

Predictors of Behavioural Treatment Outcome for Young Children with Autism

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degree of Master of Arts

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Abstract

The purpose of this study was to investigate outcomes of autistic children (ages 4 to 10 years) who received home-based behavioural interventions, with a particular focus on factors associated with improved outcomes. Parents ($n = 16$) of children diagnosed with Autistic Disorder completed questionnaires and were interviewed to obtain information about their children's treatment histories and current levels of functioning. Treatment outcome was assessed using a measure of educational placement, the Autism Behavior Checklist (ABC) and the Vineland Adaptive Behavior Scales (VABS). Children with higher pre-treatment IQ scores scored significantly higher ($p < .01$) on the measure of educational placement than children with lower pre-treatment IQs. Children with highly qualified therapists scored significantly higher on the VABS than those with less qualified therapists. Non-significant trends were observed for treatment intensity and total treatment length. Results of a survey of 35 behaviour therapists are included. Suggestions are provided for future research.

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Predictors of Behavioural Treatment Outcome for Young Children with Autism

The purpose of this study was to examine the behavioural and social outcomes of autistic children who received home-based behavioural interventions with a particular focus on factors that may be associated with improved treatment outcomes. Factors which were hypothesized to influence a child's response to treatment include child characteristics (e.g. IQ), characteristics of the child's program (e.g. number of treatment hours per week), and characteristics of the child's treatment team (e.g. therapist education and experience). In addition, this study included a survey of behavioural program characteristics and of individuals who provide behavioural interventions to autistic children on a daily basis.

This paper will begin with an introduction to several issues relevant to the study of autism in childhood. First, factors related to diagnosis and etiology of Autistic Disorder are discussed. Next, the behavioural characteristics associated with autism are outlined. This section is organized according to the 3 main areas of dysfunction delineated in the DSM-IV: sociability, communication, and repetitive or restricted activities. Because autistic children typically show deficits in the areas of intellectual and adaptive functioning, previous research in these areas is then presented. In order to highlight the importance of identifying effective interventions for autism, research related to long-term outcomes of autistic individuals is then reviewed.

The next section provides an overview of treatments for Autistic Disorder with a particular focus on behavioural interventions. Several early studies which investigated

the utility of behavioural approaches in treating autistic children are described, followed by a detailed overview of the findings and criticisms of two of the most influential studies on behavioural interventions for autistic children (Lovaas, 1987; McEachin, Smith, & Lovaas, 1993). Finally, previous research regarding factors associated with improved treatment outcomes are reviewed in order to provide a specific context for the purpose of the current study. Following the introduction, the methods and results of the current investigation are presented.

Autism in Childhood

Autism is a developmental disorder, diagnosed in early childhood, characterized by pervasive dysfunction in three general areas: 1) social interaction and reciprocity; 2) communication and language; and 3) restricted interests and activities (American Psychiatric Association, 1994). In addition, intellectual deficits are common among autistic children, as Autistic Disorder (AD) frequently co-occurs with mental retardation (Bristol et al., 1996; Freeman, 1997; Mesibov, Adams, & Klinger, 1997). Results of studies typically suggest that autism is observed in approximately 2-5 per 10,000 individuals, and occurs three to five times more frequently in boys than girls (APA, 1994; Bryson, 1996; Volkmar, et al., 1994); however, there is considerable controversy in the literature regarding prevalence rates of Autistic Disorder. Children with autism demonstrate a great deal of variability in levels of functioning both between and within individuals (Bryson, 1996; Kasari, 2002). In many cases the prognosis for children diagnosed with autism is poor because the disorder is associated with deficits in so many

areas of functioning. Autism is often considered to be a lifelong disorder (Campbell, Schopler, Bueva, & Hallin, 1996; Freeman, 1997; Gresham & MacMillan, 1997a; Kazdin, 1993; Rogers, 1998).

Diagnosis

Autistic Disorder is one of several childhood disorders listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 1994) as a pervasive developmental disorder (PDD). The criteria outlined in the DSM-IV are the ones most commonly used to diagnose autism (Dempsey & Foreman, 2001). The other PDDs are Rett's Disorder, Childhood Disintegrative Disorder (CDD), Asperger's Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS) (APA, 1994). Some authors have shifted from their use of the term "PDD" in favour of the term Autism Spectrum Disorder (ASD); however, both of these terms encompass the same group of disorders (Lord & Risi, 2002). They are commonly described as a spectrum of disorders because children with these disorders display similar patterns of dysfunction (i.e. mental retardation, social dysfunction, unusual behaviours), and because the severity of these symptoms lies on a continuum from severe to mild, both between and within diagnostic categories. For example, as compared to children with autism, children with Asperger's Disorder often have higher intelligence and adequate language abilities but may display more perseverative behaviours or restricted interests (Ehlers et al., 1997; Volkmar et al., 1994).

