stronger versus weaker research design. These include aspects of the study's design which contribute to internal and external validity. Internal validity refers to the strength of the research design and procedures that help to rule out alternative explanations for the results. External validity refers to the generalizability of the results to other individuals besides those in the study. Characteristics of research design are somewhat different in the two research traditions but they address the same underlying principles. For example, reliability of measurement is important in both types of research. In SCRD studies, data should be reported on the inter-observer agreement of the (directly observable) outcome variable. In group designs, rating scales or psychological testing methods used should have good internal consistency (a measure of the inter-correlations of all items) and test-retest reliability for example. Whenever possible, the reliability of such measures should be assessed within the particular sample, not just based on the test manual.

Another design feature that is crucial in both types of research methodology is experimental control to ensure that the change in participants' skills or target behaviour can be attributed to the intervention, rather than some other factor, such as the passage of time, another intervention, coincidence, bias of others in the environment, poor measurement methods, and so on. A pre-post group design without a comparison group and a SCRD design with only one baseline (A) and one intervention (B) phase are both weak research designs because any changes that occur cannot conclusively be linked to the intervention; they could well be caused by some other factor.

Finally, the concept of independent replication is important in both research traditions. One study, however well designed, is insufficient for decision-making. It is important to have multiple independent researchers repeat the study to determine whether consistent results are obtained. The greater the number of studies (across different research groups) that demonstrate the same findings, the greater the degree of confidence one can have in the effectiveness of that intervention. If there is evidence from both types of research design, the results may be seen as particularly robust since the two methods have different strengths.

Some research reviews, especially those emerging from a medical or epidemiological perspective tend to discount the SCRD research methodologies. For example, one of the early reviews of interventions for individuals with ASD was conducted by the New York State Department of Health in 1999. This was a rigorous review of assessment and intervention approaches for children with ASD aged 0 to 3 years. They used a 4-level strength of evidence rating system and concluded there were, essentially, no effective interventions for ASD except for very few studies supporting early intensive intervention programs grounded in ABA. Their procedure excluded research conducted using SCRD experimental methodologies, which forms the majority of ASD intervention research due

to the highly individualized nature of the interventions. Some other recent reviews of the literature have used a minimum sample size of 10 participants as one of their criteria and this, in effect, excludes virtually all SCRD studies (e.g., Agency for Healthcare Research & Quality, 2011; National Institute for Health and Care, 2013; see below). Fortunately, some other reviews have included research evidence from both types of research traditions, which provides a much broader basis for drawing conclusions on the most effective interventions for individuals with ASD given that approximately three quarters of all ASD intervention research uses SCRD methodology (e.g., NAC, 2009). Therefore, it is crucial that this large body of research be included in any meaningful summary of research evidence for ASD intervention.

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FOCUSED VS. COMPREHENSIVE INTERVENTIONS

Another important distinction to make in examining and evaluating the ASD intervention literature is between focused and comprehensive types of intervention. As the name implies, focused interventions generally target more specific areas of skill development or behaviour reduction, and are time-limited. Comprehensive interventions tend to address multiple domains or global outcomes and are applied in an intensive way for a prolonged period of time.

Within the ABA literature, the majority of the research addresses focused interventions and uses SCRD methodology. Thus, the research summarized in this document is largely based on focused ABA interventions (further described below). Comprehensive interventions, on the other hand, may reflect different theoretical approaches or combinations of approaches and the term comprehensive is defined differently depending on the context. There are a number of "comprehensive" interventions available for children with ASD including early intensive behavioral intervention [EIBI], comprehensive ABA for individuals with significant learning challenges and behavioural excesses, Treatment and Education of Autistic and Communication Related Handicapped Children [TEACCH], Early Start Denver Model [ESDM], Floortime, etc.). Although the term "comprehensive" is used to describe these interventions, many stem from different theoretical orientations and there is substantial variation in the quantity and quality of empirical evidence supporting these interventions. The majority of research on comprehensive ABA intervention (further described below) is limited to EIBI and uses group design studies.

Focused ABA interventions. These interventions are intended to address a specific skill deficit(s) (e.g., communication skills, social initiation skills, using the toilet) and/or one or more behavioural excesses (e.g., tantrums, aggression) using specific operationally defined procedures and outcomes. These interventions may be used with individuals of any age and may take place in schools, clinics, home, or community settings. The interventions are not necessarily intensive (i.e., many hours of service provided each week). They are usually time-limited and implemented until the goal

for intervention is achieved. Such interventions may be implemented individually (i.e., one person with ASD may be receiving one specific intervention to address one problem) or an individual with ASD could receive multiple focused interventions simultaneously. Focused ABA interventions have been evaluated using a variety of research designs, but primarily using SCRD design involving the measurement of specific, observable skills or target behaviours.

Comprehensive ABA interventions (also called comprehensive ABA treatment and comprehensive treatment models in some cases). These interventions include the essential practice elements of ABA (e.g., direct observational data, individualized behaviour analytic treatment plans, ongoing and frequent direct assessment and data analysis), and are typically implemented in a very intensive (e.g., 35 hours per week) and comprehensive (i.e., targeting goals across multiple domains simultaneously) manner. Early intensive behavioral intervention (EIBI), typically called IBI in Ontario, is the most well researched. EIBI incorporates a broad curriculum (e.g., social, communication, play, self-help, academic goals) and may take place in centre-based programs, homes, schools, or clinics, or combinations of different environments.

... at the individual level, specific objective, behavioural data would always be collected on each component of the comprehensive ABA intervention and used to make clinical decisions...

It is important to understand that comprehensive ABA interventions incorporate a large array of focused ABA procedures, such as peer-mediated strategies to teach play, modeling and prompting to teach prerequisite social skills, chaining to teach self-help skills such as making toast, and direct instruction to teach academic skills, to name just a few examples. Many of these procedures are themselves considered evidence-based practices for individuals with ASD. In fact, focused as well as comprehensive ABA interventions are often made up of multiple evidence-based ABA procedures (prompting, reinforcement, task analysis, and many others).

Several models of comprehensive ABA intervention have been evaluated using group research designs. Thus, it is difficult to compare the results of these studies with those from the focused ABA intervention studies. This is in part due to the fact that the outcome measures reported in comprehensive intervention studies are typically norm-referenced, developmental outcomes based on standardized tests (e.g., IQ, language) or parent/teacher report (e.g., adaptive behaviour, emotional problems). As noted earlier, statistical analyses of group comparisons are conducted to determine effectiveness of the intervention at the group level. As noted earlier, group designs are not helpful for individual intervention planning and decision-making. It is important to understand that, at the individual child level, specific objective, behavioural data would always be collected on each component of the comprehensive ABA intervention and used to make clinical decisions (rather than a global outcome used as a dependent variable in a group design research study).

QUANTITY AND QUALITY OF EVIDENCE

Quantity of Evidence. How much evidence is enough? Different professional bodies and interdisciplinary panels have developed different definitions and systems of classification for evaluating the evidence of systematic research. One very influential such group was the American Psychological Association (Chambless & Hollon, 1998) who were the first to quantify how much evidence and what kind of evidence is needed to call an intervention efficacious or evidence based. Their standard for what they called a "Well Established" intervention was: 9 single case research design studies or 2 or more group design studies showing superiority to another intervention, placebo, etc. They also had a category called "Probably Efficacious" interventions, which was based on: 3 single case research design studies, 2 or more group design studies showing superiority to wait-list control, or 1 group study showing superiority to another intervention, placebo, etc. Various different review processes have developed elaborations or extensions to this framework.

Quality of Evidence. Not all "evidence" is equally useful. For example, several weak studies may not be as conclusive as one very strong study. How do researchers judge the quality of research evidence? Evidence-based reports typically include some process for rating the quality or strength of the research design for each study. As noted above, there are different standards for the two types of research designs. Some recent systematic reviews of the evidence have used a rigorous process of evaluating the strength or quality of the research design of each study, using guidelines such as the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA; Moher et al., 2009). One rating method specific to ASD research that provides excellent criteria for evaluating both SCRD and group design research is the Scientific Merit Rating Scale developed by the National Autism Centre (NAC, 2009), shown in Table 3 below.

Table 3

Scientific Merit Rating Scale

Scientific Merit Rating Scale (NAC, 2009) Rating 5 (highest level)

Research Design		Measure of Outcome		Measure of Intervention (treatment integrity or fidelity)	Participant Ascertainment (how diagnosed)	Generalization of Intervention Effects
Group Design	Single Case Research Design	Test, scale, checklist	Direct Behavioural Observation			
2 or more groups Design: random assignment and/or no pre-treatment differences n ≥ 10 per group No data loss	3 or more comparisons across conditions ≥ 5 data points per condition n ≥ 3 No data loss	Observation based measure Standardized protocol Solid psychometric properties Evaluators "blind" & independent	Continuous or discontinuous with calibration data showing low error IOA (reliability) > 90% -IOA collected in > 25% sessions Data collected in all sessions	Implementation accuracy > 80% Implementation accuracy measured in > 25% sessions IOA for treatment fidelity > 80%	Diagnosed by qualified professional Diagnosis confirmed for study by "blind" and independent evaluators, using at least one solid instrument DSM or ICD criteria or commonly accepted criteria for the time	Objective data Maintenance data AND Generalization data collected across at least 2 of: setting, stimuli, persons

Note. Adapted from "National Standards Project findings and conclusions" by the National Autism Center (2009)

Previous Evidence Reviews. Many organizations and groups have reviewed and summarized the evidence for interventions for individuals with ASD published over the past 35 years. They vary in terms of the inclusion criteria for the body of research included, methodology used, and purpose of the review. Many of these, especially the earlier ones, were narrative reviews, in which the authors presented their own evaluation and synthesis of the information, which may have reflected the biases of the authors. Some were reviews done by one or a few authors commissioned by a committee or government body to synthesize evidence for particular purposes. More recently, there have been systematic reviews using a more formal process, such as the PRISMA guidelines (Moher et al., 2009) for documenting the method of review (number of articles reviewed, criteria for rating, reliability of raters, etc.) and to enhance the objectivity of the process. Some of these have included only group design studies, but the majority include SCRD studies as well. Some include both focused and comprehensive ABA interventions, while some include only one or the other, depending upon the purpose of the review. The table below describes (in chronological order) key documents providing summaries of research on interventions for individuals with ASD.

Table 4

Published Reviews of Autism Spectrum Disorder Treatment Research Literature

Organization/Authors	Year	Description
DeMyer, Hingtgen, & Jackson	1981	Narrative review of approximately 300 studies of behavioural treatment of ASD prior to 1980, mostly SCRD
US Department of Health & Human Services	1991	Narrative review of treatment approaches for reduction of destructive behaviour, mostly SCRD
Matson et al.	1996	Narrative review of approximately 250 studies of behavioural treatment of ASD between1980-1995
National Institutes of Health "State of the Science in Autism"	1996	Commissioned reviews of literature: behavioural and social outcomes (McIlvane, 1996); early intervention comprehensive programs (Rogers, 1996)
Dawson & Osterling	1997	Narrative review of 8 early intervention model programs
New York State Department of Health	1999	Systematic review of assessment and treatment, age 0-3 only, group design only
Carr et al.	1999	Narrative review and synthesis of effectiveness of positive behavior support interventions for problem behaviour
National Institutes of Health	1999, 2000	Commissioned review of assessment literature: (Filipek et al., 1999) and different aspects of treatment: Behavioural/ educational intervention (Schreibman, 2000); communication (Koegel, 2000; Lord, 2000); and socialization (Rogers, 2000)
National Research Council (NRC) Office of Special Education	2001	Narrative review for young children (age 0-8 only) in school settings, including review of 10 comprehensive programs
Horner et al.	2002	Narrative review of effectiveness of treatment methods for problem behaviours, age 0-8
Children's Mental Health Ontario	2003	Narrative review of assessment and treatment, age 0-18 (Perry & Condillac, 2003)
Rogers & Vismara	2008, 2010	Narrative review of elements of early intervention comprehensive programs (Rogers & Vismara, 2008; Vismara & Rogers, 2010)
Eldevik et al.	2009, 2010	Meta analyses, EIBI studies only
Centers for Medicare & Medicaid (CMS)	2010	Commissioned systematic review of evidence & cost; children, youth, & adults; group design and SCRD
Odom et al.	2010a	Systematic review of 30 comprehensive programs
Reichow	2012	Summary of meta-analyses of EIBI studies
Agency for Healthcare Research & Quality	2011	Systematic review, minimum n=10 (i.e., group design only). age 0-12
National Institute for Health & Care Excellence (UK)	2013 (and updated every 2 years)	Guidelines produced using standard methods including systematic review; 0-19 medical and psychosocial care practices broadly
National Autism Center (NAC)	2009, 2015	Systematic reviews of comprehensive and focused treatment methods (and some biomedical), group design and SCRD methods
National Professional Development Center (NPDC)	2010, 2014	Systematic reviews of focused treatment methods, group design and SCRD methods (Odom et al., 2010b; Wong et al., 2015)

An examination of the above table leads directly to the observation that the two most recent and most comprehensive review documents were published by the National Autism Center (NAC, 2009; 2015) and the National Professional Development Center (NPDC, 2010; 2014), each of which published initial reviews in 2009 and 2010 and updated editions in 2014 and 2015, respectively. Selected members of the OSETT Task Force reviewed both of these documents in their entirety. Although the two are substantially similar, there were some differences in their process and methodology. Note, for example that NPDC did not include comprehensive behavioural interventions and did not include studies published prior to 1990. These differences and similarities are summarized in Table 5.

As is clear from Table 5, each of these two documents is extremely comprehensive and includes results from over 1,000 research studies from both group design and SCRD research approaches. Although the two teams used slightly different methods of selecting and evaluating studies, they both engaged in an in-depth, rigorous, and well-documented review of the research base for interventions for children with ASD. Importantly, both teams comprised large numbers of professionals from multiple disciplines (e.g., behaviour analysis, special education, psychology, speech-language pathology, occupational therapy). Both made their reports publicly available, and made their rating criteria and methodology explicit. Yet the two documents were published by different organizations using slightly different processes, and this provides some protection against any particular biases or idiosyncrasies. Therefore, we chose to make a synthesis of these two authoritative documents the basis of the Scientific Review section of the present document. Further details are provided below regarding the manner in which we conducted the synthesis to address specific questions related to the provision of evidence-based interventions in Ontario.

Table 5

Comparison of the NAC and NPDC Documents Used to Inform the OSETT-ASD Report

	NAC (2009, 2015)	NPDC (2010, 2014)
Time Frame	Children: 1957 - 2012 Adults: 1987 - 2012	1990 - 2011
Age of Client Population Included	2009: Birth - 21 years Age groupings: 0-2, 3-5, 6-9, 10-14, 15-18,19-21 2015: all ages including 22+	Birth - 22 years Age groupings: 0-5, 6-14, 15-22
Diagnosis of Client Population Included	Autistic disorder, Asperger's syndrome, pervasive developmental disorder-not otherwise specified (reported separately) including those with common co-morbidities (e.g., intellectual disability)	ASD, autism, Asperger's syndrome, pervasive developmental disorder-not otherwise specified, high functioning autism, including co-occurring conditions (e.g., intellectual disability, fragile X, Down syndrome) in 38% of cases
Type of Interventions Included	Focused interventions Comprehensive behavioural treatment	Focused interventions
Type of Research Designs Included	SCRD: excluded if no graphs Group designs: excluded if no statistics Qualitative studies excluded	SCRD: multiple baseline, reversal (e.g., ABAB), multiple probe, alternating treatment, changing criterion Group designs: RCT, quasi-experimental, comparing treatment group to a control or comparison group
Number of Articles Screened	2009: 6463 2015: additional 2,705	2014: 29,105
Number of Articles Included	2009: 724 2015: additional 351 (children) Total = 1,075 +27 (adults)	Total = 1,090
Percent of Articles that Used SCRD vs. Group Design	SCRD: 73% Group designs: 27%	SCRD: 80% Group designs: 20%
Type of Outcome Measures	Direct behaviour observations, tests, scales, checklists	Discrete behaviours assessed by direct observation (e.g., # of social initiations), ratings of skills or behaviour by others (e.g., parents, teachers), standardized tests (e.g., IQ), informal academic tests (e.g., % correct on math test)

Table 5 (Continued)

	NAC (2009, 2015)	NPDC (2010, 2014)
Method of Evaluating Quality of Research Design	**Scientific Merit Rating Scale (SMRS)**(weighted 5-point scale): • Experimental rigour (separate criteria for SCRD and group designs, operationally defined for each of 5 levels) • Measurement of dependent variable/outcome (separate criteria for SCRD and group designs) • Measurement of independent variable (e.g., treatment fidelity) • Participant ascertainment & description (e.g., diagnosis) • Maintenance and/or generalization data **Treatment Effects Rating:** • Beneficial: enough evidence to be confident approach is effective • Unknown: not enough good evidence to conclude either way • Ineffective: enough evidence to be confident approach is not effective • Adverse: enough evidence to say harmful	Protocols derived from: Chambless & Hollon (1998), Gersten et al. (2005), Horner et al. (2005), and the What Works Clearinghouse, Nathan & Gorman (2007) **SCRD Quality Indicators** • 9 items rated dichotomously, must meet all to be considered as evidence **Group Design Quality Indicators** • 10 items rated dichotomously, must meet all to be considered as evidence
Strength of Evidence Classification: Number and Definition of Categories Derived	1. **"Established"** defined as: • High-quality studies (SMRS scores of 3, 4, or 5) • Beneficial intervention effects for specific targets • Number of studies: 2 high-quality group design OR 4 high-quality SCRD studies with at least 12 participants, with no conflicting results OR 3 high-quality group design or 6 SCRD studies with at least 18 participants, with no more than 10% studies reporting conflicting results 2. **"Emerging"** defined as: • SMRS scores of 2 • Beneficial intervention effects for specific targets • Number of studies: 2 SCRD or 2 group design studies with at least 6 participants with no more than 10% studies reporting conflicting results 3. **"Unestablished"** defined as: • Beneficial treatment effects but from studies with very poor methodology (SMRS scores of 0 or 1); OR • Claims based on testimonials, unverified clinical description, opinions, or speculation; OR • Ineffective, unknown, or adverse effects	1. **"Evidence-based"** defined as: • 2 high-quality group designs by independent research groups; OR • 5 high-quality SCRD by 3 independent research groups, involving at least 20 participants total; OR • Combination of designs including at least 1 high-quality group design and 3 high-quality SCRD conducted by more than one research group 2. **"Other Practices with Some Support"** (idiosyncratic combinations; not enough studies, or only one research group) No criteria for any other categories
Number and Description of Reviewers Who Evaluated Articles	N = 53 reviewers with doctoral or master's degrees or graduate students, recommended by panel of 27 experts; all passed training and met IOA standards; rated 5-10 papers	N = 159 faculty, researchers, graduate students in special education or psychology; most had clinical or school experience with ASD; one-third were BCBAs; all passed training and met IOA standards; rated 5-12 papers
Inter-rater Agreement	Not reported after training phase	Specific study evaluation criteria: 91% Summary decisions: 76% (IOA calculated on 41% of articles)

3. SCIENTIFIC EVIDENCE REVIEW AND SYNTHESIS

In the following sections, we present our synthesis of the research evidence contained in the NAC and NPDC reports (hereafter referred to as the two reports). First, we describe our methods for synthesizing the two reports and ensuring reliability of our decisions at each stage. Then, Section III.A outlines what types of interventions for individuals with ASD have been determined to be evidence based by one or both of the two reports. Definitions of each of these evidence-based interventions may be found in Appendix D Section III.B delineates a number of specific domains often targeted for intervention (e.g., play skills, academic skills) and summarizes which interventions have been shown to be evidence based, according to one or both of the two reports, and for which domains. Definitions of the domains may be found in Appendix E. Section III.C summarizes the information by age (i.e., which interventions are evidence based, according to one or both of the two reports, for which age groups of individuals with ASD (i.e., 5 years and under; 6-14 years; 15-22 years; 22+ years). Finally, Section III.D presents a more fine-grained examination of which interventions are evidence based, according to one or both of the two reports, for what domains, for which age groups.

Evidence-based interventions were defined by the NPCD as: (a) 2 high quality group designs by independent research groups; or (b) 5 high quality SCRD studies by three independent research groups, involving at least 20 participants total; or (c) a combination of designs including at least 1 high quality group design and 3 high quality SCRD conducted by more than one research group.

CATEGORIZATION OF EVIDENCE-BASED INTERVENTIONS

Selected members of the Task Force first reviewed the two reports to examine the definitions and categorization of the interventions as evidence based or not. The two reports used somewhat different terminology and definitions. The NPDC report classified interventions into only two categories: evidence based or other practices with some support.

1. Evidence-based interventions were defined as: (a) 2 high quality group designs by independent research groups; or (b) 5 high quality SCRD studies by three independent research groups, involving at least 20 participants total; or (c) a combination of designs including at least 1 high quality group design and 3 high quality SCRD conducted by more than one research group.
2. "Other Practices with Some Support" included idiosyncratic combinations of other approaches, interventions with some, but not enough, studies to meet the definition of evidence based, or situations in which only one research group (typically the interventions' developers) had published research on that intervention.

The NAC report, on the other hand, classified each intervention into one of three categories: established, emerging, or unestablished.

1. Established was defined as: (a) 2 high quality (Scientific Merit Rating Scale [SMRS] scores of 3, 4, or 5) group design; or (b) 4 high quality (SMRS scores of 3, 4, or 5) Single Case Design [SCRD] studies with at least 12 participants, with no conflicting results, and showing beneficial effects; or (c) 3 high quality group design; or (d) 6 SCRD with at least 18 participants with no more than 10% of studies reporting conflicting results.
2. Emerging was defined as: (a) 2 group design studies (studies with SMRS scores of at least 2); or (b) 2 SCRD studies (with SMRS scores of at least 2) with at least 6 participants, and beneficial treatment effects and no more than 10% of studies reporting conflicting results.
3. Unestablished was defined as (a) beneficial treatment effects but from studies with very poor methodology (SMRS scores of 0 or 1); or (b) based solely on testimonials, unverified clinical description, opinions, or speculation; or (c) ineffective, unknown, or adverse effects reported.

Established interventions were defined by the NAC as: (a) 2 high quality (Scientific Merit Rating Scale [SMRS] scores of 3, 4, or 5) group design; or (b) 4 high quality (SMRS scores of 3, 4, or 5) Single Case Design [SCRD] studies with at least 12 participants, with no conflicting results, and showing beneficial effects; or (c) 3 high quality group design; or (d) 6 SCRD with at least 18 participants with no more than 10% of studies reporting conflicting results.

In conducting our synthesis of the two reports, we considered "Established" (NAC) and "Evidence based" (NPDC) to be essentially comparable (though not identical) and we used the general term evidence based for these interventions. Likewise, we considered "emerging" (NAC) and "other practices with some support" (NPDC) to be, essentially, equivalent and used the general term emerging for these interventions. All other interventions were considered to be not evidence based, including those reviewed by NPDC which did not meet criteria for either of their two categories and those determined by NAC to be unestablished.

DEFINITIONS AND CLASSIFICATION OF INTERVENTIONS

The next step in the synthesis process was to determine whether the interventions reviewed in the two documents were named and defined in comparable ways. For the most part, the two documents used identical or very similar titles for interventions. To ensure this was in fact the case, a table of the 11 identical or similar-sounding intervention names was reviewed by four raters. The four raters reviewed the two reports, the intervention definitions, and, when available, the list of studies reviewed for each intervention (i.e., the reference list). Excellent inter-rater agreement was achieved on these decisions (91%). In several cases, slightly different wording was used, which is reflected in the tables below. For example, story-based intervention (NAC) and social narratives (NPDC)

are, essentially, the same type of intervention (i.e., social narratives are interventions that "describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responding" [NPDC, p.89], while story-based interventions are interventions that "involve a written description of the situations under which specific behaviors are expected to occur" [NAC, p. 69]). The only disagreement between raters was between visual schedules (NAC) and visual supports (NPDC). Conceptually, visual schedules (NAC) are actually a subset of visual supports (NPDC). Further, similar studies and methods were included by both reports under these intervention types. Therefore, the consensus decision was to consider them comparable.

In some cases, however, the interventions could not be directly compared or were grouped differently. The most problematic instance of this was that the NAC report grouped together many specific ABA procedures under the title "behavioral interventions," whereas the NPDC broke this broad category of interventions down more finely into specific behaviour analytic procedures, such as prompting, reinforcement, and task analysis. Therefore, a number of cells in the tables below are marked "—". This denotes instances when a particular intervention title was used by one report and not by the other. However, this does not denote a disagreement between reports.