Autism is a behaviourally defined disorder. In other words, a diagnosis of Autistic

Disorder is given based on whether certain observable behaviours are present or absent in the child (Freeman, 1997). Parents are generally first to notice these behaviours in their children, and then bring their concerns to the attention of clinicians (Yeung-Courchesne & Courchesne, 1997). In some cases, parents sense very early that something about their children is different. However, the majority of parents first voice their concerns when their children are about two years old (Aarons & Gittens, 1999; Bailey et al., 1996; Bryson, Clark, & Smith, 1988). In order to receive a diagnosis of Autistic Disorder, the onset of abnormal functioning must have occurred prior to age 3 years (APA, 1994).

Many types of instruments have been developed to help clinicians to identify and diagnose children with autism. These instruments can be grouped into four main categories: 1) rating scales (e.g., Childhood Autism Rating Scale, CARS; Schopler, Reichler, DeVellis, & Daly, 1980); 2) clinical interviews (e.g., Autism Diagnostic Interview; ADI; LeCouteur et al., 1989); 3) observational assessments (e.g., Autism Diagnostic Observation Schedule, ADOS; Lord et al., 1989); and 4) behaviour questionnaires or checklists (e.g., Autism Behavior Checklist, ABC; Krug, Arick, & Almond, 1993). Rating scales and checklists, including the CARS and the ABC, are the most commonly used assessment instruments for identifying children with autism (Eaves, Campbell, & Chambers, 2000; Miranda-Linne & Melin, 2002). Clinicians may use one or more of these types of instruments to aid in the diagnosis of AD (Sturmeijer, Matson, & Sevin, 1992; Yirmiya, Sigman, & Freeman, 1994).

Etiology

Although autism is defined in behavioural terms, the etiology of Autistic Disorder is thought to be largely biological in nature. It is widely accepted that genetics play a role in the development of AD (Bailey, Phillips, & Rutter, 1996; Bristol et al., 1996; Mesibov et al., 1997). Mesibov and colleagues (1997) reviewed twin studies and found that concordance rates for autism ranged from 36% to 91% in monozygotic twins; however, there were no sets of dizygotic autistic twins (i.e., both twins with autism) in any of the studies. Other family studies have indicated that the rate of autism in siblings of children with autism is between 3% and 8% (Bailey et al., 1996; Mesibov et al., 1997). Further evidence of a genetic component comes from the association between autism and known genetic disorders, most notably Fragile X syndrome, tuberose sclerosis, and phenylketonuria. Children with these genetic disorders display symptoms that are often observed in children with autism, such as mental retardation, social impairments, and repetitive behaviours (Bailey et al., 1996; Mesibov et al., 1997; Pelios & Lund, 2001; Yeung-Courchesne & Courchesne, 1997). In addition, a few children who are diagnosed with autism also have one these genetic abnormalities (Mesibov et al., 1997).

Another line of research which supports the notion of a biological component to autism comes from studies of brain structure and functioning. First, results of studies have revealed abnormalities in the cerebellum, hippocampus, the limbic system (e.g., amygdala, septum), and the cerebral cortex (Bailey et al., 1996; Bristol et al., 1996; Mesibov et al., 1997; Pelios & Lund, 2001). Second, some autistic people have been

found to have larger than average brain size and head circumference (Bailey et al., 1996; Bristol et al., 1996). Third, studies have found that autistic individuals have abnormal EEG patterns, and as many as 20-30% develop seizures by adulthood (Bailey et al., 1996; Mesibov et al., 1997). Finally, some individuals with autism have been found to have elevated levels of serotonin (Bailey et al., 1996; Mesibov et al., 1997).