An important limitation in this evidence synthesis is the degree to which comprehensive ABA interventions, as defined above, are included. The NPDC report and Wong et al. (2014) state that comprehensive ABA intervention, specifically EIBI, has been determined to be solidly evidence based for some time, meta-analyses have been published regarding its effectiveness, and so on. Therefore, the NPDC's goal was to evaluate evidence for focused ABA interventions only. The NAC report also focused primarily on focused ABA interventions but it did include comprehensive behavioural treatment for young children (i.e., EIBI). Neither report reviewed evidence on other forms of comprehensive interventions, such as TEACCH or ESDM, among others.

CODING INTERVENTIONS AS EVIDENCE BASED

The next step in the evidence synthesis was for two reviewers to independently code each intervention as evidence based, emerging, not evidence based, or not included for each of the two reports. Following that, the evidence-based interventions were broken down by domain and age. At each level of decision-making, careful consideration was given to inter-rater agreement. All judgments or classifications were conducted by at least two raters. If any disagreements occurred (which was rare), both raters reviewed the item upon which they disagreed together with the classification criteria. Using a consensus approach, 100% inter-rater reliability was achieved for all tables presented throughout this document. These ratings were used as the basis for all the data presented in the next three sections of this report.

1. WHAT INTERVENTIONS ARE EVIDENCE BASED, IN GENERAL, FOR INDIVIDUALS WITH ASD?

In the following series of tables (i.e., Tables 6 to 11), the colour coding indicates that the intervention was considered evidence based (green), emerging (orange), not evidence based (red), or not considered in the document (--). First, in Table 6, we summarized interventions with sufficient evidence to be classified as evidence based.

Comprehensive ABA intervention was considered evidence based in the NAC report (not included in the NPDC report). Comprehensive ABA intervention incorporates the essential practice elements of ABA (as described earlier). However, it is generally defined based on intensity (e.g., 30-40 hours per week) and the process of targeting multiple goals across different domains simultaneously. It should be clarified that the NAC only included studies on what might be considered a subset of all possible comprehensive ABA interventions: EIBI. Other forms of comprehensive interventions were not included in this review. As such, the use of the term comprehensive ABA interventions in this report specifically refers to EIBI, including the UCLA or Lovaas model (e.g., Lovaas, 1987; Sallows & Graupner, 2005) and other broad-based ABA models (e.g., Howard et al., 2005, 2014).

The majority of entries in Tables 6 to 11 refer to focused ABA interventions. The following focused ABA interventions were considered evidence based (i.e., both designated as green, or one green and one not included in Table 6): behavioral interventions, cognitive behavioral intervention, differential reinforcement (Differential Reinforcement of Alternative Behaviour [DRA], Differential Reinforcement of Incompatible Behaviour [DRI], Differential Reinforcement of Other Behaviour [DRO]), discrete trial teaching, extinction, functional behavior assessment, language training, modeling, naturalistic teaching, parent training, peer-mediated intervention, Pivotal Response Treatment® (PRT), visual schedules, scripting, self-management, social skills training, story-based intervention, prompting, reinforcement, response redirection, structured play groups, task analysis, time delay, and video modeling.

Table 6

Interventions Determined to be Evidence Based by the NAC and NPDC Reports

Evidence Based or Established	Emerging or Some Evidence	Level of Evidence	
Not Evidence Based	**Intervention Not Included: --**	**NAC**	**NPDC**
COMPREHENSIVE INTERVENTION			
Comprehensive Behavioral Treatment for Young Children		✓	--
FOCUSED INTERVENTIONS			
Antecedent-based Interventions		--	✓
Behavioral Interventions*		✓	
Cognitive Behavioral Intervention		✓	✓
Differential Reinforcement of Alternative, Incompatible, or Other Behavior		--	✓
Discrete Trial Teaching		--	✓
Extinction		--	✓
Functional Behavior Assessment		--	✓
Language Training (production)		✓	--
Modeling		✓	✓
Natural Teaching Strategies (NAC); Naturalistic Intervention (NPDC)		✓	✓
Parent Training Package (NAC); Parent-implemented Interventions (NPDC)		✓	✓
Peer Training Package (NAC); Peer-mediated Instruction & Intervention (NPDC)		✓	✓
Pivotal Response Treatment® (NAC); Pivotal Response Training (NPDC)		✓	✓
Schedules (NAC); Visual Supports (NPDC)		✓	✓
Scripting		✓	✓
Self Management		✓	✓
Social Skills Package (NAC); Social Skills Training (NPDC)		✓	✓
Story-based Intervention (NAC); Social Narratives (NPDC)		--	✓
Prompting		--	✓
Reinforcement		--	✓
Response Interruption/Redirection		--	✓
Structured Play Groups		--	✓
Task Analysis		--	✓
Time Delay		--	✓
Video Modeling		--	✓

Note. Many specific interventions not listed in the NAC report (--) were grouped into the broader category of behavioral interventions* in the NPDC report.

In addition, four other interventions as shown in Table 7, fell short on the NAC criteria but were noted to be evidence based according to the NPDC. For the purpose of the present report, these interventions were considered evidence based. These are exercise, functional communication training, the Picture Exchange Communication System® (PECS), and technology-based intervention.

Table 7

Interventions Determined to be Evidence Based by One Report and Emerging by One Report

Evidence Based or Established	Emerging or Some Evidence	Level of Evidence	
Not Evidence Based	**Intervention Not Included: --**	**NAC**	**NPDC**
Exercise		✓	✓
Functional Communication Training		✓	✓
Picture Exchange Communication System®		✓	✓
Technology-based Intervention (NAC); Technology-aided Instruction & Intervention (NPDC)		✓	✓

Thus, synthesizing the results of Table 6 and 7, there are 29 focused ABA interventions that are considered evidence based for individuals with ASD (in addition to comprehensive ABA intervention). Please see the detailed definitions of these interventions (see Appendix D), which indicate clearly that the significant majority of these interventions are drawn exclusively from the ABA literature, while others incorporate behaviour analytic strategies and/or draw their support from the behavioural literature (NAC, 2009).

The significant majority of evidence-based interventions are drawn exclusively from the ABA literature, while others incorporate behaviour analytic strategies and/or draw their support from the behavioural literature.

Table 8 includes an additional 34 types of intervention which have been shown to have some evidence, but not yet sufficient quantity or quality of evidence, for them to be considered evidence based. With additional research being published, these spaces, currently indicated as orange, could in the future turn to green, or red. As such, these interventions are not currently recommended for use, unless evidence-based interventions, which have been implemented with good fidelity, at the appropriate intensity, and with ongoing supervision, are demonstrated through direct methods of assessment to be ineffective. In this situation, careful data-based monitoring of effectiveness and possible side effects must occur and caregivers must be informed of the risks and benefits of use. Auditory integration was the sole intervention deemed emerging by one and not evidence based by the other (see Table 9).

Table 8

Interventions Determined to be Evidence Based by the NAC and NPDC Reports

Evidence Based or Established	Emerging or Some Evidence	Level of Evidence	
Not Evidence Based	**Intervention Not Included: --**	**NAC**	**NPDC**
Aided Language Modeling		--	✓
Augmentative & Alternative Communication Devices		✓	
Behavioral Momentum Intervention		--	✓
Collaborative Coaching		--	✓
Cooperative Learning Groups		--	✓
Developmental Relationship-based Treatment		✓	--
Direct Instruction		--	✓
Exposure Package (NAC); Exposure (NPDC)		✓	✓
Handwriting without Tears		--	✓
Imitation-based Intervention		✓	--
Independent Work Systems		--	✓
Initiation Training		✓	
Joint Attention-Symbolic Play Instruction		--	✓
Language Training (production & understanding)		✓	--
Massage Therapy		✓	--
Multi-component Package		✓	--
Music Intensity		--	✓
Music Therapy		✓	✓
Reciprocal Imitation Training		--	✓
Reductive Packages		✓	--
Removal of Restraints		--	✓
Schema-based Strategy Instruction		--	✓
Self-Regulated Strategy Development Writing Intervention		--	✓
Sensory Diet		--	✓
Sensory Integration & Fine Motor Intervention		--	✓
Sentence-combining Technique		--	✓

Table 8 (Continued)

Sign Instruction	✓	--
Social Communication Intervention	✓	--
Structured Teaching	✓	--
Task Taking Strategy Instruction	--	✓
Theory of Mind Training	✓	✓
Toilet Training	--	✓
Touch-point Instruction	--	✓
Touch Therapy	--	✓

Table 9

Interventions Determined to be Emerging or Not Evidence Based

Evidence Based or Established	**Emerging or Some Evidence**	**Level of Evidence**	
Not Evidence Based	**Intervention Not Included: --**	**NAC**	**NPDC**
Auditory Integration Training		✓	✓

Finally, Table 10 provides a list of interventions that are not evidence based, designated in red. This includes a number of interventions for which there is little or no evidence on which to base decisions and/or the quality of the research is very poor. In some cases, there are sufficient studies of good quality to show the intervention to be ineffective or harmful (e.g., facilitated communication).

Table 10

Interventions Determined to be Not Evidence Based by NAC and NPDC Reports

Evidence Based or Established	Emerging or Some Evidence	Level of Evidence	
Not Evidence Based	**Intervention Not Included: --**	**NAC**	**NPDC**
Animal-assisted Therapy		✓	--
Concept Mapping		✓	--
DIR/Floor Time		✓	--
Facilitated Communication		✓	--
Gluten-free/Casin-free Diet		✓	--
Movement-based Intervention		✓	--
SENSE Theatre Intervention		✓	--
Sensory Intervention Package		✓	--
Shock Therapy		✓	--
Social Behavioral Learning Strategy		✓	--
Social Cognition Intervention		✓	--
Social Thinking Intervention		✓	--

In summary, there are many forms of intervention that have been clearly documented as being evidence based for individuals with ASD, most of which are behaviour analytic or contain behaviour analytic components. It is important to remember that these determinations are based on the existing studies at the time of the review and are aggregated across age groups and intervention targets. It may be the case that certain interventions noted here as being evidence based have only been studied in certain age groups. Further, it is likely the case that certain interventions have been used to address specific targeted skill deficits or behavioural excesses and not others. In the next sections, data on evidence-based interventions are further broken down by intervention target domain and age group, and then domain and age together, synthesized across the two documents.

There are many forms of intervention that have been clearly documented as being evidence based for individuals with ASD, most of which are behaviour analytic or contain behaviour analytic components.

2. WHICH EVIDENCE-BASED INTERVENTIONS HAVE EVIDENCE FOR DIFFERENT TARGET DOMAINS IN ASD?

Individuals with ASD may have a wide range of skill deficits and behavioural excesses. As such, it is appropriate that many interventions, especially focused ABA interventions, do not target ASD as a whole, or global types of outcomes such as IQ. Rather, many interventions are designed to target individually assessed specific skill deficits (e.g., social skills) or behavioural difficulties (e.g., tantrums). Interventions should generally aim to improve overall adaptive functioning of individuals with ASD by increasing specific skills needed for success, as well as decreasing behaviours that may interfere with overall functioning in particular environments. Practitioners and clients seeking information to facilitate appropriate intervention selections may benefit from having the research evidence categorized by domain to help determine which interventions are evidence based for specific goals, such as improving communication, teaching peer play skills, or decreasing self-injury. To this end, members of the Task Force examined which target domains are addressed by which evidence-based interventions.

The two reports address very similar target domains, as shown in Table 11, although there are a few domains addressed by only one of the two. Detailed definitions of these target domains, based on an amalgamation of definitions from the two reports may be found in Appendix E. Thus, we report on the evidence base for interventions designed to address 12 areas within the

Interventions should generally aim to improve overall adaptive functioning of individuals with ASD by increasing specific skills needed for success, as well as decreasing behaviours that may interfere with overall functioning in particular environments.

Table 11

Target Domains Addressed in the NAC and NPDC Reports

Domain	Report
Skills Increased	
Social/Interpersonal	NAC, NPDC
Academic	NAC, NPDC
Communication	NAC, NPDC
Cognitive/Higher Cognitive Functions	NAC, NPDC
Learning/School Readiness	NAC, NPDC
Motor	NAC, NPDC
Personal Responsibility/Adaptive	NAC, NPDC
Play	NAC, NPDC
Self-Regulation	NAC
Joint Attention	NPDC
Vocational	NPDC
Placement	NAC
Behaviours Decreased	
Challenging Behaviour	NAC, NPDC
Restricted, Repetitive, Non-functional Behavior/ Interests	NAC
Sensory/Emotion Regulation	NAC

Note. Refer to Appendix E for definitions of each domain.

Increasing Skills category and 3 domains within the Behaviours Decreased category. Note, however, that a particular study may often have included outcome targets in more than one domain (e.g., the intervention method known as functional communication training includes decreasing challenging behaviour and increasing communication skills).

Once the domains addressed by various evidence-based interventions were identified, the next step was to tabulate and synthesize across the two reports, to see which types of interventions are evidence based for which target domains. We embarked on a similar process as described above to ensure inter-rater agreement on our classifications and achieved 100% agreement. Results are shown in Table 12, including both skills increased and behaviours decreased. Evidence-based interventions are listed in the rows. The check mark indicates the intervention was reviewed and deemed evidence based for that report or a check mark on an orange cell means it was reviewed and deemed to be emerging. The notation "—" means that the particular intervention was not included in that report. A green box indicates that one or both reports classified that intervention as evidence based for that target domain. A blank box indicates that no information was available from either report since, presumably, relevant studies had not been conducted.

Table 12 indicates that there are many different evidence-based interventions (20 or more different interventions) that have been shown to increase skills for certain domains: social/interpersonal, academic, communication, learning/school readiness, personal responsibility/adaptive, and play skills. In addition, there were over 20 evidence-based interventions for reducing challenging behaviour. Therefore, for all of these domains, there are many intervention options that are evidence based according to either or both of the two reports. There are also a good number (over 10 but less than 20 types) of evidence-based interventions to improve cognitive/higher cognitive functions, motor skills, and joint attention. There are 8 forms of evidence-based intervention that have been shown to increase vocational skills. Only 2 forms of evidence-based intervention have been shown to affect the "placement" domain (this is not surprising as placement is impacted by many variables and its validity as an outcome measure is unknown, but we included it since it was included in the NAC report). Only 4 forms of evidence-based intervention were found to improve self-regulation skills, but there were also 4 evidence-based interventions for reducing sensory/emotional regulation problems. Finally, there were 5 evidence-based interventions noted for decreasing repetitive behaviours.

Table 12

Evidence-based Interventions by Target Domain

Intervention	Report		DOMAIN														
			Skills Increased													Behaviours Decreased		
	NAC	NPDC	Social / Interpersonal	Academic	Communication	Cognitive/ Higher Cognitive Functions	Learning/ School Readiness	Motor	Personal Responsibility/ Adaptive	Placement	Play	Self-Regulation	Joint Attention	Vocational	Challenging Behaviour	Restricted / Repetitive	Emotional Regulation
Comprehensive Intervention																	
Comprehensive Behavioral Treatment for Young Children	✓	--	■	■	■	■	■	■	■		■				■		
Focused Interventions																	
Antecedent-based Interventions	--	✓	■	■	■		■	■	■		■				■		
Behavioral Interventions	✓	--	■	■	■	■	■	■	■		■	■			■	■	■
Cognitive Behavioral Intervention Package (NAC); Cognitive Behavioral Intervention (NPDC)	✓	✓	■		■	■			■	■					■		■
Differential Reinforcement of Alternative, Incompatible, or Other Behavior	--	✓	■	■	■		■	■	■		■		■		■		
Discrete Trial Teaching	--	✓	■	■	■		■		■				■	■	■		
Exercise	✓	✓		■			■	■							■		
Extinction	--	✓			■		■		■						■		
Functional Behavior Assessment	--	✓		■	■		■		■						■		
Functional Communication Training	✓	✓	■		■		■		■		■				■		
Language Training (production)	✓	--	■		■						■						
Modeling	✓	✓	■	■	■	■	■		■		■		■	■	■		■
Natural Teaching Strategies (NAC); Naturalistic Intervention (NPDC)	✓	✓	■	■	■		■				■		■		■		
Parent Training Package (NAC); Parent-implemented Interventions (NPDC)	✓	✓	■	■	■	■	■		■		■		■		■	■	

Table 12 (Continued)

Intervention	Report		DOMAIN														
			Skills Increased												Behaviours Decreased		
	NAC	NPDC	Social / Interpersonal	Academic	Communication	Cognitive/ Higher Cognitive Functions	Learning/ School Readiness	Motor	Personal Responsibility/ Adaptive	Placement	Play	Self-Regulation	Joint Attention	Vocational	Challenging Behaviour	Restricted / Repetitive	Emotional Regulation
Peer Training Package (NAC); Peer-mediated Instruction & Intervention (NPDC)	✓	✓	■	■	■		■				■		■			■	
Picture Exchange Communication System®	✓	✓	■		■								■				
Pivotal Response Treatment® (NAC); Pivotal Response Training (NPDC)	✓	✓	■		■		■				■		■				
Prompting	--	✓	■	■	■		■	■	■		■		■	■	■		
Reinforcement	--	✓	■	■	■	■	■	■	■		■		■	■	■		
Response Interruption/Redirection	--	✓	■		■		■		■		■				■		
Schedules (NAC); Visual Supports (NPDC)	✓	✓	■	■	■	■	■	■	■		■	■			■		
Scripting	✓	✓	■		■	■	■				■		■	■			
Self Management	✓	✓	■	■	■		■				■	■		■	■	■	
Social Skills Package (NAC); Social Skills Training (NPDC)	✓	✓	■		■	■	■			■	■				■	■	■
Story-based Intervention (NAC); Social Narratives (NPDC)	✓	✓	■	■	■		■		■		■	■	■		■		
Structured Play Groups	--	✓	■	■	■		■				■				■		
Task Analysis	--	✓	■	■	■			■	■				■				
Technology-based Intervention (NAC); Technology-aided Instruction & Intervention (NPDC)	✓	✓	■	■	■	■	■	■	■				■	■	■		
Time Delay	--	✓	■	■	■	■	■	■	■		■		■		■		
Video Modeling	--	✓	■	■	■	■	■	■	■		■		■	■	■		
TOTAL	14	27	27	23	29	12	26	12	20	2	22	4	16	8	24	5	4

Note. Exercise, functional communication training, Picture Exchange Communication System®, and technology-based Intervention (NAC); technology-aided instruction & intervention (NPDC) were determined to be "emerging" interventions by the NAC and are denoted by an orange cell.

3. WHAT EVIDENCE-BASED INTERVENTIONS HAVE EVIDENCE FOR DIFFERENT AGE GROUPS IN ASD?

It is important to consider which types of intervention have been shown to be evidence based for which age groups. Clients, practitioners, and policy makers seeking to deliver services to a particular age group might benefit from having the information provided in this manner. Thus, we tabulated and synthesized across the two reports which types of interventions are evidence based for which age groups (5 and under; 6-14; 15-22; 22+). We embarked on a similar process as described above to ensure inter-rater agreement on our classifications and, again, we obtained 100% agreement.

Results are shown in Table 13. The first column, as before, lists the interventions. The second columns indicate whether interventions were reviewed in one or both reports. A checkmark indicates that evidence for that Intervention was reviewed within the report and met criteria for being evidence based. An indication of "—" means that evidence for the intervention was not evaluated by that report. The next columns indicate, for each of four age groups, whether there is evidence for that approach for that age group, as indicated by green boxes.

Table 13

Evidence-based Interventions by Age Group

Intervention	Report		0-5	6-14	15-22	22 + (NAC only)
	NAC	NPDC				
Comprehensive Intervention						
Comprehensive Behavioral Treatment for Young Children	✓	--				
Focused Interventions						
Antecedent-based Interventions	--	✓				
Behavioral Interventions	✓	--				
Cognitive Behavioral Intervention Package (NAC); Cognitive Behavioral Intervention (NPDC)	✓	✓				
Differential Reinforcement of Alternative, Incompatible, or Other Behavior	--	✓				
Discrete Trial Teaching	--	✓				
Exercise	✓	✓				
Extinction	--	✓				
Functional Behavior Assessment	--	✓				
Functional Communication Training	✓	✓				
Language Training (Production)	✓	--				
Modeling	✓	✓				
Natural Teaching Strategies (NAC); Naturalistic Intervention (NPDC)	✓	✓				

Table 13 (Continued)

Intervention	Report		0-5	6-14	15-22	22 + (NAC only)
	NAC	NPDC				
Parent Training Package (NAC); Parent-implemented Interventions (NPDC)	✓	✓				
Peer Training Package (NAC); Peer-mediated Instruction & Intervention (NPDC)	✓	✓				
Picture Exchange Communication System®	✓	✓				
Pivotal Response Treatment® (NAC); Pivotal Response Training (NPDC)	✓	✓				
Prompting	--	✓				
Reinforcement	--	✓				
Response Interruption/Redirection	--	✓				
Schedules (NAC); Visual Supports (NPDC)	✓	✓				
Scripting	✓	✓				
Self Management	✓	✓				
Social Skills Package (NAC); Social Skills Training (NPDC)	✓	✓				
Story-based Intervention (NAC); Social Narratives (NPDC)	✓	✓				
Structured Play Groups	--	✓				
Task Analysis	--	✓				
Technology-based Intervention (NAC); Technology-aided Instruction & Intervention (NPDC)	✓	✓				
Time Delay	--	✓				
Video Modeling	--	✓				
TOTAL	**14**	**27**	**28**	**30**	**21**	**5**

Note. Exercise, functional communication training, Picture Exchange Communication System®, and technology-based Intervention (NAC); technology-aided instruction & intervention (NPDC) were determined to be "emerging" interventions by the NAC and are denoted by an orange cell.

As the results displayed in Table 13 indicate all 30 forms of evidence-based intervention have been researched and determined to have evidence for children in the 6 to 14 age group. Also, the majority of the evidence-based interventions have evidence for younger children as well (5 and under). One implication of these encouraging findings is that, for focused ABA interventions at least, the child's age is not likely to be a major determining factor in which interventions will be effective across the two age groups (i.e., 5 and under, 6 to 14 years). There are more gaps in the research for adolescents and very little research for individuals aged 22 and older, though additional research with adolescents and adults has been published since the NAC and NPDC teams completed their reviews. Only the NAC

report included individuals 22 and older and there were very few studies in this age group. Only the broad category of behavioral interventions was fully evidence based and 4 additional interventions were considered emerging for this older age group. This does not mean that other interventions have been found ineffective or that they would not work for older individuals, but simply that they have not been studied.

4. WHAT EVIDENCE-BASED INTERVENTIONS HAVE EVIDENCE FOR DIFFERENT TARGET DOMAINS IN DIFFERENT AGE GROUPS IN ASD?

Finally, our last synthesis was of the evidence-based intervention methods by both age and domain together. There may be many situations and audiences for whom the research evidence would be most helpfully summarized in this way. Select members of the Task Force synthesized this information in two different ways. First, we constructed a table, akin to the previous tables and modeled after a summary table in the NPDC report, but synthesized across the two reports. We followed a similar procedure to that described in earlier sections with two raters achieving consensus on all decisions. Results are shown in Table 14. The table structure is similar to the previous tables except that within each domain column (e.g., social/interpersonal, academic, etc.) there are separate columns for each of the age ranges. The green boxes below each age range indicate that the intervention was determined to be evidence based for that domain, for that age group, in either or both reports. Boxes that are blank indicate that the studies reviewed by the reports did not provide evidence for that intervention to be evidence based for the particular outcome measure for the associated age range. Only the NAC report included individuals 22 and older and these results are summarized separately in Table 15. Further, evidence-based interventions for those 22 and older are described, by domain, in the series of Fact Sheets below.

Table 14 indicates, in a more fine-grained way, which of the interventions deemed evidence based actually have evidence for different domains and in different age groups. As noted above, blank spaces in these tables indicate a lack of research evidence rather than evidence of interventions being ineffective. Thus, it should be stated that more extensive research is needed to fill these gaps, especially with older individuals with ASD.