Prenatal and perinatal complications are often reported in the histories of children with autism, more often than in siblings or groups of control children (Bristol et al., 1996; Mesibov et al., 1997). Risk factors include maternal age, premature birth, bleeding during pregnancy, and viral infection (Bristol et al., 1996). Mesibov et al. (1997) reported that autistic children are most likely to be first-born in two-child families, and in larger families, they tend to be fourth or later. One explanation that was put forward to explain this result was related to the mother's exposure to viral illnesses. It was proposed that while pregnant with their first-born children, mothers are more likely to be in the workplace, whereas mothers of four or more children may be more likely to contract illnesses from one of their school-aged children.

Although quite a bit of research has been conducted to try to develop a biological explanation for autism, there is little consistent evidence across studies (Bailey et al., 1996; Bristol et al., 1996; Mesibov et al., 1997; Yeung-Courchesne & Courchesne, 1997). In addition, many of the abnormalities that are observed are not specific to autism (Bristol et al., 1996). Although many researchers agree that autism is a neurobiological disorder with a genetic component, a specific abnormality has not been consistently

identified, and precise biological causes remain unclear (Mesibov et al., 1997; Bailey et al., 1996).

Behavioural Characteristics of Autistic Children

The first area of dysfunction that is associated with autism concerns social relations. Autistic children are often indifferent to other children and/or to adults and may even react negatively to physical contact and affection (Bryson et al., 1988). They are sometimes thought to have hearing impairments because of their lack of responsiveness to human voices (Aarons & Gittens, 1999). Many autistic children also tend to avoid eye contact and seem to demonstrate an inability to share interests and emotions with others. For example, they often do not use gestures, such as pointing, to engage joint attention with other people. Higher functioning autistic individuals may monopolize conversations, or abruptly end social interactions. They may lack emotional expressiveness, or display strong emotions at inappropriate times, and they often show a limited understanding of the emotions and thoughts of others. Finally, autistic children, even those who desire social relationships, tend to lack reciprocal friendships (Aarons & Gittens, 1999; Bailey et al., 1996; Bryson et al., 1988; Mesibov et al., 1997).

The second major area of dysfunction is related to communication and language. Results of some studies have indicated that at least one-third and as many as half of autistic children are mute or have no understandable speech (Bristol et al., 1996; Mesibov et al., 1997; Pelios & Lund, 2001; Volkmar et al., 1994; Wolf & Goldberg, 1986).

Children who do acquire some language abilities often have deficits both in their

understanding of speech (i.e., receptive language) and in their ability to appropriately use speech (i.e., expressive language) (Bristol et al., 1996; Stone, Ousley, Hepburn, Hogan, & Brown, 1999). Autistic children may have an unusual pitch or tone of voice, and their speech may have an atypical rhythm, sounding too rushed or too slow. In addition, autistic children commonly display specific speech abnormalities such as pronoun reversals (“I” instead of “you”) and echolalia (Aarons & Gittens, 1999, Bryson et al., 1988). *Immediate echolalia* involves repeating a word or phrase uttered by another person immediately after the other person speaks; *delayed echolalia* refers to repeating a word or phrase at a later time (Aarons & Gittens, 1999; Mesibov et al., 1997).

Autistic children’s use of language tends to be concrete. For example, they may possess an extensive labelling vocabulary but have difficulty with abstract language (e.g., sarcasm, jokes) (Aarons & Gittens, 1999; Bristol et al., 1996; Emerich, Creaghead, Grether, Murray, & Grasha, 2003). In addition, children with autism often do not use language (or even gesture) for communicative purposes (Mesibov et al., 1997; Pelios & Lund, 2001). Some authors have suggested that autistic children’s lack of social interest is a major factor in their failure to develop communicative language (Aarons & Gittens, 1999). Even children who appear to have adequate language abilities (e.g., they can imitate several lines from a movie with perfect pronunciation) often do not initiate or sustain conversations with others (Bryson et al., 1988; Mesibov et al., 1997).

The third area of dysfunction relates to autistic children’s limited interests and repetitive activities. Children with autism may engage in stereotypic behaviours such as

repeated body rocking, hand-flapping, jumping, or spinning (APA, 1994; Mesibov et al., 1997; Pelios & Lund, 2001). These actions are sometimes labelled *self-stimulatory* behaviours (Lovaas et al., 1980), and are commonly referred to as “stims” (Maurice, 1993) or “isms” (Kaufman, 1994). Occasionally, autistic children display serious self-injurious behaviours such as head-banging (Pelios & Lund, 2001; Wolf, Risley, & Mees, 1964). Play behaviours of many autistic children are non-social and repetitive in nature, often consisting of activities such as lining up objects, spinning wheels or other parts of toys, or watching videos (Aarons & Gittens, 1999). They may prefer to play with unusual objects (e.g., a straw), or with only one or two particular toys (Mesibov et al., 1997). Higher functioning children or adolescents may seem preoccupied with learning and talking about a particular subject such as meteorology or baseball (Pelios & Lund, 2001). Many children with autism display distress at even slight changes in daily routines or activities, and they often have very limited attention for activities that are not of particular interest to them (Aarons & Gittens, 1999; Bristol et al., 1996; Mesibov et al., 1997; Pelios & Lund, 2001).