Table 14

Evidence for Evidence-based Interventions According to Domain and Age

	Report		DOMAIN																																												
			Skills Increased																																		Behaviours Decreased								
			Social/ Interpersonal			Academic			Communication			Cognitive/ Higher Cognitive Functions			Learning/School Readiness			Motor			Personal Responsibility/ Adaptive			Placement			Play			Self-Regulation			Joint Attention			Vocational			Challenging Behaviour			Restricted/ Repetitive/ Non-functional Interests			Sensory/ Emotional Regulation		
Intervention	NAC	NPDC	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22
Comprehensive Interventions																																															
Comprehensive Behavioral Treatment for Young Children	✓	--																																													
Focused Interventions																																															
Antecedent-based Interventions	--	✓																																													
Behavioral Interventions	✓	--																																													
Cognitive Behavioral Intervention Package (NAC); Cognitive Behavioral Intervention (NPDC)	✓	✓																																													
Differential Reinforcement of Alternative, Incompatible, or Other Behaviors	--	✓																																													
Discrete Trial Teaching	--	✓																																													

Note. No evidence for a particular age group is denoted by a white cell.

Table 14 (Continued)

	Report		DOMAIN — Skills Increased																																				Behaviours Decreased								
			Social/ Interpersonal			Academic			Communication			Cognitive/ Higher Cognitive Functions			Learning/School Readiness			Motor			Personal Responsibility/ Adaptive			Placement			Play			Self-Regulation			Joint Attention			Vocational			Challenging Behaviour			Restricted/ Repetitive/ Non-functional Interests			Sensory/ Emotional Regulation		
Intervention	NAC	NPDC	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22
Exercise	✓	✓				■	■								■	■		■	■																				■	■							
Extinction	--	✓							■	■	■				■	■	■				■	■	■																■	■	■						
Functional Behavior Assessment	--	✓				■	■	■	■	■	■				■	■	■				■	■	■																■	■	■						
Functional Communication Training	✓	✓	■	■	■				■	■	■				■	■	■				■	■	■				■	■	■										■	■	■						
Language Training (Production)	✓	--	■	■					■	■																	■	■																			
Modeling	✓	✓	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■				■	■	■				■	■	■	■	■	■	■	■	■				■	■	■
Natural Teaching Strategies (NAC); Naturalistic Intervention (NPDC)	✓	✓	■	■		■	■		■	■					■	■											■	■					■	■					■	■							
Parent Training Package (NAC); Parent-implemented Intervention (NPDC)	✓	✓	■	■	■	■	■		■	■		■	■		■	■					■	■					■	■	■				■	■					■	■	■	■	■	■			

Note. No evidence for a particular age group is denoted by a white cell.

Table 14 (Continued)

	Report		DOMAIN																																														
			Skills Increased																																				Behaviours Decreased								
			Social/ Interpersonal			Academic			Communication			Cognitive/ Higher Cognitive Functions			Learning/School Readiness			Motor			Personal Responsibility/ Adaptive			Placement			Play			Self-Regulation			Joint Attention			Vocational			Challenging Behaviour			Restricted/ Repetitive/ Non-functional Interests			Sensory/ Emotional Regulation		
Intervention	NAC	NPDC	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22
Peer Training Package (NAC); Peer-mediated Instruction & Intervention (NPDC)	✓	✓	■	■	■	■	■	■	■	■	■				■	■	■										■	■	■				■	■	■							■	■				
Picture Exchange Communication System® (PECS)	✓	✓	■	■					■	■					■	■																	■	■													
Pivotal Response Treatment® (NAC); Pivotal Response Training (NPDC)	✓	✓	■	■					■	■					■	■											■	■					■	■													
Prompting	--	✓	■	■	■	■	■	■	■	■	■				■	■	■	■	■	■	■	■	■				■	■	■				■	■	■	■	■	■	■	■	■						
Reinforcement	--	✓	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■				■	■	■	■	■	■	■	■	■						
Response Interruption/ Redirection	--	✓	■	■	■				■	■	■				■	■	■				■	■	■				■	■	■										■	■	■						
Schedules (NAC);Visual Supports (NPDC)	✓	✓	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■	■	■								■	■	■						
Scripting	✓	✓	■	■	■				■	■	■	■	■	■	■	■	■										■	■	■				■	■	■	■	■	■									

Note. No evidence for a particular age group is denoted by a white cell.

Table 14 (Continued)

Intervention	Report		DOMAIN																																									
			Skills Increased																																		Behaviours Decreased								
			Social/ Interpersonal			Academic			Communication			Cognitive/ Higher Cognitive Functions			Learning/School Readiness			Motor			Personal Responsibility/ Adaptive			Placement			Play			Self-Regulation			Joint Attention			Vocational			Challenging Behaviour			Restricted/ Repetitive/ Non-functional Interests			Sensory/ Emotional Regulation		
	NAC	NPDC	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22	0 - 5	6 - 14	15 - 22
Self-Management	✓	✓	■	■	■	■	■	■	■	■	■				■	■	■										■	■	■			■				■	■	■	■	■	■			■			
Social Skills Package (NAC); Social Skills Training (NPDC)	✓	✓	■	■	■				■	■	■	■	■	■		■	■								■	■	■	■	■										■	■	■		■	■		■	■
Story-based Intervention (NAC); Social Narratives (NPDC)	✓	✓	■	■	■	■	■	■	■	■	■				■	■	■				■	■	■				■	■	■	■	■		■	■	■				■	■	■						
Structured Play Groups	--	✓		■			■			■						■												■												■							
Task Analysis	--	✓	■	■		■	■		■	■								■	■		■	■											■	■													
Technology-based Intervention (NAC); Technology-aided Instruction & Intervention (NPDC)	✓	✓	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										■	■	■	■	■	■	■	■	■						
Time Delay	--	✓	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■				■	■	■				■	■	■						
Video Modeling	--	✓	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■				■	■	■	■	■	■	■	■	■						

Note. No evidence for a particular age group is denoted by a white cell.

Table 14 (Continued)

Intervention	Report		DOMAIN														
			Skills Increased												Behaviours Decreased		
	NAC	NPDC	Social/Interpersonal	Academic	Communication	Cognitive/Higher Cognitive Functions	Learning/School Readiness	Motor	Personal Responsibility/ Adaptive	Placement	Play	Self-Regulation	Joint Attention	Vocational	Challenging Behaviour	Restricted/ Repetitive/ Non-functional Interests	Sensory/Emotional Regulation
	22+ y		22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y	22+ y
Behavioral Interventions	✓	--															

Note. No evidence for a particular age group is denoted by a white cell. A dash mark (—) denotes that studies reviewed for interventions by the NPDC report did not look at outcomes for participants over the age of 22 years.

We also developed an alternate, more descriptive method of synthesizing the three-way evidence-based research information (i.e., what interventions have evidence for what domains in which age groups?). This was to develop a series of factsheet-like summaries, organized according to target domain, each with a brief description of the domain and why it is important for ASD intervention, and the list of evidence-based interventions by age group. These are presented in the following pages for 12 domains of skills increased and 3 domains of behaviours decreased.

1. Social/Interpersonal Domain

Individuals with ASD have significant impairments in social/interpersonal skills, such as failure to initiate conversations or share emotions with others, deficits in the use and understanding of nonverbal communicative behaviours, and failure to establish and maintain friendships. These skill deficits may become even more pronounced as children get older.

Age Group: 5 years or under

25 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Functional Communication Training
- Language Training (Production)
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

27 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Functional Communication Training
- Language Training (Production)
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction & Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Structured Play Groups
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

19 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Functional Communication Training
- Modeling
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction & Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not *yet* meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

2. Academic Domain

Academic skills are those skills typically taught and used in academic settings, such as reading and writing. These skills vary based on the age- and grade-level of the individual.

Age Group: 5 years or under

20 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Exercise
- Functional Behavior Assessment
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Prompting
- Reinforcement
- Schedules/Visual Supports
- Self-management
- Story-based Interventions/Social Narratives
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

21 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Exercise
- Functional Behavior Assessment
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Prompting
- Reinforcement
- Schedules/Visual Supports
- Self-management
- Story-based Interventions/Social Narratives
- Structured Play Groups
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

14 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Functional Behavior Assessment
- Modeling
- Peer Training Package/Peer-mediated Instruction and Intervention
- Prompting
- Reinforcement
- Schedules/Visual Supports
- Self-management
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

3. Communication Domain

Communication deficits or disorders are commonly associated with ASD, including difficulties using and understanding verbal and nonverbal communication. Examples of communication difficulties include a total lack of speech, abnormalities in pitch, rhythm and intonation, stereotypical and repetitive language use, idiosyncratic word use, among others.

Age Group: 5 years or under

27 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Language Training (Production)
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

29 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Language Training (Production)
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Structured Play Groups
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

20 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Peer Training Package/Peer-mediated Instruction & Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

1 Evidence-based Intervention

- Behavioral Interventions

4. Cognitive/Higher Cognitive Functions Domain

Cognitive abilities include problem-solving, reasoning, information processing, executive functioning, and intelligence, among others. Cognitive abilities are important for children's overall learning and affect individual functioning in adulthood. There is substantial variation in the cognitive abilities of individuals with ASD.

Age Group: 5 years or under

11 Evidence-based Interventions

- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Modeling
- Parent Training Package/Parent-implemented Intervention
- Reinforcement
- Schedules/Visual Supports
- Scripting
- Social Skills Package/Social Skills Training
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

12 Evidence-based Interventions

- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Comprehensive Behavioral Treatment for Young Children
- Modeling
- Parent Training Package/Parent-implemented Intervention
- Reinforcement
- Schedules/Visual Supports
- Scripting
- Social Skills Package/Social Skills Training
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

10 Evidence-based Interventions

- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Modeling
- Reinforcement
- Schedules/Visual Supports
- Scripting
- Social Skills Package/Social Skills Training
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

5. Learning/School Readiness Domain

Learning/school readiness includes skills where task performance is not necessarily related to the content of that task and these skills are prerequisites for success with other more complex tasks.

Age Group: 5 years or under

25 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Exercise
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

27 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Exercise
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Structured Play Groups
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

19 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Peer Training Package/Peer-mediated Instruction & Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD within this domain.

6. Motor Domain

Motor skills include gross motor movements (i.e., large movements of legs, arms, feet, or the entire body) and fine motor movements (i.e., fine movements of the hands, fingers and wrists).

Age Group: 5 years or under

12 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Exercise
- Prompting
- Reinforcement
- Schedules/Visual Supports
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

12 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Exercise
- Prompting
- Reinforcement
- Schedules/Visual Supports
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

9 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Prompting
- Reinforcement
- Schedules/Visual Supports
- Technology-based Intervention/Technology-aided Instruction & Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

7. Personal Responsibility/Adaptive Domain

Adaptive and personal responsibility skills are practical skills required to function optimally in daily environments and routines, such as maintaining personal hygiene, using kitchen appliances, and community safety skills. These skills are required to achieve optimal independence. The types of adaptive skills targeted for improvement vary according to age.

Age Group: 5 years or under

19 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Parent Training Package/Parent-implemented Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Story-based Interventions/Social Narratives
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

20 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Parent Training Package/Parent-implemented Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Story-based Interventions/Social Narratives
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

16 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

1 Evidence-based Intervention

- Behavioral Interventions

8. Placement Domain

A person's placement, whether in an educational or residential facility, sets the stage for the individual's learning and living arrangements. Placement is often determined by many other variables or factors, such as geographical location, parent preferences, and school support availability, which may vary by school board and individual school resources. Therefore, it's validity as an outcome measure is uncertain.

Age Group: 5 years or under

19 Evidence-based Interventions

No interventions with sufficient quality or quantity of support to warrant rating as evidence-based intervention.

Age Group: 6-14 years

2 Evidence-based Interventions

- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Social Skills Package/Social Skills Training

Age Group: 15-22 years

1 Evidence-based Intervention

- Social Skills Package/Social Skills Training

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

9. Play Domain

Many individuals with ASD lack effective play and leisure skills, including deficits in appropriate engagement with play items/activities, engagement in cooperative or imaginative play, and interest in, and friendships, with peers.

Age Group: 5 years or under

21 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Functional Communication Training
- Language Training (Production)
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Time Delay
- Video Modeling

Age Group: 6-14 years

22 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Functional Communication Training
- Language Training (Production)
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Structured Play Groups
- Time Delay
- Video Modeling

Age Group: 15-22 years

17 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Functional Communication Training
- Modeling
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Scripting
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Time Delay
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

10. Self-Regulation Domain

Self-regulation includes the ability to manage one's behaviour, such as sustaining and shifting attention, completing tasks, self-management and self-montioring.

Age Group: 5 years or under **4 Evidence-based Interventions**	
• Antecedent-based Interventions • Behavioral Interventions	• Schedules/Visual Supports • Story-based Interventions/Social Narratives

Age Group: 6-14 years **4 Evidence-based Interventions**	
• Antecedent-based Interventions • Behavioral Interventions	• Schedules/Visual Supports • Story-based Interventions/Social Narratives

Age Group: 15-22 years **3 Evidence-based Interventions**	
• Antecedent-based Interventions • Behavioral Interventions	• Self-management

Age Group: Over 22 years **1 Evidence-based Intervention**
• Behavioral Interventions

11. Joint Attention Domain

Joint attention, an early social-communicative behaviour in which gestures and eye gaze are used to share interest in an object or event, are often significantly impaired in young children with ASD. These behaviours are required for individuals to share interests or experiences with each other, and are fundamental for developing more advanced language and social-communication skills.

Age Group: 5 years or under

16 Evidence-based Interventions

- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Scripting
- Story-based Interventions/Social Narratives
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

16 Evidence-based Interventions

- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Picture Exchange Communication System®
- Pivotal Response Treatment®/Pivotal Response Training
- Prompting
- Reinforcement
- Scripting
- Story-based Interventions/Social Narratives
- Task Analysis
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

10 Evidence-based Interventions

- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Modeling
- Peer Training Package/Peer-mediated Instruction and Intervention
- Prompting
- Reinforcement
- Scripting
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

12. Vocational Domain

Vocational skills include practical skills and knowledge required for success in a trade, vocation or profession. Vocational skills become a larger priority as children progress through their adolescent and early adult years.

Age Group: 5 years or under

8 Evidence-based Interventions

- Discrete Trial Teaching
- Modeling
- Prompting
- Reinforcement
- Scripting
- Self-management
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Video Modeling

Age Group: 6-14 years

8 Evidence-based Interventions

- Discrete Trial Teaching
- Modeling
- Prompting
- Reinforcement
- Scripting
- Self-management
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Video Modeling

Age Group: 15-22 years

7 Evidence-based Interventions

- Modeling
- Prompting
- Reinforcement
- Scripting
- Self-management
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Video Modeling

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

13. Challenging Behaviour Domain

Challenging behaviours commonly occur in the ASD population. These behaviours, including aggression, disruptive behaviour, self-injurious behaviour, and others, may interfere with skill development and prevent participation in social and community events.

Age Group: 5 years or under

22 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Exercise
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 6-14 years

24 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Comprehensive Behavioral Treatment for Young Children
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Discrete Trial Teaching
- Exercise
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Naturalistic Teaching Strategy/Naturalistic Intervention
- Parent Training Package/Parent-implemented Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Structured Play Groups
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: 15-22 years

19 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Differential Reinforcement of Alternative, Incompatible, or Other Behaviors
- Extinction
- Functional Behavior Assessment
- Functional Communication Training
- Modeling
- Parent Training Package/Parent-implemented Intervention
- Prompting
- Reinforcement
- Response Interruption/Redirection
- Schedules/Visual Supports
- Self-management
- Social Skills Package/Social Skills Training
- Story-based Interventions/Social Narratives
- Technology-based Intervention/Technology-aided Instruction and Intervention
- Time Delay
- Video Modeling

Age Group: Over 22 years

1 Evidence-based Intervention

- Behavioral Interventions

14. Restricted/Repetitive/Non-functional Interests Domain

Restricted and/or repetitive interests are a core symptom of ASD. These may include stereotyped or repetitive speech, motor movements, or object use, excessive adherence to routines, or ritualized use of verbal or nonverbal behaviour, among others.

Age Group: 5 years or under

4 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention

Age Group: 6-14 years

5 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Parent Training Package/Parent-implemented Intervention
- Peer Training Package/Peer-mediated Instruction and Intervention
- Social Skills Package/Social Skills Training

Age Group: 15-22 years

5 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Parent Training Package/Parent-implemented Intervention
- Self-management
- Social Skills Package/Social Skills Training

Age Group: Over 22 years

0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

15. Sensory/Emotional Regulation

Some individuals with ASD experience hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment. Examples of this include high pain tolerance, aversion to specific textures or sensory experiences, and persistent focus on sensory input. In providing support to individuals with ASD, one area of focus is on decreasing challenging behaviours, such as sensory/emotional regulation challenges, that may interfere with overall functioning.

Age Group: 5 years or under
3 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Modeling

Age Group: 6-14 years
5 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Cognitive Behavioral Intervention Package/Cognitive Behavioral Intervention
- Modeling
- Social Skills Package/Social Skills Training

Age Group: 15-22 years
4 Evidence-based Interventions

- Antecedent-based Interventions
- Behavioral Interventions
- Modeling
- Social Skills Package/Social Skills Training

Age Group: Over 22 years
0 Evidence-based Interventions

Within the range of dates sampled, many of the high-quality studies conducted with this population were not included. In addition, far fewer studies evaluating the effectiveness of ABA interventions for adults with ASD have been published; therefore, many ABA interventions do not yet meet the evidence-based intervention criteria for this population. These findings should not be interpreted to mean that ABA interventions are not effective for adults with ASD.

RESEARCH SYNTHESIS SUMMARY POINTS

1. There is a very large body of research pertaining to evidence-based interventions for children and youth with ASD. Over 1,000 studies were reviewed for each of the two major reports on which this evidence synthesis is based (the NAC and NPDC reports), although older studies (prior to 1990) were not included in the NPDC report and there have been some additional studies since these reports were published. Approximately three-quarters of these studies used single case research design (SCRD) methodology.
2. The significant majority of the intervention methods deemed to be evidence based by these two authoritative reports are behaviour analytic in nature. Many others involve some behaviour analytic procedures.
3. Comprehensive ABA intervention, or comprehensive behavioral treatment for young children (i.e., EIBI), is the only comprehensive approach included in this review. This model of intervention was only reviewed by one of the teams (NAC). There is no question that EIBI is evidence based, but the emphasis in this evidence synthesis is on the wide range of other ABA approaches known as focused ABA interventions. Comprehensive ABA interventions other than EIBI, (i.e., interventions that are intensive in terms of time per week and target skills across a wide range of domains) were beyond the scope of the present report, as they were not included in either of the two documents we synthesized.
4. Many evidence-based focused interventions involve one specific ABA procedure, such as reinforcement, prompting, or task analysis. Others involve a combination of behaviour analytic procedures. For example, the category of antecedent-based interventions, as described in the NPDC report, might include strategies such as varying the format, level of difficulty, or order of tasks, enriching the environment, incorporating student choice, or modifying prompt delivery. The category of behavioural interventions, as used by the NAC report, includes interventions in which antecedent strategies, such as prompting, are combined with consequent strategies, such as response blocking and differential reinforcement of alternative behaviour. A number of these procedures individually meet criteria to be considered evidence based (i.e., prompting, differential reinforcement).

Behaviour analytic interventions have been identified as evidence based to increase skills or reduce challenging behaviour across 12 different domain areas (e.g., academic skills, cognitive functions, play, challenging behaviour, etc.).

5. Other focused ABA interventions, such as PECS® and PRT®, which are examples of 'branded' evidence-based interventions also incorporate subsets of evidence-based focused ABA procedures. For example, PECS® includes prompting, task analysis, reinforcement, and time delay, which are themselves identified as evidence based.
6. The significant majority of evidence-based interventions have been shown to improve functioning across a wide range of important domains, including social, academic, communication, adaptive skills, and so on, as well as to reduce the occurrence of challenging behaviour. For example, behaviour analytic interventions have been identified as evidence based to increase skills or reduce challenging behaviour across 12 different domain areas (e.g., academic skills, cognitive functions, play, challenging behaviour, etc.).
7. Approximately 30 different ABA interventions, including combinations of behaviour analytic procedures, have been shown to be evidence based for children in the 0 to 5 and 6 to 14 age range. In addition, 21 ABA interventions, including combinations of behaviour analytic procedures, have been demonstrated to be evidence based for adolescents. A variety of behaviour analytic procedures (classified as behavioural interventions) have been demonstrated to be evidence based for adults 22 years and older across the domains of communication, personal responsibility/adaptive, self-regulation, and in the treatment of challenging behaviour. Unfortunately, there have been far fewer published research articles evaluating the effects of ABA interventions on older adolescents and adults with ASD at the time the NAC and NPDC reviews were completed. These findings should not be interpreted to mean that ABA interventions are not effective for older adolescents and adults with ASD within these other domains; rather more research is required. Importantly, 20 ABA interventions have been demonstrated to be evidence-based across three age ranges (i.e., 0-5, 6-14, and 15-22). This suggests that for focused ABA interventions in particular, age is not likely to be a major determining factor in which interventions will be effective.

20 ABA interventions have been demonstrated to be evidence-based across three age ranges suggesting that for focused ABA interventions in particular, age is unlikely to be a determining factor in which interventions will be effective.

8. Importantly, 20 ABA interventions have been demonstrated to be evidence-based across three age ranges (i.e., 0-5, 6-14, and 15-22). This suggests that for focused ABA interventions in particular, age is not likely to be a major determining factor in which interventions will be effective.

4. PRACTICE GUIDELINES FOR THE TREATMENT OF AUTISM SPECTRUM DISORDER

In keeping with the definition of evidence-based intervention as a process that integrates the best available scientific evidence with clinical expertise and client values and context (Slocum et al., 2014), the second body of information synthesized for this report was recently published practice guidelines. It is believed that practice guidelines, produced by established experts within behaviour analysis, reflect recent literature related to evidence-based intervention, and are an essential source of clinical expertise.

SEARCH PROCEDURE AND RESULTS

A Google search using the terms (including all possible combinations of these terms): (a) practice/practise, (b) guideline[s], (c) standard[s], (d) autism, (e) autism spectrum disorder [ASD], (f) applied behavior/behaviour analysis, (g) service, and (h) treatment, was initially conducted to find all publicly available ABA practice guidelines. The search yielded numerous results (i.e., over 10,000 pages), including documents that: (a) referenced practice guidelines, (b) were related to practice guidelines, but were not practice guidelines themselves, and (c) were limited in relevance to practice guidelines. Although some relevant practice guidelines were identified, given the vast number of unrelated results, raters reached a consensus to use a more targeted approach. This targeted approach involved contacting four of the leading behaviour analytic organizations (i.e., the Association for Behavior Analysis International [ABAI], Association of Professional Behavior Analysts [APBA]), the international behaviour analytic credentialing organization (i.e., the Behavior Analyst Certification Board [BACB]), and one chapter affiliate ABAI organization (i.e., the California Association for Behavior Analysis [CalABA]), in order to create an exhaustive list of behaviour analytic practice guidelines for the treatment of ASD. These organizations were asked for a copy of their published practice guidelines for the treatment of ASD, if applicable, and if they were aware of any other practice guidelines that had been published by other organizations. Based on the approach outlined above, eight documents were identified, some of which overlapped with those identified in the initial "Google search". Each document was reviewed for inclusion based on the following four inclusion criteria:

- The practice guidelines were developed for the provision of services for individuals with ASD
- The practice guidelines were developed primarily to inform behaviour analytic services
- The practice guidelines were published within the past 10 years (2006 and later)
- The practice guidelines were published by an organization that identifies itself as behaviour analytic and was authored by individuals with an applied behaviour analytic background

Two independent raters reviewed each of the eight guidelines separately based on each of the four inclusion criteria. These ratings were merged and inter-rater agreement was calculated on a total of 28 items (i.e., 4 inclusion criteria x 8 documents). A score of 96% inter-rater agreement was achieved. The single item of disagreement was discussed between both raters and consensus was reached. Based on this process, four guidelines met all inclusion criteria. These were: the BACB Practice Guidelines for Treatment of ASD, the CalABA Task Force Report, Standards of Practice for ABA in Minnesota, and the Consumer Guidelines for Identifying, Selecting, and Evaluating Behavior Analysts. See Table 15 (below) for the results of the review of the eight practice guidelines. The remaining four guidelines did not meet all inclusion criteria, and as such these were not reviewed.

Table 15

Outcome of Ratings on the Recommended Practice Guidelines Based on Inclusion Criteria

Practice Guideline Title	Source	Met Inclusion Criteria
BACB Practice Guidelines for Treatment of ASD	BACB (2014)	Yes
CalABA Task Force Report	CalABA (2011)	Yes
Standards of Practice for ABA in Minnesota	MNABA (2012)	Yes
Department of Vermont Health Access Applied Behavior Analysis Clinical Practice Guidelines	VtABA (2016)	No
Introduction to Magellan's Adopted Clinical Practice Guideline for the Assessment and Treatment of Children with Autism Spectrum Disorders	Magellan Health (2016)	No
Consumer Guidelines for Identifying, Selecting, and Evaluating Behavior Analysts Working with Individuals with ASD	Autism-SIG ABAI (2007; 2013)*	Yes
TRICARE Operations Manual	TRICARE (2008)	No
Management of Children with Autism Spectrum Disorders	Myers et al (2007)	No

Note. Original version of the Autism-SIG ABAI guidelines (2007) was primarily used as it was more comprehensive. However, updated information from the 2013 version was integrated as necessary.

To compare and summarize key themes across the four practice guidelines that met inclusion criteria, a rating template was developed that included key questions related to these practice guidelines. These key questions were derived from the BACB (2014) practice guidelines as the BACB is an international credentialing body that is dedicated to the protection of consumers of behaviour analytic services worldwide, as opposed to guidelines produced by local states, which may incorporate recommendations specific to the relevant state services, funding bodies, and so on. As such, three raters reached a consensus that the issues addressed in the BACB practice guidelines would likely be relevant to practitioners of recipients of ABA services in Ontario. Therefore, the BACB guidelines were then used to generate a broad list of questions that would then be answered

using information from each of the four guidelines. Once the relevant questions were identified, they were entered into a template. Next, each rater answered each of the questions using the information in the BACB practice guidelines themselves (i.e., each rater independently reviewed the BACB practice guidelines and attempted to answer each question in the template from this information). This process was undertaken to develop consistency among raters. The responses across all three raters were then merged into one document and the responses were analyzed qualitatively to obtain consensus across all three raters. This method of qualitative analysis involved identifying separate themes within each response, and assigning an alphabetical character to each theme. Themes that matched across all three raters were evaluated such that the raters could come to final consensus on the themes to be included in the response for each question. If a theme was unclear, the independent rater inserted a comment for clarification prior to completing the scoring for that rating. If there was disagreement or contradictory information reported across raters, the independent rater inserted a comment for discussion between all three raters. The results of the rating process for all guidelines are described below.

For some questions, more detail was included in one rater's response relative to another rater's response. When this occurred, these questions were discussed and consensus was reached regarding which details should be included. Overall, consensus across all three raters was achieved on key themes for all questions reviewed for the BACB practice guidelines (i.e., contradictory information across raters was not noted, raters were in agreement with respect to key themes across all questions). Following this, the remaining three guidelines were independently reviewed by two of the three raters. The third rater merged both ratings into one document. The same qualitative analysis method for agreement as described above was then used to analyze the responses (i.e., separate themes within each response were assigned an alphabetical character, themes were reviewed for consistency, a consensus decision was made regarding which themes to include in the final synthesis). All three raters reached consensus on the remaining three practice guidelines.

SYNTHESIS OF PRACTICE GUIDELINES

The following section summarizes recommendations that were developed to help inform clinical best practice for ABA interventions for individuals with ASD. As noted above, this summary was informed by recommendations derived from four behaviour analytic Practice Guidelines (i.e., Autism-SIG ABAI, 2007, 2013; BACB, 2014; CalABA, 2011; MNABA, 2012).

1. What are the models of intervention included in the practice of ABA services?

Comprehensive and focused ABA interventions were listed as the two core models of intervention included in the practice of ABA services for individuals with ASD (BACB, 2014; CalABA, 2011; MNABA, 2012).

Comprehensive ABA intervention involves 30-40 hours of ABA services per week (BACB, 2014; CalABA, 2011). This model of intervention is appropriate for individuals who require support in the development of numerous intervention goals across developmental domains simultaneously and may include the reduction of challenging behaviours (BACB, 2014; CalABA, 2011). This model of intervention has been reported to "remediate core symptoms of autism" (MNABA, 2012). Intervention is typically delivered in a 1:1 format initially and gradually altered to less intensive ratios, where appropriate (BACB, 2014). Average duration of comprehensive ABA intervention was noted to be between 2-4 years depending on the individual's needs (CalABA, 2011). CalABA (2011) also reported Early Start Services (a general term for ABA interventions designed for toddlers) as a model of intervention for children 3 years and younger who have a diagnosis of ASD or those who have been identified as "at risk" for ASD. Early Start Services include services funded by the State of California Department of Developmental Services. California's Early Start Services model should not be conflated with the Early Start Denver Model (ESDM). Rather, the Early Start Services model is an extension of comprehensive ABA intervention, but is designed specifically for infants and toddlers between 0 to 36 months. Given the young age of the children receiving this type of intervention (i.e., toddlers), it involves a minimum of 10-20 hours of ABA services per week and may be increased to 25 hours per week for children who have a diagnosis of ASD. This reduced dosage (number of hours of ABA services) is consistent with the BACB's recommended dosage for very young children (BACB, 2014). After children turn 3 years of age or older, if they continue to present with gaps in their skill development across developmental domains, children continue to receive comprehensive ABA intervention (i.e., 30-40 hours of ABA intervention per week). The CalABA guidelines emphasized the need for Early Start Services in order to reduce the significant risk associated with time spent away from ABA services (e.g., children who are waiting for services, children who are accessing non-evidence-based services). Mediator/caregiver training was noted to be an important component of comprehensive ABA models of intervention (BACB, 2014; CalABA, 2011; MNABA, 2012).

Average duration of comprehensive ABA intervention was noted to be between 2-4 years depending on the individual's needs.

Focused ABA intervention involves 10-25 hours of ABA services per week (BACB, 2014). This model of intervention is appropriate when a limited number of intervention

goals are identified (BACB, 2014; CalABA, 2011; MNABA, 2012). The focus of services may include the reduction of challenging behaviour and/or the development of specific, socially meaningful skills (e.g., communication, adaptive, social; BACB, 2014; CalABA, 2011; MNABA, 2012). When intervention involves the reduction of challenging behaviour, more hours per week of intervention may be required (BACB, 2014). Intervention may be delivered in a 1:1 format or small groups depending on the individual's needs (BACB, 2014). In cases of severe challenging behaviour, a higher staffing ratio (e.g., 2 or 3 staff for one individual) may be required (BACB, 2014). CalABA (2011) suggested that the typical duration of Focused ABA services is between 6 months to 2 years, depending on the individual's needs. Following the mastery of one specific goal, or multiple goals, further focused ABA intervention may be started depending on the individual's needs. Mediator/caregiver training was also noted to be an important component of focused ABA models of intervention (BACB, 2014; CalABA, 2011; MNABA, 2012).

2. For what populations were ABA services recommended?

ASD was consistently reported as one of the populations for which ABA services are appropriate (Autism-SIG ABAI, 2007, 2013; BACB, 2014; CalABA, 2011; MNABA, 2012). Further, the BACB (2014) noted that ABA intervention (i.e., comprehensive ABA intervention, focused ABA intervention) is also appropriate for individuals with ASD with co-occurring conditions (e.g., intellectual disability, seizure disorders, chromosomal abnormalities).

In terms of focused ABA interventions, the BACB (2014), the CalABA (2011), and the MNABA (2012) did not report any limitations on the service delivery with respect to a particular disorder, rather it was reported as appropriate for individuals who demonstrate gaps in a limited number of skills, engage in severe challenging behaviours, and behaviour that interferes with participation in least restrictive community settings.

3. What is the appropriate age range for ABA services?

It was consistently emphasized across three guidelines that ABA intervention should be delivered based on clinical need, without specific age restrictions (BACB, 2014; CalABA, 2011; MNABA, 2012). Further, it was recommended that ABA interventions be delivered as soon as possible after diagnosis (BACB 2014; CalABA, 2011; MNABA 2012), or even before diagnosis (BACB, 2014; CalABA, 2011), to maximize intervention effectiveness. However, the MNABA (2012) further noted that the "age at intake is not necessarily a predictor of treatment response" (p.10).

It was recommended that Early Start Services, as described earlier, be offered to children at risk of a diagnosis of ASD who are under 3 years of age (CalABA, 2011). The CalABA (2011) was the only guideline to discuss a separate model of ABA intervention for young children "at risk" of an ASD diagnosis under 3 years of age, which is most likely due to California's government funded Early Start Services program; however, other guidelines provided recommendations for comprehensive ABA intervention that were inclusive of children under 3 years of age (BACB, 2014; MNABA, 2012).

The recommendations for the age range at which comprehensive ABA intervention should be delivered to individuals with a diagnosis of ASD varied between 1-12 years of age (MNABA, 2012), 3-8 years of age (CalABA, 2011), and no recommendations for age restrictions (BACB, 2014). As noted above, the CalABA (2011) recommended that children under 3 years old receive Early Start Services, as described above. As such, the CalABA's recommendations include the provision of comprehensive ABA interventions for toddlers into school-age years, with the assumption that the child begins comprehensive ABA services prior to the age of 5 (CalABA, 2011). It should be highlighted that the BACB (2014) recommended that treatment decisions be based on individual need, not age. Further they emphasized that ABA is effective across the lifespan and there has been no age identified at which ABA becomes ineffective.

Overall, it should be emphasized that ABA interventions (i.e., comprehensive ABA intervention, focused ABA intervention) should be based on "needs and not constrained by age" (BACB, 2014, p. 18).

All three guidelines reported that focused ABA interventions were appropriate for all individuals with ASD, without mention of a particular age range or developmental disability diagnosis (BACB, 2014; CalABA, 2011; MNABA, 2012). In other words, ABA intervention should be considered across the life span, where appropriate (BACB, 2014).

Overall, it should be emphasized that ABA interventions (i.e., comprehensive ABA intervention, focused ABA intervention) should be based on "needs and not constrained by age" (BACB, 2014, p. 18).

4. Who should develop and deliver ABA services?

Design and oversight by qualified behaviour analysts was consistently reported to be a critical component of ABA interventions for individuals with ASD (Autism-SIG ABAI, 2007, 2013; BACB, 2014; CalABA, 2011; MNABA, 2012). Notably, the Board Certified Behavior Analyst (BCBA) and the Board Certified Behavior Analyst-Doctoral (BCBA-D) credentials were identified as the necessary professional qualifications of those who develop and supervise ABA services across all four guidelines (Autism-SIG ABAI, 2007, 2013; BACB, 2014; CalABA, 2011; MNABA, 2012). Key supervisory activities that BCBAs/BCBA-Ds should perform were reported to include, but were not limited to, conducting behavioural assessments, developing intervention plans, conducting caregiver training, and conducting ongoing reviews of programs including making data-based decisions (BACB, 2014; CalABA, 2011). The Autism-SIG ABAI (2007; 2013) emphasized that while the BCBA or BCBA-D certification is the recommended competency for supervisors, this certification alone does not ensure that an individual has specific supervisory competencies with respect to the ASD population and ABA services. In addition to the BCBA or BCBA-D credential, the BACB has specific requirements for the training of supervisors and the provision of supervision (see https://bacb.com/supervision-requirements/). Further, the Autism-SIG ABAI (2007) suggested that evidence of the following specific to ASD should be documented: minimum one year hands-on training providing ABA to individuals with ASD under the

supervision of a BCBA or BCBA-D and mastery of a variety of ABA competencies (e.g., application of empirically-validated intervention methods for individuals with ASD, designing and implementing comprehensive ABA programs across a wide range of ages and skill-sets, application of various empirically-validated teaching methods [e.g., natural environment training, discrete trial teaching], application of a variety of ABA-techniques in programming [e.g., prompting, errorless teaching, preference assessments], designing and overseeing both individual and group instruction programming, making data-based decisions to guide programming, designing and evaluating function-based behaviour intervention plans, collaborating across disciplines).

BCBAs and BCBA-Ds may delegate supervision to Board Certified Assistant Behavior Analysts (BCaBAs) who have a direct reporting relationship to the BCBA or BCBA-D (BCBA, 2014; MNABA, 2012). It should be noted that the BCBA or BCBA-D should continue to conduct some direct client supervision sessions when supervision is delegated to a BCaBA (e.g., Autism-SIG ABAI, 2007; MNABA, 2012).

Notably, the Board Certified Behavior Analyst (BCBA) and the Board Certified Behavior Analyst-Doctoral (BCBA-D) credentials were identified as the necessary professional qualifications of those who develop and supervise ABA services across all four guidelines (Autism-SIG ABAI, 2007, 2013; BACB, 2014; CalABA, 2011; MNABA, 2012).

Autism-SIG ABAI (2007, 2013), CalABA (2011), and MNABA (2012) discussed considerations for non-BCBA professionals who may supervise behaviour analytic programming under very specific circumstances in which they can demonstrate evidence of extensive behaviour analytic backgrounds. Autism-SIG ABAI (2007) describes why it may be important to consider a "group of professionals who have been in practice for a number of years, but are not currently certified by the BACB." Specifically, Autism-SIG ABAI (2007) states that "some completed their training well before the BACB certification program was initiated and are now in the later stages of their careers. Some are excellent clinicians who have served hundreds of consumers with autism." However, Autism-SIG ABAI (2013) also emphasized "there are other degrees of formal education that are less preferred and which do not necessarily meet the standards of the BACB. Therefore, consumers should approach individuals with these alternate credentials with a higher degree of caution." For example, an individual with a "Master's in a related field (15 units of graduate level coursework in behaviour analysis), or licensed or certified in a related field with behaviour analysis in its scope of practice", plus 3-5 years experience overseeing behavioural treatment programs for ASD, may supervise behaviour analytic programming (CalABA, 2011; MNABA, 2012). Autism-SIG ABAI (2007) suggested the following criteria for non-BCBA professionals who may supervise ABA services: Master's degree or higher in ABA or related field, membership in ABAI or chapter affiliate, 10 years post-master's professional experience "implementing, designing, and overseeing" ABA services for individuals with ASD, publications of research on ABA treatment of ASD in peer-reviewed journals, and presentations on ABA treatment of ASD at ABA conferences. In 2013, however, the Autism-SIG ABAI further defined the competencies for non-BCBA professionals who may supervise behaviour analytic programming to include licensure as a psychologist

and evidence of behaviour analysis within their scope of practice (e.g., transcript with graduate level coursework in behaviour analysis, supervised clinical work in behaviour analysis that is "comparable to the requirements to sit for the BCBA examination") or completion of graduate studies through a program that meets the ABAI accreditation standards and supervised clinical work in behaviour analysis that is "comparable to the requirements to sit for the BCBA examination". In addition to these credentials and experience, Autism-SIG ABAI (2013) also suggested the same experiential supervisory training in ASD specific supervisory competencies as described earlier for BCBAs/BCBA-Ds. For example, non-BCBA/BCBA-Ds should provide evidence of minimum one year hands-on training providing ABA to individuals with ASD under the supervision of a BCBA or BCBA-D and mastery of a variety of ABA competencies (e.g., application of empirically-validated intervention methods for individuals with ASD, designing and implementing comprehensive ABA programs across a wide range of ages and skill-sets, application of various empirically-validated teaching methods [e.g., natural environment training, discrete trial teaching], application of a variety of ABA-techniques in programming [e.g., prompting, errorless teaching, preference assessments], designing and overseeing both individual and group instruction programming, making data-based decisions to guide programming, designing and evaluating function-based behaviour intervention plans, collaborating across disciplines). The increased stringency in requirements for non-credentialed professionals to supervise behaviour analytic programs reflects the evolution of the behaviour analytic profession.

In terms of the implementation of ABA services, competency-based qualifications were consistently reported to be the most important skill for this level of service (BCBA, 2014; CalABA, 2011; MNABA, 2012). Some implementers may be Registered Behavior Technicians (RBTs; BCBA, 2014); however, the BACB only recently began to offer the RBT certification to implementers as of mid-2014. Other implementers may come from a variety of educational backgrounds (e.g., bachelor's degree, high school diploma) and demonstrate evidence of successful completion of "competency-based training." The importance of ongoing supervision of implementers was also emphasized (e.g., BACB, 2014; CalABA, 2011).

5. What are the core characteristics of ABA?

One of the core characteristics of ABA is that it relies heavily on scientific evaluations of the effects of interventions (BACB, 2014; CalABA, 2011; MNABA, 2012). Thousands of studies published over more than 50 years of literature support the clinical application of a wide array of ABA procedures to address core symptoms of ASD and other developmental disabilities as well as associated skill deficits and challenging behaviours (CalABA, 2011; MNABA, 2012). The application of behaviour analytic principles and procedures can substantially improve an individual's quality of life (BACB, 2014). Notably, individual, family and community values are given careful consideration with respect to intervention planning (BACB, 2014).

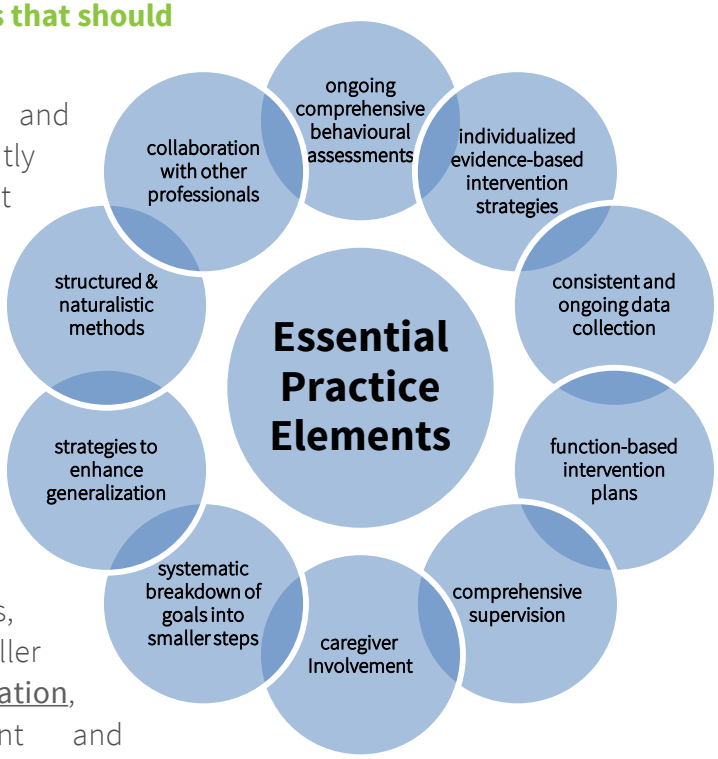
The BACB (2014) and the CalABA (2011) practice guidelines strongly emphasized the importance of data-based decision making and systematic manipulation of environmental arrangements as core characteristics of ABA services. Data should be used to inform both assessment and intervention (BACB, 2014). Further, ongoing summary and analyses of data are important to determine an individual's responsiveness to intervention (BACB, 2014).

6. Can ABA services be combined with other services? How should ABA practitioners work with other professionals?

A conceptually and procedurally consistent approach to client services across professionals can "produce the best outcomes for the client and their families" (BACB, 2014, p. 38). Further, "consultation with other professionals helps to ensure client progress through efforts to coordinate care and ensure consistency including during transition periods and discharge" (BACB, 2014, p. 38). Therefore, when appropriate, providers of ABA services (i.e., BCBAs, BCBA-Ds) should work with professionals from other disciplines (e.g., respite staff, physicians, speech and language pathologists, psychologists). When ABA practitioners work with other professionals it is recommended that the ABA practitioners use behaviour analytic methods to evaluate individual and combined intervention effectiveness (MNABA, 2012). The MNABA (2012) recommended that ABA practitioners be informed about other services (e.g., respite services) that may support a family's participation in ABA intervention (e.g., mediator-model intervention). Under these circumstances, ABA practitioners should coordinate their services with other services to help support ABA intervention goals (MNABA, 2012). Behaviour analysts directing ABA programs should demonstrate competency in working with professionals from other disciplines and at the same time remain committed to making data-based decisions and to using scientifically validated interventions (Autism-SIG ABAI, 2007).

Importantly, the BACB (2014, p. 38) noted "Differences in theoretical orientations or professional styles may sometimes make coordination difficult. If there are treatment protocols that dilute the effectiveness of ABA treatment, these differences must be resolved to deliver anticipated benefits to the client." Further, ABA practitioners should consider that interventions "that lack scientific evidence as established by peer-reviewed publications should be considered **eclectic** and do not constitute ABA treatment" (BACB, 2014, p. 18). Research across numerous studies has demonstrated that application of "an eclectic model, where ABA is combined with non-evidence-based treatment, is less effective than ABA alone" (BACB, 2014, p.18). Questions about the appropriateness and efficacy of non-ABA services should be reviewed by an expert panel of behaviour analysts (MNABA, 2012), and the BACB cautioned that the effectiveness of ABA services might be diminished when they are combined with non-evidence-based interventions (for a review of non-evidence-based interventions, refer to Table 10).

7. What are the essential practice elements that should be included in ABA services?



Consideration for socially meaningful and individualized intervention goals was consistently identified as an essential practice element (BACB, 2014; CalABA, 2011; MNABA, 2012). Further, inclusion of the following elements was encouraged: ongoing comprehensive, behavioural assessments, individualized evidence-based intervention strategies, consistent and ongoing data collection, function-based intervention plans for behavioural excesses, comprehensive supervision that integrates data-based decisions, structured and naturalistic methods, the systematic break down of goals into smaller steps, strategies to enhance generalization, opportunities for caregiver involvement and collaboration with other professionals (excluding methods that are not evidence based) (BACB, 2014; CalABA, 2011; MNABA, 2012). The MNABA (2012) emphasized the importance of parental/caregiver involvement in intervention. In the event that parental/caregiver involvement is challenging, clinicians should work with families to identify barriers related to their involvement and collaborate with families to determine solutions to help overcome these barriers (MNABA, 2012).

8. What procedures should be included in the practice of ABA services?

In addition to use of the practice elements outlined above, ABA practitioners may select from a range of evidence-based behaviour analytic procedures when developing individualized intervention plans for individuals with ASD (BACB, 2014; CalABA, 2011; MNABA, 2012). ABA procedures such as, shaping, differential reinforcement, chaining, and functional communication training (for definitions please refer to the glossary) are just a few examples of procedures that may be included in the ABA services for individuals with ASD. Structured and naturalistic procedures may be included in ABA services. Clinicians should select procedures based on each individual's specific needs, and intervention effectiveness should be determined through careful analysis of direct data. It should be noted that, behaviour analysis is a science. As such, new ABA interventions and improvements to existing

Clinicians should select procedures based on each individual's specific needs, and intervention effectiveness should be determined through careful analysis of direct data.

ABA interventions are constantly being added to the growing list of ABA interventions based on the most current literature (BACB, 2014). Intervention procedures employed in services for individuals with ASD should reflect the most current research.

9. What is the appropriate dosage (i.e., number of hours per week) for ABA services and how should this be determined?

Dosage of ABA services must be individualized. The appropriate dosage for ABA services as presented by three guidelines was emphasized to be dependent on factors such as the service model employed (refer to descriptions of different service models in previous section), the individual's goals, and complexity of their needs (BACB, 2014; CalABA, 2011; MNABA, 2012). Further, MNABA (2012) highlighted that when treating challenging behaviour, one should consider the frequency, duration, and severity of the challenging behaviour in addition to the extent of relative skill deficits when determining dosage of services (e.g., a relatively higher dosage of ABA services may be required for an individual who lacks skills across multiple domains such as communication and self-help skills, and exhibits a high rate or intensity of aggression, self-injurious, or other harmful behaviours). It should be noted that these dosages do not include critical indirect activities such as supervision, assessment, training and professional development.

Dosage of ABA services must be individualized.

Across guidelines and service models (i.e., focused and comprehensive) variations in the recommended dose of services was noted. The BACB (2014) and the CalABA (2011) reported the dosage of comprehensive ABA services (i.e., targeting a number of skills across domains, delivered in a one-on-one intensive teaching format) to be within the range of 30-40 hours per week. Further, the CalABA suggested that these 30-40 hours be delivered 6-7 hours daily, 5-6 days/week. The MNABA (2012) presented a wider dosage range of 10-60 hours per week (3-12 hours per day for 5-7 days per week). As noted previously, the CalABA reported additional considerations for comprehensive ABA services when delivered to children younger than three years. Children at risk for ASD were recommended to receive a range of 10-20 hours of direct Early Start Services per week (as described above), which may be delivered 2-4 hours per day across 5-6 days per week (CalABA, 2011). Children diagnosed with ASD under 3 years were recommended to receive minimum 25 hours of comprehensive ABA services per week for 2 to 5 hours per day across 5 to 6 days per week (CalABA, 2011).