Intellectual Functioning of Autistic Children

In the past, it was assumed that autistic children were not testable using standard measures of intellectual functioning. However, it was also believed that autistic children possessed a level of intelligence that was above what would be expected on the basis of their language deficits and unusual behaviour (Baker, 1983; DeMyer et al., 1974).

DeMyer and colleagues (1974) challenged these beliefs when they conducted a study to

evaluate autistic children's ($n = 115$) IQ scores and the stability of these scores over time. Their assessment consisted of items from the Stanford-Binet and the Cattell intelligence tests. When the children ($M_{\text{age}} = 5.32$ years) were initially evaluated, their mean IQ score was 45. Most of the sample (94%) scored in the range of mental retardation. The children were retested two to sixteen years later at a mean age of 11.45 years. There was a strong correlation between IQ scores at initial evaluation and follow-up ($r = .70$). The authors noted that this correlation was similar to those found with normal populations (DeMyer et al., 1974). It was concluded that autistic children were testable using standard measures, and that they had very low IQ scores that were stable over time.

More recently, researchers have used a wide variety of instruments and study designs to evaluate the intellectual functioning of autistic children. Tests are generally selected based on the participants' age, developmental level, and verbal ability (Freeman, Ritvo, Needleman, & Yokota, 1985; Schatz & Hamdan-Allen, 1995). Studies have found that at least 75% of autistic children score obtain very low scores (i.e., below 70) on measures of intellectual functioning (Bailey et al., 1996; Bryson et al., 1988; Freeman et al., 1985; Volkmar et al., 1987).

There is a great deal of heterogeneity in intellectual abilities of autistic children (Mottron, 2004). IQ scores of autistic children range from extremely low to above average. For example, performance IQs of autistic children in one sample ranged from 30 to 105 (Lord & Schopler, 1989b), and Stanford-Binet composite scores in another sample ranged from 44 to 127 (Mayes & Calhoun, 2003). In a study of high-functioning autistic

children, full-scale IQ scores ranged from 72 to 131 (Siegel, Minshew, & Goldstein, 1996). Because of this variability, researchers often group autistic children based on levels of intellectual functioning. In some studies, groups of high-functioning autistic children (IQ > 70) are compared with low-functioning autistic children (IQ < 70) (e.g., Freeman et al., 1991). Others have used cut-off IQ scores of 80 to categorize children as high- or low-functioning (Liss, Fein, et al., 2001; Liss, Harel, et al., 2001; Mayes & Calhoun, 2003).

A great deal of variability in intellectual ability is also found within individual autistic children. Close analyses of individuals' performances indicate that there is often significant variability among scores on the sub-tests of intellectual assessments. Some children with autism have been found to show specific patterns of strengths and weaknesses on the sub-tests of the WISC and Stanford-Binet IQ tests (Mayes & Calhoun, 2003; Mesibov et al., 1997; Siegel et al., 1996). Also, scores on certain sub-tests may be lower or higher than would be expected based on the child's overall level of ability. On the Stanford-Binet, for example, autistic children have been found to score highest on Bead Memory and lowest on Memory for Sentences (Mayes & Calhoun, 2003). Highest scores are observed on the Block Design sub-test of the WISC and lowest scores are observed on the Comprehension sub-test (Ehlers et al., 1997; Mayes & Calhoun, 2003; Mottron, 2004; Siegel et al., 1996). This pattern has also been observed in adults with autism (Howlin et al., 2004). However, there is currently insufficient empirical support for a profile that is uniquely characteristic of autistic children (Ehlers et al., 1997; Siegel

et al., 1996).