The BACB (2014) reported the dosage of focused ABA interventions (i.e., targeting a limited number of skills and/or challenging behaviours) to be within the range of 10-25 hours per week with the highest dosage to be considered for those who exhibit severe challenging behaviours (BACB, 2014). The CalABA (2011) and the MNABA (2012) reported the dosage of focused ABA intervention to be within a range of 2 hours to 20 hours per week. The CalABA further recommended that when client needs justify services at the low end of the dosage range, services may be delivered using consultation and parent training; while service provided near the high end is intensive and direct combined with consultation and parent training. The MNABA also presented recommendations for

the dosage of focused ABA intervention that ranged from 2-20 hours of direct services per week in combination with additional parent education and training services (e.g., 2 hours per week).

Finally, individualized adjustments to intensity (dosage) of ABA services at the onset and end of services were recommended. Specifically, the number of service hours per week may be gradually increased at the start of the service (e.g., over the first 6 months) and/or gradually decreased when transitioning toward discharge (BACB, 2014; CalABA, 2011; MNABA, 2012). In addition, service hours may be faded for young children receiving comprehensive ABA once a child reaches 6-8 years old assuming they began comprehensive ABA prior to age 5 (CalABA, 2011; MNABA, 2012).

10. What are the appropriate location(s) of service delivery?

In order to maximize the likelihood of generalization and maintenance of acquired skills, it was recommended that intervention be conducted across multiple settings and be delivered by multiple individuals (BACB, 2014). Specifically, settings such as the client's home, school, community, and treatment centers were identified as appropriate locations (MNABA, 2012). CalABA (2011) noted that Early Start Services were typically provided in the client's home, but that treatment centers for young children could also be effective. It was recommended that ABA strategies be used in environments other than the therapeutic setting in order to support transition to other environments following intervention (BACB, 2014). In terms of comprehensive ABA intervention, the CalABA recommended establishing criteria for placing clients in small group instructional settings and using these criteria to guide the selection of intervention settings (e.g., intervention in the context of community outings, playgroups).

11. What is the appropriate assessment process for ABA services?

The BACB (2014) recommended that typical assessment procedures for ABA intervention consider the inclusion of a variety of assessment tools and measures with the goal of identifying a skill profile, as well as possible barriers to progress or challenging behaviour. While assessment may include components such as file review, assessments from other professionals, and interviews and rating scales, individual direct behavioural assessment and observations are the "defining characteristics of ABA" and should be prioritized (BACB, 2014, p.20). These measures serve as a "primary basis" for determining treatment needs and evaluating "response to treatment and progress toward goals" (BACB, 2014, p.20).

It was also recommended that clinicians consider the model of ABA intervention when selecting assessment tools. In terms of comprehensive ABA and focused ABA models of service, direct observational assessments that include measures of behavioural targets and mediator implementation were recommended (MNABA, 2012). Additional assessment methods used to determine the intervention plan may include standardized and non-standardized assessment tools, as well as developmentally-appropriate assessments that measure quality of life, adaptive skills, and behaviour (CalABA, 2011; MNABA, 2012). It was cautioned that while standardized measures may be used as part of the assessment process, they should not be the sole measure used to decide whether a client is benefiting from the ABA intervention (BACB, 2014).

Regardless of the model of ABA service delivery, it was consistently noted across guidelines that if problem behaviour is identified for intervention, a functional behavioral assessment must be conducted (BACB, 2014; CalABA, 2011; MNABA, 2012). The assessment should consist of direct and indirect assessments, including a functional analysis, if appropriate. If a functional analysis is conducted, it must be run under the direct supervision of a BCBA or BCBA-D. The results of this analysis would then be used to directly inform a function-based intervention plan (BACB, 2014; MNABA, 2012).

The duration and frequency of assessments may vary based on the model of intervention. For example, it was noted that behavioural assessments for comprehensive ABA intervention and functional behavioral assessments for challenging behaviour may require more time in comparison to behavioural assessments for focused ABA interventions (BACB, 2014). Assessment results that evaluate "overall progress toward comprehensive treatment goals" should be summarized on a regular basis (e.g., "a semi-annual basis"; BACB, 2014, p.22). Finally, daily data should be collected during comprehensive ABA interventions and reviewed a minimum of every week (MNABA, 2012). Daily data should be collected during focused ABA interventions and reviewed a minimum of every two weeks (MNABA, 2012).

12. How should ABA service goals be selected and monitored?

Service goals for ABA interventions should be selected using results of multiple assessments, including direct behavioural observation and measurement (CalABA, 2011; MNABA, 2012). In terms of goal selection, priority should be given to goals that improve the quality of an individual's life (e.g., that lead to improvements in health, well-being, independence, and safety; BACB, 2014) and those that include parental involvement (CalABA, 2011).

The BACB (2014) highlighted that while standardized measures may be used, they should not be used alone to determine whether a client is responsive to treatment, nor to "deny or discontinue ABA treatment" (BACB, 2014, p. 21).

In terms of behavioural assessment, it was recommended that when selecting goals to address challenging behaviour, functional behavioral assessments and/or functional analysis of the problem behaviours be completed (BACB, 2014; CalABA, 2011; MNABA, 2012). In addition, adaptive behaviour assessments (MNABA, 2012) and "developmentally appropriate behavioural assessments" (CalABA, 2011, p. 9,13,16) should be administered. In terms of goal selection and monitoring for comprehensive ABA interventions, tools that assess core ASD symptomology may also be used (BACB, 2014; MNABA, 2012).

Goals should be clearly defined, so that progress toward them can be closely monitored and revised as needed (BACB, 2014). Measures that determine progress towards goals should be specific, direct, and observable, as well as individualized for the client in order to be sensitive to their specific needs (BACB, 2014). Progress should be monitored through the establishment and implementation of a data collection system (BACB, 2014). Daily data should be reviewed minimum every 1-2 weeks (MNABA, 2012) in order to make data-based intervention decisions (CalABA, 2011; MNABA, 2012). The BACB (2014) highlighted that while standardized measures may be used, they should not be used alone to determine whether a client is responsive to treatment, nor to "deny or discontinue ABA treatment" (BACB, 2014, p. 21).

13. What are the critical features that should be included in service plan reports?

The BACB (2014) suggested that individual service plan reports include background information such as the reason for referral, information about the client, a clinical interview, and a review of recent assessments and reports. In addition, the CalABA (2011) suggested the inclusion of the goals and objectives for the service for both clients and their caregivers, as well as measureable outcomes of the service, and the level at which service will be provided. The CalABA also recommended that the service plan identify whether the recipient of the ABA intervention is a good candidate for the service and report whether the caregivers or family are committed to participating in and implementing the recommended intervention as designed. Further, the BACB (2014) and the MNABA (2012) recommended that the service plan report include details of the assessment procedures and the results. The MNABA also recommended considerations for selecting assessment tools based on the model of service delivery. In terms of focused ABA intervention, the results of a functional behavioural assessment or a functional analysis of problem behaviour should be reported where appropriate (i.e., if the focus of intervention is on the reduction of challenging behaviour), as well as the results of an adaptive behaviour assessment. In terms of comprehensive ABA, the results of a "developmentally appropriate behavioural assessment" should be reported (CalABA, 2011, p. 9,13,16).

Overall, the intervention plan should be derived from assessment results and should be outlined in detail in the service plan (BACB, 2014; MNABA, 2012). Other details that the BACB (2014) and the MNABA (2012) recommended for inclusion in the service plan included: information about the intervention setting, strategies included in the intervention plan, definitions of each skill targeted, data collection methods, caregiver training plan, dosage of intervention, coordination of services and transition plan to other services, as well as a discharge plan and a crisis plan, where appropriate. It was also recommended that the specific objectives of the intervention be outlined, including the baseline data collection, intervention introduction date, parent/ caregiver responsibilities, whether the goal has been met or not met, or the projected date of mastery, and plan for generalization.

14. How often should service plans be reviewed and authorized?

The BACB (2014), the CalABA (2011), and the MNABA (2012) indicated that data must be reviewed regularly to evaluate progress. Overall, the BACB recommended that service plans be reviewed and authorized no less frequently than every 6 months. Further, the BACB noted that service plans may require review every 3 months when responsiveness to service requires evaluation. The CalABA and the MNABA outlined recommendations related to the frequency of service-plan reviews based on the service model being delivered. For Early Start Services (CalABA, 2011) and comprehensive ABA intervention (CalABA, 2011; MNABA, 2012), it was recommended that service plans be reviewed every 3 months. For focused ABA intervention (CalABA, 2011; MNABA, 2012) data reviews were recommended every 6 months to evaluate progress and to determine the appropriateness of the intervention.

15. How should the duration of ABA services be determined?

Responsiveness to intervention and considerations for the needs of each individual were consistently recommended as two important considerations when determining the duration of ABA services in general (BACB, 2014; CalABA, 2011; MNABA, 2012). Specifically, progress on objective measures (for a review of appropriate methods of assessment, refer to question 11) of intervention goals should be evident to continue in ABA services (BACB, 2014; CalABA, 2011; MNABA, 2012). MNABA (2012) further recommended that, following 6 months of intervention, data should demonstrate a strong response to intervention. CalABA (2011) also emphasized that duration of services should be dependent on the individual's needs.

The BACB (2014) did not report a specific range of duration for comprehensive ABA services. The reported range of duration of comprehensive ABA services varied between 2 to 4 years as reported by CalABA (2011) and 6 months to 5 years as reported by MNABA (2012). This variability may reflect the need to consider a variety of individual factors, such as the extent of the specific needs of the individual, responsiveness to intervention, and so on. Importantly, following comprehensive ABA intervention, focused ABA intervention may continue to be appropriate (CalABA, 2011).

In terms of focused ABA services, CalABA (2011) and MNABA (2012) reported that services may be offered for 6 months to 2 years depending on individual considerations of need related to severity of problem behaviour and skill deficits. The BACB (2014) did not report a specific range of duration for focused ABA intervention; however, similar to the considerations for duration of services for comprehensive ABA, responsiveness to intervention and progress relative to intervention goal(s) should be considered when determining the length of focused ABA intervention (BACB, 2014; CalABA, 2011). Finally, the MNABA highlighted that measures of generalization and maintenance of the targeted behaviour should be considered with respect to duration of focused ABA interventions.

16. What are the options for case supervision of service delivery?

Regardless of the model of intervention used (e.g., comprehensive ABA intervention or focused ABA intervention), a service delivery model that includes a combination of implementers (i.e., behaviour technicians) and qualified supervisors (i.e., BCBA, BCBA-D) was recommended (BACB, 2014; CalABA, 2011; MNABA, 2012). Specifically, the implementation of a "tiered" service delivery model was recommended by BACB in which (a) service is supervised by a BCBA or BCBA-D, with or without additional support of a BCaBA and (b) direct service is provided by behaviour technicians who may be RBTs or others with demonstrated competencies as described in question 4. Similarly, the CalABA recommended a structured service delivery

The implementation of a "tiered" service delivery model was recommended by BACB in which (a) service is supervised by a BCBA or BCBA-D, with or without additional support of a BCaBA and (b) direct service is provided by behaviour technicians who may be RBTs or others with demonstrated competencies.

model that involves a supervisor who is a BCBA (or working toward BCBA) overseeing the staff who are implementing the program. Although a hierarchical service delivery model was not explicitly described by the MNABA, this guideline recommended supervision of ABA services by a "qualified professional with expertise in ABA" (e.g., licensed behaviour analysts, professionals certified by the BACB, licensed behavioural health professionals with expertise in ABA) and delivery of direct services by individuals with an educational background in ABA and supervised clinical work in ABA services.

17. What should be considered with respect to case supervision for ABA services?

As described in the earlier section regarding who should develop and deliver ABA services, ABA intervention requires frequent, direct supervision due to the individualized nature of services, the requirement for ongoing, data-based decision making, and the application of a tiered service delivery model (BACB, 2014). Consistent across all guidelines, recommendations included that supervisors and implementers must meet minimum competency qualifications and preference is given to those with respective BACB credentials (Autism-SIG ABAI, 2007, 2013; BACB, 2014; CalABA, 2011; MNABA, 2012). Supervisors must also work within their scope of competence (BACB, 2014). Please refer to question 4 for details on supervisor qualifications and training.

Further to meeting minimum supervisory qualifications, the Autism-SIG ABAI (2007) emphasized that supervisors pursue ongoing training including: considerations for best practices; how to develop and oversee curriculum for at least one learner with a large scope of skills considered; how to develop and oversee curriculum to develop verbal and non-verbal communication skills including the use of AAC; and participation in ongoing continuing education related to ASD.

Case supervision for ABA services was described based on three stages of service (e.g., assessment, intervention, and discharge) where supervision activities involve both direct (e.g., observation, monitoring of staff performance, training on new techniques or program changes) and indirect work (e.g., intervention planning, analysis and summary of data, review of client progress, data-based program revisions, case coordination, crisis intervention, writing progress reports, planning for and supervising transition/discharge, training of parents and staff). Direct supervision activities were recommended to represent 50% or more of the supervised hours (BACB, 2014).

The BACB (2014) stated that supervision may be delivered in person or remotely. However, if provided remotely, some in-person supervision should be considered. Allowances were made for some indirect work to be completed offsite and some small group supervision.

The amount or intensity of supervision should be individualized based on the needs of the client (BACB, 2014; CalABA, 2011; MNABA, 2012); the number of intervention hours; expertise of the BCBA/BCBA-D (i.e., supervisor); location and form of supervision; and availability of other staff to support supervision (e.g., BCaBA; BACB, 2014). The recommended amount of supervision varied somewhat across guidelines, likely due to considerations based on individualized needs. BACB (2014) recommended that approximately 20% of intervention hours be supervised (e.g., 2 hours for every 10 hours of intervention). The CalABA (2011) and the MNABA (2012) suggested that supervision

be provided at a minimum of 2 hours per week, with ratio of 1-1.5 hours of supervision for every 10 hours of intervention with regular supervision including review of data (minimum weekly) and overall service plan (minimum every 3 months) recommended. The BACB suggested that the supervisor's caseload for focused ABA intervention include 10-15 clients without BCaBA support and 16-24 with BCaBA support and for comprehensive ABA intervention include 6-12 clients without BCaBA support and 12-16 with BCaBA support.

The Autism-SIG ABAI (2007) cautioned ABA practitioners to carefully manage their caseloads and not overcommit to too many clients beyond what they can effectively manage. Clients should ask prospective providers questions about availability and responsiveness, including the amount of time dedicated to individual clients; adjustments to dedicated time based on programming needs; response time with crisis; adequacy of available time to meet needs of individual clients; and expectations regarding type and frequency of communication with clients (Autism-SIB ABAI, 2007).

18. How should ABA practitioners work with caregivers and other professionals?

All three practice guidelines stated that a critical component of the provision of ABA services involves the engagement and collaboration between ABA practitioners and caregivers (BACB, 2014; CalABA, 2011; MNABA, 2012). Working with caregivers throughout the course of intervention was reported to increase intervention effectiveness (MNABA, 2012). Key strategies reported to encourage caregivers' and other professional's involvement throughout ABA interventions included focused discussions aimed to identify family needs and incorporate caregiver feedback, provision of caregiver training as an integrated component of intervention (not stand alone), collaboration with other professionals to address concerns regarding counter-productive interventions, and coordination of referrals to other services.

All three practice guidelines stated that a critical component of the provision of ABA services involves the engagement and collaboration between ABA practitioners and caregivers (BACB, 2014; CalABA, 2011; MNABA, 2012).

At the outset of service, the BACB (2014) suggested that factors related to family dynamics (e.g., family values, needs, stress levels, priorities and resources) be considered in determining a plan for the implementation of intervention, family support and involvement, and caregiver training as these factors impact client progress. Further, CalABA (2011) recommended that when providing focused ABA intervention, the behavioural assessment should also identify caregiver goals and plans for caregiver implementation of behavioural strategies. Moreover, the CalABA and the MNABA (2012) provided guidelines for ABA practitioners and the intervention team to consider the family's needs when creating opportunities for them to be involved in the services (e.g., ease of understanding and use of the data sheets, opportunities to practice the skills with the supervisor, user-friendly instructions and procedures).

A key role for the ABA practitioner is to provide effective and explicit training to caregivers to promote development, maintenance and generalization of behaviour change (CalABA, 2011). As such, ABA practitioners should integrate caregiver training into intervention (e.g., work on generalization of skills, treatment of challenging behaviours, implementation of strategies for adaptive skills, set up opportunities to practice social skills and play), rather than providing training as a "stand alone" option (BACB, 2014). It is the practitioner's responsibility to provide training and structure opportunities for practice (MNABA, 2012). Training should be provided by the supervisor or experienced clinician with similar qualifications (see question 2 for more detailed information on qualifications). The MNABA (2012) recommended that training be provided at least monthly (comprehensive ABA intervention), or at least biweekly (focused ABA intervention). Practitioners should consider providing additional training opportunities when skills are developing at a faster rate and when goals for generalization are a priority, both of which warrant a denser caregiver training schedule (CalABA, 2011).

ABA practitioners must work within the scope of their competencies (BACB, 2014). As a result, it may be necessary to coordinate access to other professionals should the client exhibit needs beyond the scope of ABA intervention (e.g., medical or psychiatric conditions; BACB, 2014).

ABA practitioners must consider and promote evidence-based interventions. Consequently, ABA practitioners have the responsibility to collaborate with caregivers and other involved professionals to discuss and resolve any interventions that may be contra-indicated (e.g., conflict with ABA strategies; BACB, 2014). This may involve coordinating ABA intervention with other professionals and discussing other interventions that other professionals may be involved with (e.g., medication; BACB, 2014). Any sharing of private and confidential information with other professionals for this purpose, or any other purpose, would require written consent from the caregiver, but most importantly, the ABA practitioner should engage the caregiver and professionals in a focused discussion to examine the evidence from client data and peer-reviewed studies to inform intervention coordination decisions.

ABA practitioners must work within the scope of their competencies (BACB, 2014). As a result, it may be necessary to coordinate access to other professionals should the client exhibit needs beyond the scope of ABA intervention (e.g., medical or psychiatric conditions; BACB, 2014). In addition, coordination with other support services may be warranted to fulfill plans in meeting the goals, which the ABA intervention context is not able to address. For example, this may be needed if a goal for generalization would be best addressed in another setting (e.g., transition to small group settings where school district supports may be appropriate; CalABA, 2011).

19. When should client discharge from ABA services be considered?

A decision to discharge a client from ABA services must be client specific (MNABA, 2012) and occur when (a) intervention goals are met (BACB, 2014; CalABA, 2011; MNABA, 2012), (b) the client no longer meets diagnostic criteria for ASD (BACB, 2014), (c) "the client does not demonstrate progress towards goals for successive authorization periods" (BACB, 2014, p. 40), or (d) the family initiates discharge or there are unresolved concerns related to intervention between the family and service provider (BACB, 2014).

Objective measures of treatment goals must be reviewed prior to decisions to continue, modify, or terminate ABA services (CalABA, 2011; MNABA, 2012). Potential generalization of goals (MNABA, 2012) and caregiver implementation of goals and data may also be considered for review (CalABA, 2011; MNABA, 2012). Quality of life measures (standardized and non-standardized) can also be used to determine impact of service on the individual and their regular environment (MNABA, 2012).

Objective measures of intervention goals must be reviewed prior to decisions to continue, modify, or terminate ABA services (CalABA, 2011; MNABA, 2012).

Services may be deemed ineffective (CalABA, 2011) due to lack of responsiveness to intervention (i.e., lack of progress on goals across multiple review periods; BACB, 2014) and/or lack of caregiver participation for comprehensive services (i.e., frequent/chronic missed/cancelled sessions; CalABA, 2011; MNABA, 2012). If responsiveness to intervention is questionable, CalABA (2011) and MNABA (2012) recommended that an individualized review of services and data be conducted by an independent expert panel of behaviour analysts and other professionals.

20. What are important considerations that should be made with respect to transition planning?

Transition planning is essential to ensure maintenance and generalization of progress when a change of services is to occur. The BACB (2014) recommended that a written transition plan be developed and implemented at least 3 to 6 months prior to the change in service. In terms of comprehensive ABA services, at least 6 months of transition planning is required (BACB, 2014). The written transition plan should provide specific details outlining how and when services will be systematically decreased or increased over the course of the transition period. Details including the number of service hours, and the number and type of behaviour targets, which must be achieved prior to moving to each phase of transition, should be specified. The set plan should be created in consultation with, and agreed upon, by all involved (e.g., parents, providers, community caregivers, and other involved professionals). The plan must clearly outline the roles and responsibilities of all of those involved in the transition process.

5. RECOMMENDATIONS

PROCESS

We have examined two substantive research reviews on evidence-based practices for individuals with ASD, as well as four established practice guidelines in the field of ABA. From these two sources of information, together with the expert judgment of Task Force members, we identified the following recommendations to inform individuals with ASD and their caregivers, practitioners in the field, and policymakers. To develop these recommendations, we first generated eight key questions that we thought should be addressed in the delivery of ABA interventions for individuals with ASD in Ontario.

A consensus approach was used to ensure that each recommendation represented the opinion of each member of the Task Force. Recommendations to the ONTABA Board were only included if they met unanimous agreement from all members of the Task Force. When we did not obtain initial consensus, there was additional discussion to clarify or amend the recommendation to achieve unanimous agreement. Recommendations that did not achieve consensus were not included. As a result, the consensus approach resulted in more conservative recommendations.

Each recommendation is presented with its associated question and, where needed, related commentary.

1. WHAT INTERVENTIONS SHOULD BE SUPPORTED FOR INDIVIDUALS WITH AUTISM SPECTRUM DISORDER (ASD)?

Recommendation 1a: Only those interventions that meet the standards of evidence-based practice should be supported.

Commentary: As noted in previous reports, the vast majority of evidence-based interventions consist of applied behaviour analysis (ABA) or incorporate established behaviour analytic procedures. These interventions are often described as either focused ABA interventions or comprehensive ABA interventions.

The term “focused ABA interventions” generally refers to ABA interventions that target a relatively small number of selected behaviours and skills for change and are provided between 10 and 25 hours per week (BACB, 2014). The majority of evidence-based interventions are focused ABA interventions.

Different terms and definitions have been used to describe “comprehensive interventions”. The NAC used the term, “Comprehensive Behavioral Treatment for Young Children.” (Although mentioned in the report, comprehensive interventions were not included in the evidence-based practice review conducted by the NPDC). The three Practice Guidelines reviewed used the term “comprehensive ABA interventions” more broadly.

In our recommendations, we have generally used the term, "comprehensive ABA interventions" to refer to Early Intensive Behavioural Intervention (EIBI) or what the NAC referred to as "Comprehensive Behavioral Treatment For Young Children", described as "intensive service delivery typically being provided for 25-40 hours per week for 2-3 years based on the principles of ABA" (p.47). However, we also use "comprehensive ABA interventions" in a manner consistent with Practice Guidelines (BACB, 2014) to refer to the simultaneous use of several focused ABA interventions (many of which are evidence based in their own right), necessitating many hours of intervention, to address significant skill deficits and/or severe behaviour excesses. It is important to note that EIBI, for which there is an established evidence base spanning more than 30 years, and the use of comprehensive ABA interventions involving idiosyncratic combinations of evidence-based focused ABA interventions, should not be conflated with other forms of "comprehensive" or "behavioural" interventions which do not currently meet criteria for evidence-based practice according to the NAC and the NPDC (e.g., TEACHH, ESDM, Floortime).

The interventions that we have accepted as evidence based are shown in Tables 6 and 7 and are: comprehensive behavioral treatment for young children (EIBI) and the following focused ABA interventions: cognitive behavioural intervention, differential reinforcement (DRA, DRI, DRO), discrete trial teaching, extinction, functional behaviour assessment, language training, modeling, naturalistic teaching, parent training, peer-mediated intervention, Pivotal Response Treatment® (PRT), visual schedules, scripting, self-management, social skills training, story-based intervention, prompting, reinforcement, response redirection, structured play groups, task analysis, time delay, video modeling, exercise, functional communication training, Picture Exchange Communication System® (PECS), and technology-based intervention.

Recommendation 1b: Unestablished and emerging interventions should not be supported.

Commentary: Although it is tempting to consider using emerging interventions in the treatment of individuals with ASD, until additional research is conducted, there is a risk of promoting an intervention that has not been firmly proven to be effective (e.g., sensory interventions, facilitated communication, packaged social communication interventions). As intervention time and other resources are limited, careful consideration should be given to where efforts are best focused; time spent engaged in unestablished interventions is time that could have been allocated to evidence-based interventions.

Recommendation 1c: A mechanism should be established for regularly updating which interventions are identified as evidence based.

Commentary: There have been recent updates in the reports of the National Autism Center (NAC; 2015) and National Professional Development Center (NPDC; 2014). These reports reflect the changing nature of evidence-based intervention. With additional research, it is likely that some emerging interventions for individuals with ASD may meet the threshold for being considered evidence based. Considerations should then be made for the use of these interventions. The most recent publication dates of studies included in the latest NPDC and NAC reports are 2011 and 2012, respectively. A systematic review of research published since that date should commence as soon as possible.

2. WHICH INDIVIDUALS SHOULD RECEIVE FOCUSED AND COMPREHENSIVE ABA INTERVENTIONS?

Recommendation 2a: Determination of the types, dosage, and duration of ABA interventions for individuals with ASD should be based on an assessment of individual need.

Commentary: These decisions may involve information from caregivers and a diversity of professionals, but decisions about behaviour analytic services should be determined by qualified behaviour analysts (BCBA, BCBA-D). Intervention plans may include both structured and naturalistic behaviour analytic teaching procedures. Behaviour analysts should make clinical decisions about which types of behaviour analytic procedures are appropriate on a case-by-case basis. Factors to consider when selecting appropriate procedures include the type of skill being taught (e.g., play and social-communication skills may be best taught using behaviour analytic naturalistic teaching procedures, early academic skills may be best taught using structured behaviour analytic teaching procedures) and the individual's responsiveness to different teaching procedures, as indicated by data based on direct observation. Similarly, methods of evaluation consistent with a behaviour analytic framework, including ongoing direct assessment of intervention outcomes, should be used to make decisions related to dosage and duration of treatment.

Recommendation 2b: Individuals with ASD who have deficits across multiple skill domains and/or exhibit behavioural excesses that jeopardize health or safety should receive comprehensive ABA interventions.

Commentary: Comprehensive ABA interventions, such as EIBI for young children with ASD, tend to be intensive (30 – 40 hours per week), target multiple goals across multiple domains simultaneously, and incorporate a large number of ABA procedures. The BACB (2014) indicated that comprehensive intervention might also be appropriate for older individuals with ASD, particularly those who exhibit severe behavioural excesses across environments (e.g., aggression, repetitive behaviour, self-injury).

Recommendation 2c: Comprehensive and focused ABA interventions should start as early as possible following a diagnosis of ASD.

Recommendation 2d: Comprehensive ABA intervention should also be offered to toddlers at risk for ASD.

Commentary: There is evidence that the earlier intervention begins, the better the longer-term outcome of intervention. At times, early indicators of ASD may be identified (e.g., delay in communication development, deficits in joint attention). The child may then be referred for a diagnosis that may take many months to complete. The BACB (2014) and CalABA (2011) recommended that ABA interventions might be warranted before formal diagnosis in some cases. Behaviour analytic naturalistic teaching procedures may be particularly beneficial for this age group. These procedures involve child choice (i.e., the child initiating the response), teaching a variety of early social and communication skills within a play-based setting (i.e., less "structured" setting), and delivering reinforcers that are functionally related to the teaching context.

3. WHO SHOULD DEVELOP AND SUPERVISE ABA INTERVENTIONS?

Recommendation 3a: ABA interventions should be developed and supervised by a Board Certified Behavior Analyst (BCBA or BCBA-D) with experience in the application of ABA interventions for individuals with ASD.

Commentary: The Autism Special Interest Group of the Association for Behavior Analysis (2007; 2013) indicated that a BCBA credential is a necessary, but not sufficient qualification for professionals to direct ABA intervention for individuals with ASD. They indicated that supervisors of ABA interventions for persons with ASD also need to have received extensive supervised experience in the field (i.e., minimum 5 years), and additional training on the design, monitoring, and supervision of ABA interventions. Guidelines for service provision should define competency (e.g., minimum 1-3 years supervisory experience, programming for at least 8 individuals with ASD with a range of profiles and ages, training a sufficient number of family members and service implementers, and experience with a variety of ABA procedures across multiple environments, etc.).

(For a detailed description of required qualifications readers are directed to the Association for Behavior Analysis International Autism Special Interest Group – Consumer Guidelines, 2013; http://www.asatonline.org/pdf/sig.pdf).

Recommendation 3b: An appropriately qualified BCBA/BCBA-D who is supervising ABA interventions for persons with ASD should not be required to be supervised by another professional such as a psychologist, physician, occupational therapist, social worker, or speech and language pathologist.

Commentary: In previous decades (including during the inception of the Autism Intervention Program) the limited number of BCBAs/BCBA-Ds in Ontario may have been a rationale for external supervision; however, as of 2016, Ontario has one of the highest per capita concentrations of BCBAs worldwide.

The BCBA certification is a distinct credential in the independent professional practice of ABA with competencies, education and experiential requirements, and a legally and psychometrically validated professional examination in ABA, all derived from multiple job analysis studies involving thousands of professional behaviour analysts. The BACB has developed the Professional and Ethical Compliance Code for Behavior Analysts, which it enforces with all individuals to whom the BACB issues credentials in order to protect the public. There is no reason why other professionals should be required to supervise BCBAs in Ontario. Although there are some exceptions, professionals in other disciplines typically do not have the training and competence that the profession of behaviour analysis has determined to be necessary to practice ABA. In fact, professionals in other disciplines supervising the delivery of ABA services may (a) jeopardize client outcomes and, (b) be at risk of violating their professions' codes of ethics.

Recommendation 3c: Behaviour analysts in Ontario should be publicly regulated as a separate profession in the Province.

Commentary: Currently, anyone in Ontario may indicate to clients, policy makers, and funders that he or she is a behaviour analyst despite not meeting the international standards established by the profession (i.e., BACB certification). With the increased use of ABA interventions, clients must be protected by public regulations restricting who can use the titles associated with the delivery of behaviour analytic services.

Recommendation 3d: The hours of supervision of ABA interventions by an appropriately qualified BCBA or BCBA-D should constitute between 10 and 20% of the actual hours of the intervention. Under strict guidelines to prevent overextension and to ensure competency, some of this supervision may be delegated to a BCaBA.

Commentary: Supervision of ABA interventions is direct and intensive compared to other service models, many of which use a consultation model. Supervision of ABA interventions, especially comprehensive ABA interventions, is typically provided in a tiered fashion with an appropriately qualified behaviour analyst supervising staff, some of who may directly implement the interventions and others who, in turn, supervise direct staff who implement the intervention. The BACB (2014) indicated that, on average, 2 hours of supervision should be provided for every 10 hours of intervention with at least half the supervision constituting direct supervision activities such as direct observation of the intervention in real time, reviewing daily data to revise programming, demonstrating techniques, and directing staff in program implementation. Additionally, the BACB indicates that the "ratio of case supervision hours to direct treatment hours reflects the complexity of the client's ASD symptoms and the responsive, individualized, data-based decision-making which characterizes ABA treatment" (p.34). A number of factors increase or decrease case supervision needs on a shorter- or longer-term basis."

4. WHO SHOULD IMPLEMENT ABA INTERVENTIONS?

Recommendation 4a: Practitioners who implement ABA interventions with individuals with ASD should only do so with demonstrated competence and under the training and supervision of an appropriately qualified BCBA or BCBA-D.

Commentary: Decisions about who can implement ABA interventions should be based on demonstrated competence (BACB, 2014; CalABA, 2011, MNABA, 2012), as determined by the responsible supervisor. There are a number of colleges and universities in Ontario, which offer a course sequence approved by the BACB that if passed, in addition to accumulating supervised practice, will enable individuals to write an exam for the BCaBA or BCBA credential. In addition, the BACB issues a Registered Behavior Technician (RBT) credential to those who have a secondary education, received specific behaviour analytic training, and pass both a competency-based assessment and a written objective exam in ABA. Many other implementers come from a variety of educational and work experiences and have successfully completed competency-based training. Anyone directly implementing ABA interventions, including RBTs or BCaBAs, must be supervised by a BCBA or a BCBA-D per BACB standards.

5. HOW SHOULD CLINICAL DECISIONS FOR ABA INTERVENTIONS BE MADE IN GENERAL AND MORE SPECIFICALLY FOR: ELIGIBILITY, INTENSITY, DURATION, TRANSITION PLANNING, GOAL-SELECTION, OUTCOMES, AND SETTINGS?

Recommendation 5a: In general, all clinical decisions on the determination and delivery of ABA interventions should be based on direct, empirical, and frequent assessment of behaviour change. Accordingly, appropriately qualified BCBA-Ds and BCBAs should lead the decision making process.

Commentary: The core of applied behaviour analysis is its reliance on direct and frequent measurement for clinical decision-making.

Recommendation 5b: Eligibility – ABA interventions should be provided to individuals diagnosed with ASD and young children at risk for ASD, with or without comorbid disorders (e.g., intellectual disability). These decisions must be based on direct assessment of behavioural excesses and skill deficits that contribute to challenges across multiple domains.

Commentary: There has been no upper age limit established for the effectiveness of ABA interventions (BACB, 2014). In addition, ABA interventions reviewed in this report were shown to be effective for many individuals with ASD, including those with intellectual disability or other comorbid diagnoses.

Recommendation 5c: Intensity – A direct assessment of the complexity, severity, and nature of individual needs, as well as the number of intervention targets across domains, should be used to determine the scope and quantity of ABA interventions.

Commentary: The BACB (2014) recommended that comprehensive ABA intervention consist of between 30 and 40 hours of 1:1 intervention per week. The CalABA guidelines (2011) suggested lesser amounts for toddlers (e.g., 10-20 hours). The BACB recommended that focused ABA interventions, that may consist of one or more interventions, range from 10 to 25 hours a week with the possibility of more hours for those demonstrating behavioural excesses.

Recommendation 5d: Duration – The duration of ABA interventions should be determined using methods of evaluation consistent with a behaviour analytic framework, including ongoing direct assessment of intervention outcomes with demonstration that the individual receiving intervention is making adequate progress toward program goals. As long as the individual is demonstrably improving because of the intervention and relevant goals remain, services should not be arbitrarily discontinued.

Recommendation 5e: Discharge – Discharge from ABA interventions should be considered when: (a) the individual has completed intervention goals identified during a collaboration between the supervising behaviour analyst, the individual receiving services, and their family; (b) the child is no longer meeting the criteria for ASD; (c) there is no evidence of mastery of goals or targets over successive review periods (using methods of evaluation consistent with a behaviour analytic framework); and/or (d) the family wishes to discontinue intervention (BACB, 2014; CalABA, 2011).

Commentary: Comprehensive ABA interventions have been recommended for an average duration of 2 to 4 years, after which caregivers, in collaboration with the ABA provider, may identify ongoing/additional intervention goals. Depending on the nature and number of goals other focused ABA interventions may be warranted.

If gains are not being observed, careful consideration should be given to intervention variables that may impact progress, such as the integrity of implementation, mediator involvement, intervention dosage, and the appropriateness of goals selected. Steps should be taken to identify environmental conditions that may interfere with implementation and attempts made to reduce these constraints (BACB, 2016).

Recommendation 5f: Transition Planning – Transitions from one service type or setting to another should be carefully planned. The caregivers, supervising behaviour analyst, and those in the receiving settings should be directly involved in the determination of a transition plan of an individual with ASD from one setting to the next. Transition plans should be based on: (a) ongoing assessment of the behaviours and skills of the individual with ASD that are needed for the next settings, (b) establishment of objective, measurable goals / criteria the individual should achieve prior to transition, (c) identification of ABA interventions required in the current setting in order to meet the established goals and prepare for the next settings, (d) identification of ABA interventions needed in the next setting, (e) strategies for the transition itself, and (e) fading out of ABA intervention if the transition is towards discharge.

Commentary: Behaviour analysts should work to equip parents, educators, and other practitioners with the tools and techniques required to promote the best possible outcomes in the discharge location. Individuals with ASD should have the opportunity to develop the required skills for success in the next setting prior to transition.

Recommendation 5g: Goal-setting – Goals of ABA interventions are set (and revised frequently) using methods consistent with a behaviour analytic framework, and determined jointly by the supervising behaviour analyst and caregivers.

Commentary: Goals selected should target core symptoms of ASD and other outcomes that are expected to improve quality of life (e.g., reduction of behavioural excesses that interfere with safe, independent functioning; development of adaptive skills). These goals may be informed by: caregivers' preferences, consultation with other professionals, and a variety of

assessment measures. All specific skills selected to become intervention goals should then be assessed regularly using methods consistent with a behaviour analytic framework (i.e., direct observation).

Recommendation 5h: Outcome Measurement – The effectiveness of ABA interventions for an individual with ASD should be determined by comparing direct data on the person's skills and behaviours to measurable objectives that were previously set through collaboration between the individual, caregivers, and the supervising behaviour analyst.

Commentary: In many focused ABA interventions, the expected outcome may be mastery of a skill set (e.g., able to use transit independently) or the elimination of excessive behaviour (e.g., reduction in tantrum behaviour). The primary measures of outcome, or whether the focused ABA intervention has been effective, should be based on specific, observable, and direct data using individualized assessments tailored to the goal. Comprehensive ABA interventions are often comprised of many focused ABA interventions. As such, progress on individual targets should be measured similarly. In comprehensive ABA interventions, specifically, one of the goals may be to change a child's developmental trajectory, which may involve comparing a child's previous rate of acquisition of a broad range of developmental skills, to his or her rate of acquisition during the intervention. As standardized assessment may not be sensitive to meaningful individual changes, they should not be the sole measure of individual outcomes (BACB, 2014).

Recommendation 5i: Settings – ABA interventions, including both focused and comprehensive ABA interventions, should not be restricted to clinical settings. Rather, ABA interventions should take place in all necessary environments, including the home, community, early childhood, school and vocational settings. Close consultation and collaboration between the supervising behaviour analyst and professionals in the other settings should be a priority across government divisions and programs.

Commentary: ABA interventions are not specific to any one setting. Generalization of behaviour changes achieved within ABA interventions depends on their application with a variety of people, in a variety of settings, among other factors. Generalization is improved when there is regular communication and information sharing between involved professionals (i.e., the ABA intervention team and school staff). To facilitate success, collaboration should include opportunities for the behaviour analyst to directly observe the individual in relevant settings, including the home, early childhood, school, and vocational settings, as well as other professionals to observe the individual in relevant ABA intervention settings. Other professionals should be provided with appropriate support and ongoing supervision by appropriately credentialed behaviour analysts to facilitate the use of evidence-based interventions within their settings, including appropriate policies, systems, training, and resources.

ABA interventions, including both focused and comprehensive ABA interventions should be provided in schools when needed. Both the NAC (2009, 2015) and the NPDC (2014) indicated that ABA interventions are effective for improving academic, play, and other skills, that are common targets for children in school or early childhood settings.

6. SHOULD ABA INTERVENTION BE COMBINED WITH OTHER SERVICES?

Recommendation 6a: Behaviour analysts should coordinate ABA intervention with other services an individual with ASD may be receiving, such as speech and language pathology and medical treatment.

Commentary: With caregiver consent, coordination may involve sharing of assessment information, inviting input into goal setting, or sharing information on intervention effectiveness. In the delivery of behaviour analytic interventions, the behaviour analyst should take the lead coordinating with other professionals when needed. In this situation, behaviour analysts must remain committed to data-based decision-making, scientifically validated interventions, and their code of ethical conduct.

Although ABA services should be coordinated with other professional services, ABA interventions should **not be combined** with other interventions into "eclectic" interventions which, according to the BACB (2014), do not constitute ABA interventions. Group design studies have clearly shown comprehensive ABA interventions to be superior to "eclectic" services (e.g., Eldevik et al., 2010; Howard et al., 2014). As individuals with ASD frequently present with a variety of co-morbid disorders (Doshi-Velez, Ge, & Kohane, 2014), a multidisciplinary approach may be indicated and beneficial (e.g., neurology to treat and monitor co-morbid epilepsy). However, given that the evidence base for the treatment of ASD is predominantly behaviour analytic, it is imperative that qualified behaviour analysts direct decisions related to service delivery, evaluation, and review.

7. WHAT ROLE SHOULD PARENTS HAVE IN ABA SERVICES?

Recommendation 7a: Parents of individuals with ASD, along with the individuals themselves, if capable, should be recognized as the central decision-makers and be integrally involved in goal setting with the supervising behaviour analyst and other members of the ABA intervention team.

Commentary: As the legal guardians of an individual with ASD, parents are not only important partners in the planning for their child's service plan but need to be recognized as the most important party in setting goals for their child.

Recommendation 7b: Parents should be encouraged to be as involved as possible in the generalized application of ABA intervention at home and in the community.

Commentary: Parents are members of the intervention team. Generalization of the skills and behaviours targeted in ABA interventions to the home is unlikely to be achieved without the ongoing and consistent involvement of parents. There should be an appropriate range of options for parent training, coaching, and support that take into account program goals and caregiver preferences and capacities.

8. WHAT SHOULD BE THE MECHANISM FOR RESOLUTION OF DISPUTES?

Recommendation 8a: Disagreements between parents of an individual with ASD and the funder of ABA interventions on eligibility, intervention type, intensity, or discharge should be resolved by committees that are: (a) local; (b) independent from the funder, provider, and parent; (c) composed mainly of expert-level behaviour analysts; and (d) capable of responding rapidly (e.g., 1 month rather than 6 months).

Commentary: Prior to receiving ABA intervention, there is a decision process for determining the eligibility for intervention, the type and amount of intervention, and subsequently, the discharge from ABA interventions. Differences of opinion may occur between the funder of services and the ABA provider or between the funder of services and the parents. Differences of opinion between the funder and the ABA provider would not proceed unless the parents are in agreement with the provider. Differences between the parents and provider are resolved between those two parties or by parents finding a new provider.

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APPENDIX A

TASK FORCE MEMBER BIOGRAPHIES

Julie Koudys, Ph.D., C. Psych., BCBA-D (Chair)

Dr. Koudys is an Assistant Professor, and Clinical Coordinator, at Brock University in the Centre for Applied Disability Studies. She has worked with individuals with ASD, intellectual disabilities, and communication and behavioural disorders for over 15 years. Dr. Koudys teaches graduate level course work in ABA. Her research interests include treatment fidelity and child outcomes following participation in IBI and Augmentative Alternative Communication (AAC) training. Her clinical experience includes work within government programs, such as IBI/ABA services, educational and residential services, children's mental health, and hospital settings, including McMaster Children's Hospital and the Children's Hospital of Eastern Ontario. As the former Director of Pyramid Educational Consultants of Canada, she provided consultation and training in ABA and AAC in a diversity of service sectors across Canada.

Louis Busch, BST, M.Ed, BCaBA (ex-officio)

Louis Busch is a Behaviour Therapist with the Complex Care and Recovery Program at the Centre for Addiction and Mental Health and President of the Ontario Association for Behaviour Analysis. Louis has over 10 years of experience applying the science of behaviour to address socially significant behaviour of adults living with autism, acquired brain injury, developmental disability, dual diagnoses, and mental health disorders within community and tertiary care settings. Louis' clinical interests include the assessment and treatment of severe problem behaviour and the application of behaviour analytic technologies to build habilitative environments within the forensic mental health system. Louis' research interests include behaviour analytic educational strategies for training human service providers, delay discounting in mental health populations, and the application of metacontingency as a conceptual framework for interprofessionality

Joel Hundert, Ph.D., C. Psych., BCBA-D

Dr. Joel Hundert is Director of Behaviour Innovations, Associate Clinical Professor Department of Psychiatry and Behavioural Neurosciences, McMaster University. He was President of the Ontario Association For Behaviour Analysis, served as a Director on the Behavior Analyst Certification Board for six years, and continues to serve as chair of the BACB disciplinary committee. Dr. Hundert is a clinical psychologist and Board Certified Behavior Analyst – Doctoral level. From 1999 to 2003, Dr. Hundert developed and directed the training of Instructor Therapists in the Ontario Autism Initiative.

Nancy Marchese, M.A., C. Psych., BCBA

Nancy is the Executive Director and Founder of Breakthrough Autism. She has been working in the field of Behaviour Analysis for over 18 years. A Board Certified Behavior Analyst

and Clinical Psychologist, Nancy clinically supervises focused and comprehensive ABA interventions for children and adolescents with Autism Spectrum Disorder. She also works closely with their families offering customized ABA caregiver coaching. Throughout her career, Nancy has conducted ABA training for hundreds of Instructor Therapists and Supervisors across Ontario.

Adrienne Perry, Ph.D., C. Psych., BCBA-D

Dr. Perry is currently a full Professor and Director of the Graduate Program in the Department of Psychology at York University. She has 32 years experience in the autism and behaviour analysis field, beginning at the TRE-ADD program at Thistletown Regional Centre in 1984. Dr. Perry worked as Consulting Psychologist to the Ministry in the initial design of the Ontario IBI program in 1998 and chaired the Clinical Directors' Network during the first few years of program implementation. She has also served as Expert Witness in court cases and human rights cases and served on the Expert Clinical Panel and Benchmarks Development Panel. Together with her students and colleagues, she has undertaken a program of research on the effectiveness of the Ontario EIBI program and developed quality assurance measures for evaluating the quality of service.

Stasia Rossinsky, M.ADS., BCBA

Stasia Rossinsky is a Board Certified Behavior Analyst with over 12 years of experience in the provision of behavioural intervention to children and adolescents diagnosed with Autism Spectrum Disorder. Stasia is currently a Clinical Supervisor in the Autism Intervention Program at Surrey Place Centre. In addition to providing clinical supervision and oversight of the implementation of intensive behavioural intervention in a centre-based program for children with autism, Stasia is responsible for the design and delivery of training on the intensive implementation of ABA to new therapists hired into the program. Stasia's clinical experience includes the use of ABA in the treatment of severe problem behaviour in adolescents in a school-based setting in the TRE-ADD program at Surrey Place Centre, as well as research on feeding and toileting interventions for young children with autism.

Kimberley Zonneveld, Ph.D., BCBA-D

Dr. Zonneveld is currently an assistant professor in the Centre for Applied Disability Studies at Brock University. She has worked with individuals with intellectual and developmental disabilities, including autism spectrum disorders, in the field of behaviour analysis for over 15 years. Dr. Zonneveld received her Ph.D. from the University of Kansas in Behavioral Psychology (with an emphasis in Behaviour Analysis). Prior to earning her Ph.D., she completed doctoral coursework at the University of Nevada Reno and earned her master of science degree (with an emphasis in applied behaviour analysis) at Florida Institute of Technology. Her clinical and research interests include autism and other intellectual and developmental disabilities, early intensive behavioral intervention, parent and teacher training, and assessment and treatment of problem behaviour (e.g., aggression, self-injury, pediatric feeding disorders).

APPENDIX B

MISCONCEPTIONS ABOUT ABA

Children and adolescents with ASD, and their families, require effective services at critical periods of time in order to achieve best outcomes. As mentioned previously, the majority of evidence-based interventions are derived from the field of behaviour analysis. However, as behaviour analysis is a relatively new professional field in Ontario and is unfamiliar to many, there is a paucity of clear information on the topic. Unfortunately, this has resulted in the development of several misconceptions about ABA. Left unchecked, these misconceptions have the potential to (at best) confuse parents and practitioners, to (at worst) delay or prevent access to the most effective services, provided in the most effective manner, at the most critical time. The following information is intended to clarify these misconceptions for recipients of behaviour analytic services in the province of Ontario in order to facilitate access to effective treatment.

Misconception 1: ABA is Based on the Use of Punishment

Although in the very beginnings of the use of ABA for children with ASD, a punishment approach was included along with positive reinforcement approaches, the routine use of aversive stimuli to change problem behaviours or teach new skills is seldom used. The effectiveness of ABA for children with ASD relies on developing an engaging and instructive learning environment that can only be achieved through the careful arrangement of learning tasks and the strategic use of positive reinforcement.

Misconception 2: ABA is Only Problem Focused

Frequently, persons with ASD are referred to behaviour analysts when they are exhibiting behavioural excesses, such as self-injury and aggression. In fact, ABA interventions are very effective in preventing and/or reducing the occurrence of interfering behaviour. However, these changes are primarily made through the systematic teaching of cognitive, communication, daily-living and other adaptive skills, which often serve as functional replacements for problem behaviour. In fact, the core use of ABA with children with ASD is the arrangement of learning opportunities to develop positive behaviours and essential skills across all areas of development (e.g., speaking, playing with peers).

Misconception 3: ABA is a "Closed Door" Therapy That Does Not Involve Parents

Although parents are not always required to be present, it is essential for parents to be involved. Sometimes ABA is mistakenly perceived as a therapy where parents drop their child off in the morning and pick them up later, with parents having little awareness of or involvement in the therapy itself. In fact, there are at least two essential areas in which parents must be involved in the delivery of ABA for their child with ASD. The first is in the selection and refinement of objectives for their child and family. It is not possible to develop ABA programs for every single area of need presented

by a child with ASD. Some outcomes are more important to achieve than others, and there may be a particular order to address those outcomes that are selected as important to address. Parents must have input and agree with the instructional targets selected for their child.

The second essential area for parent involvement is learning ABA procedures that they can use to produce generalization of key child skills in the home and community. Maintenance of gains made in IBI, and generalization across settings, is unlikely to occur without these areas of parent involvement (Iovannone, Dunlap, Huber, Kincaid, 2003; Lovaas, Koegel, Simmons, & Long, 1973).

Misconception 4: IBI is Only Offered in Clinic Settings and is Not Integrated into Family Homes

Early examples of IBI tended to be provided in clinical settings, as the procedures were being developed and as many of the therapists consisted of undergraduate and graduate students (Lovaas, 1996). Although, centre-based models of IBI are common, IBI is also frequently delivered in homes, sometimes under the direct management of parents. There appears to be no difference in the effectiveness of home-based and centre-based IBI (Cohen, Amerine-Dickens, & Smith, 2006; Sallows & Graupner, 2005). IBI can also be implemented in childcare, preschool, and school settings in the community, as long as properly trained and supervised staff are available.

Misconception 5: Behaviour Analysis is not a Profession

Over the past 50 years, behaviour analysis has emerged as a distinct and separate discipline from psychology (Shook & Flavell, 2008). Now, there are separate university departments in behaviour analysis (e.g., Florida Institute of Technology, University of North Texas), a separate credentialing process (Behavior Analyst Certification Board), and separate professional organizations for behaviour analysts (e.g., Association for Behavior Analysis International; Association of Professional Behavior Analysts). In fact, a Board Certified Behavior Analyst may have a graduate degree in psychology, speech language pathology, education, or some other discipline, but must accumulate 39 graduate level education credits through an approved course sequence, be supervised by an appropriately qualified supervisor (i.e., a BCBA, BCBA-D) for 1500 hours, pass a written exam, and maintain continuing education credits. In Ontario, behaviour analysis is not yet a regulated health profession but it has been licensed as a distinct health profession in about 20 US states. Behaviour analysis is a profession that is emerging in Ontario.

Misconception 6: ABA Includes Highly "Structured" Procedures Only, Naturalistic Procedures are Not Used

Behaviour Analytic naturalistic teaching procedures have been researched extensively since the 1970's (e.g., Charlop-Christy & Carpenter, 2000; Gillett & LeBlanc, 2007; Hart & Risley, 1975; Koegel et al., 1980; Koegel, Bradshaw, Ashbaugh, & Koegel, 2014; Koegel, Carter, & Koegel, 2003; McGee, Morrier, & Daly, 1999; Rogers-Warren & Warren, 1980). These naturalistic teaching procedures involve capturing the child's motivation, reinforcing "natural speech production," and the delivery of reinforcers that

are functionally related to the child's behaviour and are available in the child's day-to-day environment (Charlop-Christy & LeBlanc, 1999). For example, a child who enjoys playing with dollhouses may be taught a variety of language skills and communicative gestures within the context of dollhouse-play activities (e.g., vocally requesting for the dolls, pointing to gain access to the doll, vocally describing the play scenario [e.g., "doll up" while the dolls walks up the stairs of the dollhouse], responding to "wh" questions such as "where is the doll?" by pointing to the doll, vocally requesting information using "wh" questions [e.g., "where's doll?"]). Importantly, these naturalistic procedures include the core elements of ABA (e.g., instructions, prompting, reinforcement, data collection, and data analysis) in less structured settings (e.g., play settings; Charlop-Christy & LeBlanc, 1999). Behaviour analytic naturalistic teaching procedures have long been demonstrated to develop play skills and increase spontaneous speech in young children with ASD (e.g., Charlop-Christy & Carpenter, 2000; Gillett & LeBlanc, 2007; Koegel et al., 1980; Koegel et al., 2014; Koegel et al., 2003; McGee et al., 1999; Rogers-Warren & Warren, 1980).

APPENDIX C

GLOSSARY OF TERMS

ABA Interventions: "Applied behavior analysis interventions are based on scientific research and the direct observation and measurement of behavior and the environment. Behavior analysts utilize contextual factors, motivating operations, antecedent stimuli, positive reinforcement, and other consequences to help people develop new behaviors, increase or decrease existing behaviors, and emit behaviors under specific environmental conditions" (BACB, 2012, p.3).

ABA Supports and Services: Minimal Focused Intervention: the current ABA service model delivered by the Ministry of Children and Youth Services. Intervention targets are generally selected from one of four areas: communication, daily living skills, social skills, and emotion/behaviour regulation. In general, ABA services are time limited (e.g., 8-10 weeks for 1-3 hours a week) and focus on one area of need best suited to the child, the family, and the service model.

ABAB Reversal Design: "An experimental design consisting of (1) an initial baseline phase (A) until steady state responding is obtained, (2) in initial intervention phase in which the treatment variable (B) is implemented until the behaviour has changed and steady state responding is obtained, (3) a return to baseline conditions (A) by withdrawing the independent variable to see whether responding 'reverts to levels observed in the initial baseline phase, and (4) a second intervention phase (B) to see whether initial treatment effects are replicated" (Cooper, Heron, & Heward, 2007, p.689).

Adaptive Function/Behaviour: "Adaptive behavior is the collection of conceptual, social, and practical skills that are learned and performed by people in their everyday lives." (http://aaidd.org/intellectual-disability/definition, 2017)

Applied Behaviour Analysis (ABA): consists of the use of scientific methodology to assess/understand and develop interventions to change behaviours of social significance and demonstrate that those interventions were responsible for the measured change in the behaviour (Baer et al., 1968; Cooper, Heron, & Heward, 2006; http://www.bacb.com). ABA can be applied to a wide range of human problems and is not limited to any particular diagnostic or age group.

Autism Spectrum Disorder (ASD): a psychiatric diagnostic category of a disorder characterized by persistent deficits in social communication, and restricted, repetitive behaviours or activities (see American Psychiatric Association's Diagnostic and Statistical Manual, Fifth Edition [DSM-5] for actual diagnostic criteria).

Baseline: A condition where no experimental or clinical changes have been made. In baseline, data are taken on a behaviour of interest prior to any intervention (Cooper, Heron, & Heward, 2007).

Behaviour Analysis: "Behavior Analysis is the scientific study of principles of learning and behavior. Two primary areas of study include the experimental analysis of behavior and applied behavior analysis" (https://bacb.com/about-behavior-analysis/).

Behavior Analyst Certification Board (BACB)®: a non-profit corporation that maintains an international certification program and ensures the standards and criteria for the credentialing process.

Behaviour Management/Modification: Behaviour-change procedures commonly employed to reduce the occurrence of problem behaviour. The focus of intervention is on the use of consequences, including reinforcement and punishment, to reduce behaviour, with limited focus on the analysis of behaviour-environment interactions, including antecedents.

Board Certified Behavior Analyst (BCBA®): independent practitioners of behaviour-analytic services. Board Certified Behavior Analysts have a graduate degree, have completed supervised practice, have passed a certification exam and are in good standing with the BACB.

Chaining: "The term chaining refers to various methods for linking specific sequences of stimuli and responses to form new performances. In forward chaining, behaviours are linked together beginning with the first behaviour in the sequence. In backward chaining, the behaviours are linked together beginning with the last behaviour in the sequence." For example, to teach handwashing using forward chaining, a therapist could teach a learner how to turn on the sink, then how to put soap on their hands, etc. until all of the steps in hand washing are taught" (Cooper, Heron, & Heward, 2007, p.436).

Comprehensive ABA Interventions: These programs are typically very intensive (e.g., 35 hours per week) and comprehensive (i.e., targeting goals across domains simultaneously). They generally use a broad curriculum (e.g., communication, play, self-help, and academic goals) and may take place in centre-based programs, homes, schools, or clinics. It is important to understand that these programs incorporate a large number of more specific intervention methods such as PECS® to teach communication, peer-mediated strategies to teach play, modelling and prompting to teach prerequisite social skills, chaining to teach self-help skills such as making toast, and direct instruction to teach academic skills.

Developmental Trajectory: The rate at which a child is developing or gains skills over time. This is often displayed graphically, with age on the x axis and a standardized measure of developmental level (e.g., mental age, adaptive age, etc.) on the y axis. Many children with ASD have a slower rate of development than their peers. One of the goals of IBI is to alter the developmental trajectory (i.e., change the slope of the line) so that the child is learning or gaining skills at a faster rate than he/she was prior to intervention.

Direct Behavioural Assessment: Assessment methods where the clinician observes directly the behaviour within the environment where it occurs. This might include frequency, duration, trials to acquisition, and so on.

Direct Instruction: "A skills-based instructional package in which teachers promote the sequential development of student competencies by following scripted instructional routines. In doing so, teachers generally use small-group instruction and instructional strategies such as modeling and positive reinforcement. Furthermore, direct instruction lessons ensure that teachers

allow students to obtain sufficient practice with targeted material and receive frequent opportunities to respond with corrective feedback" (Fisher, Piazza, & Roane, 2011, p.393).

Early Start Services (Early Start ABA): A term used in some US jurisdictions to refer to ABA services which are appropriate for children under 3 years old, including both children with ASD and those at risk for an ASD diagnosis. This treatment model is essentially an extension of comprehensive ABA for younger children. It involves a minimum of 10-20 hours of ABA services per week and may be increased to 25 hours per week for children who have a diagnosis of ASD. After children turn 3 years of age or older, if they continue to present with gaps in their skill development across developmental domains, children could continue to receive comprehensive ABA.

Eclectic Model of Services (Combining ABA with Non-evidence-based Treatments): The combination of ABA services with other, non-behavioural services.

Emerging (Promising, Probably Efficacious) Treatments: Treatment methods for which the quantity and/or quality of research evidence supporting efficacy is weaker but somewhat positive. These approaches may go on to garner additional research which could help determine, one way or another, whether they are evidence based. In the meantime, they should either not be used or used only if other interventions have not worked or cannot be provided, and only with careful data-based monitoring of effectiveness and possible side effects.

Evidence-based Practice (Well-established Treatment): Evidence-based practice includes components of expert clinical judgment and patient/client values and context, but the heart of it is the fundamental assumption that decisions about use or non-use of particular treatments/interventions/practices should be based on the best available research evidence. Some behaviour analysts define evidence-based practice as "... a decision-making process that integrates (a) the best available evidence with (b) clinical expertise and (c) client values and context" (Slocum et al., 2014, p.44).

Experimental Control: Experimental controls are procedures in scientific experiments that reduce or eliminate extraneous factors that might affect the results of an experiment. In single case research design experimental controls are defined as: "The extent to which a researcher/clinician maintains precise control of the independent variable by presenting it, withdrawing it, and/or varying its value, and also by eliminating or holding constant all confounding and extraneous variables" (Cooper, Heron, & Heward, 2007, p.695).

External Validity: The extent to which a study's findings generalize to other individuals and "real-word" conditions, outside of the research setting.

Extraneous Variables: "Any aspect of the experimental setting (e.g., lighting, temperature) that must be held constant to prevent unplanned environmental variation" (Cooper, Heron, & Heward, 2007, p.695).

Focused ABA Interventions: These types of interventions are intended to address a specific skill deficit (e.g., communication skills, social initiation skills, using the toilet) or behavioural excess (e.g., tantrums, aggression) using specific operationally defined procedures and outcomes. These interventions may be used with individuals of any age and may take place in schools,

clinics, or home settings. They are not necessarily intensive. They are usually time-limited, being implemented until the goal is reached. Such interventions could possibly be implemented individually for a particular individual but, most often, an individual with ASD would be receiving multiple focused ABA interventions as needed.

Functional Behaviour Assessment: "A systematic method of assessment for obtaining information about the purposes (functions) a problem behavior serves for a person; results are used to guide the design of an intervention for decreasing the problem behavior and increasing appropriate behavior" (Cooper, Heron, & Heward, 2007; p.696).

Functional (Experimental) Analysis: "An analysis of the purposes (functions) of problem behaviour, where antecedents and consequences representing those in the person's natural routine are arranged within an experimental design so that their separate effects on problem behaviour can be observed and measured" (Cooper, Heron, & Heward, 2007, p.696).

Generalization: When a behaviour that was taught in one context occurs spontaneously or with minimum teaching in a similar, but un-taught context (i.e. with a different person, in a different environment, with a different stimulus (Fisher, Piazza, & Roane, 2011).

Group Design Studies: Research designs that involve group(s) of participants, often involving comparing an experimental group (who receive the intervention of interest) to one or more control / comparison groups (who receive no intervention or a different intervention). Scores on variables of interest (usually standardized measures, questionnaires, etc.) are analyzed statistically to determine whether the mean of the groups differ significantly across time and/or across groups.

Instructional Targets: Behaviour(s) that is (are) the focus of an intervention or treatment plan.

Intellectual Disability: Intellectual disability is a disability characterized by significant limitations in both intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills. This disability originates before the age of 18 (AAID, 2017).

(Early) Intensive Behavioral Intervention (IBI; EIBI): Comprehensive (between 20 and 40 hours a week) use of ABA in a comprehensive package for young children with ASD.

Individual Education Plan: "A written plan describing the special education program and/or services required by a particular student, based on a thorough assessment of the student's strengths and needs – that is, the strengths and needs that affect the student's ability to learn and to demonstrate learning" (Ontario Ministry of Education, 2004, p.6).

Inter-rater Agreement (Inter-observer Agreement; Inter-observer Reliability): "The degree to which two or more independent observers report the same observed values after measuring the same events" (Cooper, Heron, & Heward, 2007, p.698). A mean of 80% agreement by independent observers is generally accepted as sufficient.

Internal Consistency: A statistical measure of item homogeneity, considered a type of reliability for tests and questionnaires containing many items, consisting of the mean

inter-correlation of every item with every other item. Values can range from 0 to 1.00. Values over .80 are generally regarded as reliable.

Internal Validity: "The extent to which an experiment demonstrates that changes in behaviour are due to changes in the independent variable being manipulated, and not due to uncontrolled or unknown variables" (Cooper, Heron, & Heward, 2007, p.698).

Maintenance: "The extent to which a learner continues to perform the target behaviour after a portion or all of the intervention has been terminated" (Cooper, Heron, & Heward, 2007, pp.698-699).

Mediator/Caregiver Training: A component of both comprehensive and focused ABA intervention, or when appropriate a model for intervention, where the focus includes the development of the mediator's (e.g., parent, caregiver) behaviour analytic skills such that the mediator can implement strategies that facilitate socially significant changes for the individual with ASD.

Meta-analysis: A research method that combines results from a large number of scientific studies. The results obtained in a meta-analysis reflect the "average" effect that has been observed in these studies and the effect size representing the magnitude of the effect.

Multiple Baseline Design: A research design characterized by the measurement of two or more behaviours. An intervention is first applied to only one of the behaviours, while baseline measurement continues for other behaviours. When behaviour change has been observed, the intervention is then applied to the second behaviour. By introducing the intervention sequentially, researchers and/or clinicians can demonstrate that their intervention is the variable that is causing behaviour change rather than just the passage of time. (Cooper, Heron, & Heward, 2007).

Not/non-evidence-based (Unestablished) Treatments: Treatment methods that do not have research evidence supporting their efficacy. Sometimes, there is simply insufficient evidence (insufficient in amount and/or quality of evidence) about the method to draw any conclusion one way or another. In a few cases, treatments/interventions have been well studied (good quality and quantity of research) but found not to work (or potentially even to be harmful).

Operational Definition: An observable and measurable definition of behaviour (Cooper, Heron & Heward, 2007).

Policy/Program Memorandum No. 140: "The purpose of this memorandum is to provide direction to school boards to support their use of applied behaviour analysis (ABA) as an effective instructional approach in the education of many students with autism spectrum disorders (ASD). This memorandum establishes a policy framework to support incorporation of ABA methods into school boards' practices." (Ontario Ministry of Education, 2007).

Policy makers: Individuals who are actively involved in the development, revision or decision-making process of legislation regarding public supports.

Positive Reinforcement: "When a behaviour is followed immediately by the presentation of a stimulus that increases the future frequency of the behavior in similar conditions" (Cooper, Heron, & Heward, 2007, p.701).

Professional and Ethical Compliance Code for Behavior Analysts (BACB, 2016): In 2014, the BACB developed a set of codes organized into ten sections that described expectations for the ethical and professional practice of behaviour analysis. It forms the foundation of any disciplinary review that may occur. The "Code" was most recently updated March 21, 2016 and all BACB applicants, certificants, and registrants are required to adhere to the Code.

Punishment: "Occurs when stimulus change immediately follows a response and decreases the future frequency of that type of behaviour in similar conditions" (Cooper, Heron, & Heward, 2007, p.702). This is a technical construct in ABA and does not reflect the common sense of "punitiveness".

Randomized Controlled Trial (RCT): Group research design that involves randomly assigning participants to either the treatment or the control group, which is likely to mean there are no differences between the groups at the outset. One group receives the treatment; the other does not. If the treatment group improves and the control group (or placebo group) remains unchanged, then the treatment is said to be efficacious. In some types of studies (e.g., drug studies), participants are "blind" to the procedures of the experiment to reduce bias.

Blind: When the participants of a study do not know which group (i.e. the experimental or control) they have been assigned to (Cooper, Heron, & Heward, 2007).

Placebo: A pseudo-treatment given to a control group to minimize the chances that those in the control group realize they are, indeed, in the control group (Cooper, Heron, & Heward, 2007).

Registered Behavior Technician (RBT): Registered Behavior Technician is the BACB's newest certification, which is applicable for front-line service providers. "The Registered Behavior Technician™ (RBT®) is a paraprofessional who practices under the close, ongoing supervision of a BCBA, BCaBA. The RBT is primarily responsible for the direct implementation of behaviour-analytic services. The RBT does not design intervention or assessment plans. It is the responsibility of the RBT supervisor to determine which tasks an RBT may perform as a function of his or her training, experience, and competence. The BACB certificant supervising the RBT is responsible for the work performed by the RBT on the cases they are overseeing" (BACB, 2016).

Regulated Health Profession: A health care professional (e.g., physician, nurse, psychologist) who is regulated (licensed) under the ***Regulated Health Professions Act*** in Ontario. "This legislative framework establishes health regulatory colleges, which regulate the professions in the public interest. Health regulatory colleges are responsible for ensuring that regulated health professionals provide health services in a safe, professional and ethical manner. This includes, among other things, setting standards of practice for the profession and investigating complaints about members of the profession and, where appropriate, disciplining them" (Ministry of Health and Long-term Care, 2016).

Reliability: "Refers to the consistency of measurement, specifically, the extent to which repeated measurement of the same event yields the same values" (Cooper, Heron, & Heward, 2007, p.702).

Replication (Replicability): Repeating whole experiments to determine whether the findings will be the same. If results from a study are replicated by another researcher, we can be more confident in the accuracy of the findings.

Shaping: A teaching method that involves teaching closer and closer approximations of a final desired behaviour. For example, if the target for instruction was wearing mittens for the duration of recess, the therapist may begin by requiring the learner to only wear them for 5 seconds, and then 30 seconds, and then 1 minute, until the total time wearing mittens was increased to the duration of recess (Cooper, Heron, & Heward, 2007).

Single Case Research Design (SCRD): "Used to evaluate unambiguously the effects of the independent variable on the behavior. Demonstrates the relation between the experimental manipulation of a specific independent variable, or treatment, on the change in behavior (the dependent variable). Behavioral research designs based on repeated measurement of a behavior under the same and under different conditions of the independent variable (phases). During each phase, sufficient data are collected to depict a convincingly valid representation of the behavior under that condition. Sometimes referred to as intensive designs, [single-subject experimental designs], repeated measures, time series experimental designs or within-subject design; Alternating treatment design; Multiple baseline design; Reversal design; Withdrawal design." (Mayer, Sulzer-Azaroff, & Wallace, pp. 714-715).

Social Significance: Behaviors selected for treatment that have an impact on the quality of life of the individual. Changing a socially significant behaviour will allow that individual to engage more fully and meaningfully with the environment, and those in it (Cooper, Heron, & Heward, 2007).

Systematic Review: A review of existing literature that includes strict guidelines as to which studies will be included, and which will not. A critical analysis of the results of the studies included is then conducted.

Test-retest Reliability: "Test-retest reliability is computed from the scores that individuals obtain on the same test on two different occasions. The obtained correlation [between these scores] provides an index of the consistency, or replicability, of test scores over relatively short intervals, during which scores would not be expected to change" (Sattler, 2014, p.66).

Tiered Service Delivery Model: A model for supervision and service provision wherein supervision is layered, with supervisors having both their own supervisors, and supervisees. For instance, a BCBA may supervise a BCaBA. This BCaBA in turn supervises RBTs, making the BCaBA both a supervisor, and supervisee.

Treatment Responsiveness (Response to Treatment): An individual's progress in a given ABA program (comprehensive ABA intervention or focused ABA intervention) as indicated by skill and behavioural target acquisition.

APPENDIX D

DEFINITIONS OF INTERVENTION METHODS

The following definitions were taken directly from the NAC (2015) and NPDC (2014) reports, with the exception of 12 instances in which we determined the interventions discussed in both reports to be similar. In these 12 cases, we synthesized the definitions provided by both reports and denoted them with an asterisk (*).

Antecedent-based Intervention (NPDC, p. 49). Antecedent-based interventions (ABI) include a variety of modifications that are made to the environment/context in an attempt to change or shape a student's behavior. ABI are typically implemented after conducting a functional behavior assessment which can assist in identifying both the function of an interfering behavior, along with environmental conditions that may have become linked to a behavior over time. Once factors in the environment that may be reinforcing interfering behavior have been identified, ABI are implemented to modify the environment or activity so that the factor no longer elicits the interfering behavior. Common ABI procedures include: 1) modifying educational activities, materials, or schedule (e.g., incorporating student interest), 2) incorporating student choice in educational activities/materials, 3) preparing students ahead of time for upcoming activities (e.g., priming), 4) varying the format, level of difficulty, or order of instruction during educational activities (e.g., varying high and low demand requests), 5) enriching the environment to provide additional cues or access to additional materials (e.g., visual cues, access to sensory stimuli), and 6) modifying prompting and reinforcement schedules and delivery (e.g., varying access to reinforcement prior to educational activities). ABI strategies often are used in conjunction with other evidence-based interventions such as functional communication training, extinction, and reinforcement.

Behavioral Intervention (NAC, p. 43). The Behavioral Intervention category is comprised of interventions typically described as antecedent interventions and consequent interventions. Antecedent 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. Consequent interventions involve making changes to the environment following the occurrence of a targeted behavior. Many of the consequent interventions are designed to reduce problem behavior and teach functional alternative behaviors or skills through the application of basic principles of behavior change.

***Cognitive Behavioral Intervention** (NAC, pp. 45-46; NPDC, p. 52). Cognitive behavioral intervention (CBI) is based on the belief that behavior is mediated by cognitive processes. Learners are taught to examine their own thoughts and emotions, recognize when negative thoughts and emotions are escalating in intensity and then use strategies to change their thinking and behavior. These interventions tend to be used with learners who display behavior related to specific emotions or feelings, such as anger or anxiety. Cognitive behavioral interventions are often used

in conjunction with other evidence-based interventions including social narratives, reinforcement, and parent-implemented intervention (NPDC). Cognitive behavioral intervention package (CBIP) was previously listed as an emerging intervention in NSP1. With additional scientific evidence published since NSP1, CBIP has moved to the Established Intervention category. Cognitive behavioral therapy has long been an evidence-based intervention for individuals diagnosed with anxiety disorders and depressive disorders (i.e., without ASD; NAC).

Comprehensive Behavioral Treatment for Young Children (NAC, pp. 47). Comprehensive behavioral treatment for young children (CBTYC) programs involve intensive early behavioral interventions that target a range of essential skills which de ne or are associated with autism spectrum disorder (ASD) (e.g., communication, social, and pre-academic/academic skills, etc.). These interventions are often described as ABA (or applied behavior analysis), EIBI (or early intensive behavioral intervention), or behavioral inclusive programs. [Comprehensive behavioral treatment typically involves] intensive service delivery (typically 25-40 hours per week for 2-3 years) based on the principles of applied behavior analysis (ABA) [and is characterized by] data-based decision making that targets the defining symptoms of ASD. Typical interventions include the use of discrete trial teaching, incidental teaching, errorless learning, behavioral momentum, shaping, modeling and other interventions derived from ABA. Individualized instruction [is provided in] various settings (e.g., home, community, inclusive, and self-contained classrooms) and small group instruction.

Differential Reinforcement of Alternative, Incompatible, or Other Behavior (NPDC, p. 53). Differential reinforcement of alternative, incompatible, or other behavior (DRA/I/O) teaches new skills and increases behavior by providing positive/desirable consequences for behaviors or their absence that reduces the occurrence of an undesirable behavior, especially behaviors that interfere with the learner's learning, development, relationships, health and so on (e.g., tantrums, aggression, self-injury, stereotypic behavior). Through differential reinforcement the learner is reinforced for desired behaviors, while inappropriate behaviors are ignored. The learner is provided reinforcement when: a) the learner is engaging in a specific desired behavior other than the inappropriate behavior (DRA), b) the learner is engaging in a behavior that is physically impossible to do while exhibiting the inappropriate behavior (DRI), or c) the learner is not engaging in the interfering behavior (DRO). Differential reinforcement is often used with other evidence-based interventions such as prompting to teach the learner behaviors that are more functional or incompatible with interfering behavior, with the overall goal of decreasing that interfering behavior.

Discrete Trial Teaching (NPDC, p. 56). Discrete trial teaching (DTT) is a one-to-one instructional approach used to teach skills in a planned, controlled, and systematic manner. DTT is characterized by repeated, or massed, trials that have a definite beginning and end. Within DTT, the use of antecedents and consequences is carefully planned and implemented. The instructional trial begins when the adult presents a clear direction or stimulus, which elicits a target behavior. Positive praise and/or tangible rewards are used to reinforce desired skills or behaviors. Data collection is an important part of DTT as it provides teachers/practitioners with information about beginning skill level, progress

and challenges, skill acquisition and maintenance, and generalization of learned skills or behaviors. Other practices that are used in DTT include task analysis, prompting, time delay, and reinforcement.

Exercise (NPDC, p. 58). Exercise (ECE) is a strategy that involves an increase in physical exertion as a means of reducing problem behaviors or increasing appropriate behavior while increasing physical fitness and motor skills. With ECE, learners engage in a fixed period of programmed physical activity on a regular basis. ECE sessions often begin with warm-up exercises and end with cool-down activities and may include aerobic activities (e.g., jogging, jumping, swimming), strength training, and/or stretching that can take place indoors, outdoors, or at a swimming pool for aquatic exercise programs. ECE is often used in conjunction with prompting, reinforcement, and visual supports.

Extinction (NPDC, p. 59). Extinction (EXT) is a strategy based on applied behavior analysis that is used to reduce or eliminate a challenging behavior. The extinction procedure relies on accurately identifying the function of the behavior and the consequences that may be reinforcing its occurrence. The consequence that is believed to reinforce the occurrence of the target challenging behavior is [withheld], resulting in a decrease of the target behavior. An initial increase in the challenging behavior (often called an "extinction burst") is common before eventually being extinguished. Extinction should not be used in isolation. Other practices that are used in combination with extinction include differential reinforcement and functional behavior assessment.

Functional Behavior Assessment (NPDC, p. 61). Functional behavior assessment (FBA) is a systematic way of determining the underlying communicative function or purpose of a behavior so that an effective intervention plan can be developed. FBA consists of describing the interfering or problem behavior, identifying antecedent and consequent events that control the behavior, developing a hypothesis of the function of the behavior, and testing the hypothesis. Data collection is an important part of the FBA process. FBA is typically used to identify the causes of interfering behaviors such as self-injury, aggression towards others, or destructive behaviors and is usually followed by the creation and implementation of a behavior package to address the interfering behavior described.

Functional Communication Training (NPDC, p. 63). Functional communication training (FCT) is a systematic practice to replace inappropriate behavior or subtle communicative acts with more appropriate and effective communicative behaviors or skills. FCT is preceded by an FBA to identify the function of an interfering behavior followed by teaching an appropriate communication skill that may serve the same purpose for the learner with ASD. FCT often includes differential reinforcement procedure in which an individual is taught an alternative response that results in the same class of reinforcement identified as maintaining problem behavior. Problem behavior is typically placed on extinction. The distinct component of FCT is that the alternative response is a recognizable form of communication (e.g., a vocalization, manual sign, Picture Exchange Communication System®). FCT usually includes functional behavior assessment, differential reinforcement of alternative behavior, and extinction.

Language Training (Production) (NAC, p. 49). Language training (production) targets the ability of the individual with autism spectrum disorder (ASD) to emit a verbal communication (i.e., functional use of spoken words). Language training (production) was identified as an Emerging Intervention in NSP1 and, with the addition of three studies in NSP2, Language training (production) met criteria to be an Established Intervention. Language training (production) makes use of various strategies to elicit verbal communication from individuals with ASD. Language training (production) begins with appropriate assessment and identification of developmentally appropriate targets.

***Modeling** (NAC, pp. 51-52; NPDC, p. 65). Modeling involves the demonstration of a desired target behavior that results in imitation of the behavior by the learner and that leads to the acquisition of the imitated behavior. Modeling is often combined with other strategies such as prompting and reinforcement (NPDC). Children can learn a great deal from observing the behavior of parents, siblings, peers, and teachers, but they often need to be taught what behaviors should be imitated (NAC).

***Naturalistic Teaching Strategies** (NAC, pp. 53-54); **Naturalistic Intervention** (NPDC, p. 66). Naturalistic teaching strategies are a compilation of strategies that are used to teach children skills in their home, school, and community. The basic concepts include using materials in the environment and naturally occurring activities as opportunities to increase adaptive skills. These strategies are primarily child-directed (NAC). Naturalistic interventions involve a collection of practices including environmental arrangement, interaction techniques, and strategies based on applied behavior analysis principles. These practices are designed to encourage specific target behaviors based on learners' interests by building more complex skills that are naturally reinforcing and appropriate to the interaction (NPDC).

***Parent Training Package** (NAC, pp. 55-56); **Parent-implemented Interventions** (NPDC, p. 68). Parent training packages and parent-implemented interventions includes programs in which parents are responsible for carrying out some or all of the intervention(s) with their own child. Parents are trained by professionals one-on-one or in group formats in home or community settings. Methods for training parents vary, but may include didactic instruction, discussions, modeling, coaching, or performance feedback. Parents may be trained to teach their child new skills, such as communication, play or self-help, and/or to decrease challenging behavior. Once parents are trained, they proceed to implement all or parts of the intervention(s) with their child (NPDC). The Parent Training Package category is new to the NSP. The NSP1 focused on the elements of the interventions used in studies in which parents acted as therapist or received training to implement various strategies. NSP2 made the change to highlight parents' and caregivers' integral role in providing a therapeutic environment for their family members with ASD (NAC).

***Peer Training Package** (NAC, pp. 57-58); **Peer-mediated Instruction and Intervention** (NPDC, p. 70). Difficulty interacting appropriately with peers is a commonly reported characteristic of ASD. Further, children with ASD often rely on adults for prompting and guidance. Peer training packages facilitate skill growth for children with ASD by training peers on how to initiate and respond during social interactions with a child with ASD. These programs have been used in school

and community settings (NAC). Peer-mediated instruction and intervention (PMII) is used to teach typically developing peers ways to interact with and help learners with ASD acquire new behavior, communication, and social skills by increasing social opportunities within natural environments. With PMII, peers are systematically taught ways of engaging learners with ASD in social interactions in both teacher-directed and learner-initiated activities. Peers are paired or placed in cooperative learning groups that include at least one learner with ASD. PMII is a useful strategy for promoting positive transitions across settings (NPDC).

Picture Exchange Communication System® (NPDC, p. 72). The Picture Exchange Communication System® (PECS) is used to teach learners to communicate in a social context. Using PECS, learners are initially taught to give a picture of a desired item to a communicative partner in exchange for the item. There are six phases of PECS instruction: (1) "how" to communicate, (2) distance and persistence, (3) picture discrimination, (4) sentence structure, (5) responsive requesting, and (6) commenting.

***Pivotal Response Treatment®** (NAC, pp. 59-60) **Pivotal Response Training** (NPDC, p. 74). Pivotal Response Treatment® (PRT) is a naturalistic intervention based on the principles of applied behavior analysis to teach learners with ASD. PRT builds on learner initiative and interests, and is particularly effective for developing communication, language, play, and social behaviors. PRT was developed to create a more efficient and effective intervention by enhancing pivotal learning variables: motivation, responding to multiple cues, self-management, and self-initiations of social interactions. According to theory, these skills are pivotal because they are the foundational skills upon which learners with ASD can make widespread and generalized improvements in many other areas. Key procedures include child choice, reinforcement of attempts, incorporation of maintenance tasks, and direct/natural reinforcers contingent on appropriate behavior (NPDC). Also key to PRT is parent involvement in the home, community, and school settings (NAC).

Prompting (NPDC, p. 76). Prompting (PP) procedures include any help given to learners that assist them in using a specific skill. Verbal, gestural, or physical assistance is given to learners to assist them in acquiring or engaging in a targeted behavior or skill. Prompts are generally given by an adult or peer before or as a learner attempts to use a skill. These procedures are often used in conjunction with other evidence-based practices, including time delay and reinforcement or may be integral parts of other evidence-based interventions such as pivotal response training, discrete trial teaching, and video modeling. Thus, prompting procedures are considered foundational to the use of many other evidence-based practices.

Reinforcement (NPDC, p. 79). Reinforcement (R+) is used to teach new skills and to increase behavior. Reinforcement establishes the relationship between the learner's behavior/use of skill and the consequence of that behavior/skill. This relationship is only reinforcing if the consequence increases the likelihood that the learner performs that behavior/skill. Reinforcement can be positive or negative. Positive reinforcement is the delivery of a reinforcer (i.e., something that the learner desires which may be tangible, edible, activity-based, interest-based, and so on) after the learner does the target skill or behavior. Positive reinforcement can also be implemented in the format of a token

economy program. Token economy programs systematically give learners access to tokens when targeted behaviors/skills are used. These tokens are exchanged for desired objects or activities that rein- force the learners' use of that behavior/skill. Negative reinforcement is the removal of an object or activity that the learner does not want (e.g., taking a break after finishing a set of math problems) when the learner does the identified behavior or skill. Reinforcement is a foundational evidence-based practice in that it is almost always used in conjunction with other evidence-based intervention (e.g., prompting, pivotal response training, discrete trial teaching, functional communication training).

Response Interruption / Redirection (NPDC, p. 83). Response interruption/redirection (RIR) involves the introduction of a prompt, comment, or other distractors when an interfering behavior is occurring that is designed to divert the learner's attention away from the interfering behavior and results in its reduction. Specifically, RIR is used predominantly to address behaviors that are repetitive, stereotypical, and/or self-injurious. RIR often is implemented after a functional behavior assessment (FBA) has been conducted to identify the function of the interfering behavior. RIR is particularly useful with persistent interfering behaviors that occur in the absence of other people, in a number of different settings, and during a variety of tasks. These behaviors often are not maintained by attention or escape. Instead, they are more likely maintained by sensory reinforcement and are often resistant to intervention attempts. RIR is particularly effective with sensory-maintained behaviors because learners are interrupted from engaging in interfering behaviors and redirected to more appropriate, alternative behaviors.

***Schedules** (NAC, pp. 61-62); **Visual Supports** (NPDC, p. 104). Visual supports (VS) are concrete cues that provide information about an activity, routine, or expectation and/or support skill demonstration. VS can provide assistance across activity and setting, and can take on a number of forms and functions. These include but are not limited to: photographs, icons, drawings, written words, objects, environmental arrangement, schedules, graphic organizers, organizational systems, and scripts. Visual supports are commonly used to: (a) organize learning environments, (b) establish expectations around activities, routines, or behaviors (e.g., visual schedules, visual instructions, structured work systems, scripts, power cards), (c) provide cues or reminders (e.g., conversation and initiation cues, choice making supports, visual timers, finished box), and (d) provide preparation or instruction (e.g., video priming, video feedback; NPDC). Schedules are one type of visual support that can be used for children with ASD to increase their independence and allow them to plan for upcoming activities. A schedule simply identifies the activities that must be completed during a given time period and the order in which the activities should be completed (NAC)

***Scripting** (NAC, pp. 63-64; NPDC, p. 85). Scripting involves presenting learners with a verbal and/or written description about a specific skill or situation that serves as a model for the learner. The main rationale of SC is to help learners anticipate what may occur during a given activity and improve their ability to appropriately participate in the activity. Scripts are practiced repeatedly before the skill is used in the actual situation. When learners are able to use the scripts successfully in actual situations, the script should be systematically faded. Scripting is often used in conjunction with modeling, prompting, and reinforcement (NPDC). Scripting was identified as an

Emerging Intervention in NSP1 and, with the addition of five studies in NSP2, Scripting met criteria to be an Established Intervention (NAC).

***Self-management** (NAC, pp. 65-66; NPDC, p. 87). Independence is greatly valued in our society because it increases the likelihood of success in any situation and setting. Self-management strategies have been widely used to promote independence with tasks in which adult supervision is not needed, accepted, or expected (NAC). Self-management is an intervention package that teaches learners to independently regulate their own behavior. Self-management involves teaching learners to discriminate between appropriate and inappropriate behaviors, accurately monitor and record their own behaviors, and reinforce themselves for behaving appropriately. Although learners may initially require adult support to accurately record behaviors and provide self-reinforcement, this support is faded over time. Self-management is often used in conjunction with other evidence-based interventions including modeling, video modeling, and visual supports (NPDC).

***Social Skills Package** (NAC, pp. 67-68); **Social Skills Training** (NPDC, p. 91). Social skills refer to a wide range of abilities including providing appropriate eye contact, using gestures, reciprocating information, initiating or ending an interaction. The challenges individuals with ASD face regarding socials skills vary greatly. The general goal of any social skills package intervention is to provide individuals with ASD the skills necessary to meaningfully participate in the social environments of their homes, schools, and communities (NAC). Social skills training involves group or individual instruction designed to teach learners to appropriately interact with typically developing peers. Most social skills meetings include instruction on basic concepts, role-playing or practice, and feedback to help learners acquire and practice communication, play, or social skills to promote positive interactions with peers (NPDC).

***Story-based Interventions** (NAC, pp. 69-70); **Social Narratives** (NPDC, p. 89). Social narratives are interventions that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responding. They are aimed at helping learners adjust to changes in routine and adapt their behaviors based on the social and physical cues of a situation, or to teach specific social skills or behaviors. Social narratives are individualized according to learner needs and typically are quite short, perhaps including pictures or other visual aids. Usually written in first person from the perspective of the learner, social narratives include sentences that detail the situation, provide suggestions for appropriate learner responses, and describe the thoughts and feelings of other people involved in the situation (NPDC). Story-based interventions identify a target behavior and involve a written description of the situations under which specific behaviors are expected to occur. Most stories aim to increase perspective-taking skills and are written from an "I" or "some people" perspective. The most well-known story-based intervention is Social Stories™ (NAC).

Structured Play Groups (NPDC, p. 93). Structured play groups (SPG) are interventions using small groups to teach a broad range of outcomes. SPG activities are characterized by their occurrences in a defined area and with a de- fined activity, specific selection of typically developing peers to be in the group, clear delineation of theme and roles by adult leading the [group], and prompting or scaffolding as needed to support the students' performance related to the goals of the activity.

Task Analysis (NPDC, p. 94). Task analysis (TA) involves breaking a complex or "chained" behavioral skill into smaller components in order to teach a skill. The learner can be taught to perform individual steps of the chain until the entire skill is mastered (also called "chaining"). Other practices, such as reinforcement, video modeling, or time delay, should be used to facilitate learning of the smaller steps. As the smaller steps are mastered, the learner becomes more and more independent in his/her ability to perform the larger skill.

***Technology-based Intervention** (NAC); **Technology-aided Instruction & Intervention** (NPDC, p. 96). Technology-aided instruction and intervention (TAII) are those in which technology is the central feature of an intervention that supports the goal or outcome for the student. Technology is defined as "any electronic item/equipment/application/or virtual network that is used intentionally to increase/maintain, and/or improve daily living, work/productivity, and recreation/leisure capabilities of adolescents with autism spectrum disorders" (Odom, Thompson, et al., 2013). TAII incorporates a broad range of devices, such as speech-generating devices, smart phones, tablets, computer-assisted instructional programs, and virtual networks. The common features of these interventions are the technology itself (as noted) and instructional procedures for learning to use the technology or supporting its use in appropriate contexts.

Note. A definition of technology-based intervention was not provided by the NAC; therefore, the above definition was taken directly from the NPDC document.

Time Delay (NPDC, p. 99). Time delay (TD) is a practice used to systematically fade the use of prompts during instructional activities. With this procedure, a brief delay is provided between the initial instruction and any additional instructions or prompts. The evidence-based research focuses on two types of time delay procedures: progressive and constant. With ***progressive time delay***, the adult gradually increases the waiting time between an instruction and any prompts that might be used to elicit a response from a learner with ASD. For example, a teacher provides a prompt immediately after an instruction when a learner with ASD is initially learning a skill. As the learner becomes more proficient at using the skill, the teacher gradually increases the waiting time between the instruction and the prompt. In ***constant time delay***, a fixed amount of time is always used between the instruction and the prompt as the learner becomes more proficient at using the new skill. Time delay is always used in conjunction with a prompting procedure (e.g., least-to-most prompting, simultaneous prompting, graduated guidance).

Video Modeling (NPDC, p. 101). Video modeling (VM) is a method of instruction that uses video recording and display equipment to provide a visual model of the targeted behavior or skill. The model is shown to the learner, who then has an opportunity to perform the target behavior, either in the moment or at a later point in time. Types of video modeling include basic video modeling, video self-modeling, point-of-view video modeling, and video prompting. ***Basic video modeling*** is the most common and involves recording someone besides the learner engaging in the target behavior or skill. ***Video self-modeling*** is used to record the learner displaying the target skill or behavior and may involve editing to remove adult prompts. ***Point-of-view video modeling*** is when the target

behavior or skill is recorded from the perspective of what the learner will see when he or she performs the response. ***Video prompting*** involves breaking the behavior into steps and recording each step with incorporated pauses during which the learner may view and then attempt a step before viewing and attempting subsequent steps. Video prompting can be implemented with other, self, or point-of-view models. Video modeling strategies have been used in isolation and also in conjunction with other intervention components such as prompting and reinforcement strategies.

APPENDIX E

DEFINITIONS OF INTERVENTION TARGET DOMAINS

Skills Increased. When designing interventions for individuals with ASD, it is essential for developmentally appropriate skills to be targeted for increase in order to support opportunities for independence and success across environments. Below is a list of the skills targeted for increase with evidence-based ABA interventions as reviewed by the two reports.

- **Social/Interpersonal** (NAC; NPDC). The behaviours within this category are those needed for enabling interactions with others, including physical and communicative engagement. These include social skills, group participation, reciprocal social interactions, maintaining friendships, social play, and social problem solving, to name a few. Examples of specific social skills include taking turns with a peer, sharing with others, and greeting others.
- **Academic** (NAC; NPDC). Academic skills involve behaviours required for successful participation in school environments. These skills may vary depending on the age and developmental level of the individual. For example, kindergarten-level skills may include tasks such as sequencing, letter and number identification, and rote counting. More advanced academic skills may include reading, writing, multiplication and division. Learning to count out objects from a set and learning to spell words accurately are examples of specific academic skills.
- **Communication** (NAC; NPDC). This area focuses on verbal and non-verbal skills needed for sharing information, expressing needs and wants, and exchanging ideas and emotions. Communication may take the form of sounds or symbols, which include verbal communication, the Picture Exchange Communication System® (PECS), or speech generating devices (SGDs), among others. Examples of behaviours targeted for increase include requesting preferred items/activities, labeling items/activities, receptive/listener skills, conversation skills, and nonverbal communication. A specific example of a targeted skill may be teaching a learner to use an alternative communication system such as PECS® to request a preferred item.
- **Cognitive/Higher Cognitive Functions** (NAC; NPDC). This area focuses on increasing the ability to acquire information and knowledge. Some examples of specific targets include organizational skills, theory of mind, memory, complex problem solving skills, and critical thinking.
- **Learning/School Readiness** (NAC; NPDC). The behaviours within this category determine the learner's ability to be successful within a school/group environment. These behaviours are prerequisites for many of the skills in some of the other areas discussed (e.g., academic tasks). For example, specific skills targeted for increase may include attending, staying on task, and following instructions. A specific goal may be teaching a learner to respond to two-step instructions that may be in context or not.

- **Motor** (NAC; NPDC). These skills include the coordinated use of muscles to complete an action. There are fine motor and gross motor skills. Fine motor skills involve small movements such as writing or tying shoelaces. Gross motor skills involve larger muscle movements such as running, sitting, crawling, jumping, and throwing/catching a ball. A specific fine motor goal that may be targeted within this domain would be using scissors to cut shapes from paper. An example of a gross motor goal would be learning how to kick a ball at a target (i.e., for coordinated play with peers).
- **Personal Responsibility/Adaptive** (NAC; NPDC). The behaviours within this domain focus on increasing practical skills needed for successful functioning in everyday life. This includes skills for involvement in, and independent completion of, daily activities and routines. Examples include self-help goals such as, independent dressing, grooming, toileting, sleeping, eating, and cleaning skills. Examples of goals for participation in activities in the environment include phone skills, time and money management, and leisure skills. An example of a specific target within this domain would be teaching the learner to prepare his or her own meal (i.e., making a sandwich, cooking eggs, etc.).
- **Play** (NAC; NPDC). This group of skills focuses on increasing appropriate engagement with a variety of non-work related activities and items, as well as interaction with others with those activities/items. Examples of play behaviours include teaching multi-step play activities and independent pretend play. An example of a specific target within this domain might be independent play with trains (i.e., setting up the track and trains and engaging in appropriate movements and vocalizations related to the train activity).
- **Self-Regulation** (NAC). This group of skills refers to the behaviours required for an individual to manage himself or herself appropriately while completing a goal/activity. Some examples of the targets associated with this domain include self-management, self-monitoring, time management, tolerating changes in activities/environment, and persistence. An example of a target in this domain would be using a checklist to remain on task for achieving a specific goal (i.e., sitting appropriately in group in order to participate in a group activity).
- **Joint Attention** (NPDC). This skill area is a sub-domain of the interpersonal domain described above. This skill defines the ability to coordinate attention between a person and an item/activity in order to share an experience.
- **Vocational** (NPDC). This domain focuses on the behaviours necessary for employment or successful employment itself. For example, a learner may be taught to sort items that belong together (i.e., cutlery, coffee cups, coffee cup lids, stir sticks, sugar packets, etc.) in order to be prepared for employment in a position where restocking may be necessary.

- **Placement** (NAC, 2015). Placement refers to the level of restrictiveness in a persons' educational, home or community placement, such as whether the individual has been placed in an integrated classroom setting or is able to be supported within the home environment. Placement is often determined by a variety of factors, such as geographical location, parent preference, and resource availability, which may vary by geographical region, service sector, etc. As such, it's validity as an outcome measure is unknown.

Behaviours Decreased. For individuals with ASD, there is often a need for interventions that are aimed at reducing behaviours that may interfere with daily functioning, completion of adaptive skills, inclusion in the community, or an inability to learn. Below is a list of the skills targeted for decrease with evidence-based ABA interventions as reviewed by the two reports.

- **Challenging Behaviours** (NAC; NPDC). These behaviours can be harmful and of concern for the individual with ASD (i.e., self-injurious behaviour), others around them (i.e., aggression), the environment (i.e., property destruction), or for participation in the community (i.e., loud screaming, disrobing in public).
- **Restricted, Repetitive, Nonfunctional, Interests** (NAC). This group of behaviours are repetitive behaviours that occur at high frequency and are maladaptive. These include motor movements, speech, and thoughts. Examples of these behaviours are circumscribed interests, inappropriate vocalizations (i.e., echolalia), compulsive behaviours, and stereotypy.
- **Sensory/Emotional Regulation** (NAC). These behaviours address the ability of individuals to respond appropriately to changes in the environment, to change their responses to adapt to the environment, and to control their level of arousal. An example in this category would be a learner engaging in disruptive/verbally aggressive behaviour as a result of losing a game with peers.

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