Adaptive Behaviour of Autistic Children

Another way to assess the functioning of autistic children is by measuring their adaptive behaviour (Bolte & Poustka, 2002; Carter et al., 1998; Freeman, Ritvo, Yakota, Childs, & Pollard, 1988). The authors of the *Vineland Adaptive Behavior Scales* (VABS; Sparrow, Balla, & Cicchetti, 1984) defined adaptive behaviour as “the performance of the daily activities required for personal and social sufficiency” (p. 6). Carter and colleagues (1998) suggest that an autistic individual’s level of adaptive functioning may be even more important than intellectual ability in determining that individual’s likelihood of achieving personal independence. Measures of adaptive behaviour allow for a direct assessment of the child’s ability to function in his or her environment (Liss et al., 2001). The VABS includes items reflecting child behaviour in the domains of communication, socialization, and daily living skills, and it has been used extensively in research with autistic children (e.g., Anderson et al., 1987; Bolte & Poustka, 2002; Fisch, Simensen, & Schroer, 2002; Freeman, Del’Homme, Guthrie, & Zhang, 1999; McEachin et al., 1993; Szatmari et al., 1994; Schatz & Hamdan-Allen, 1995; Stone et al., 1999; Volkmar, Carter, Sparrow, & Cicchetti, 1993; Weiss, 1999).

Autistic children again show a great deal of variability (or “scatter”) among scores in different areas of adaptive functioning (Schatz & Hamdan-Allen, 1995; Stone et al., 1999; Volkmar et al., 1987), and they tend to have lower adaptive scores than would be expected on the basis of their intellectual abilities (Freeman et al., 1991; Liss et al.,

2001; Lord & Schopler, 1989a; Rumsey, Rapoport, & Scerry, 1985; Stone et al., 1999). For example, results of some studies have indicated that relative to their mental age, autistic children are delayed in all domains of the VABS, with the greatest deficits observed in the socialization domain (Carter et al., 1998; Gillham, Carter, Volkmar, & Sparrow, 2000; Volkmar et al., 1987; Volkmar et al., 1993). Autistic children have been found to show greater discrepancies between levels of adaptive behaviour and IQ than a group of non-autistic children with similar IQs (Stone et al., 1999). Some researchers have found that this discrepancy between intellectual ability and adaptive behaviour is observed only in higher-functioning children with autism (Bolte & Poustka, 2002; Freeman et al., 1988).

Autistic children perform differently on measures of adaptive functioning than children with other types of developmental disabilities (Schatz & Hamden-Allen, 1995). For example, children with autism show deficits in adaptive behaviour, especially in the socialization and communication domains of the VABS, relative to comparison groups. Several groups of researchers have reported that autistic children score significantly lower on the Vineland scales than non-autistic children who are matched on IQ (Gillham et al., 2000; Liss et al., 2001; Lord & Schopler, 1989; Volkmar et al., 1987). Differences have even been observed between groups of children who are within the autism spectrum of disorders. For example, Paul et al. (2004) compared a group of children diagnosed with autism to a group of IQ-matched children diagnosed with PDDNOS. Results showed that the PDDNOS group scored significantly higher than the autistic group on the

socialization and communication domains of the VABS.

Adaptive behaviour is related to the individual's age. For example, activities such as getting dressed and playing with friends are important for children, whereas the ability to manage money is an important skill for adolescents and adults (Sparrow et al., 1984). Thus, the types of behaviours that are considered adaptive depend on the individual's developmental level. Because autistic children may learn new skills at a slower rate than typically developing children (Fisch et al., 2002), they may show a greater deficit relative to other children over time.

In one study involving almost 700 autistic people ($M_{age} = 11$ years), younger children (< 10 years) were found to have higher scores than older children (> 10 years) on the communication, socialization and daily living skills domains of the VABS (Carter et al., 1998). No information was provided about the children's history of education or treatment. In another study, children with autism between the ages of 2 and 18 years were tested using the VABS and then retested approximately two years later (Fisch et al., 2002). Older children scored significantly lower on all three domains of the VABS than younger children, and within-subject retest scores were all significantly lower than initial scores for both younger and older groups. Again, these authors did not report whether the children were receiving treatment during the course of the study.

The question of the stability of adaptive behaviour is controversial (Bolte & Poustka, 2002). Although the previous studies suggest a decline over time, some studies have found either no change in adaptive behaviour, or improvement over time. Lord and

Schopler (1989a) reported that autistic children's mean composite score on the Vineland did not change significantly over a 5 year period. Another group of researchers evaluated changes in adaptive behaviour in more than 400 autistic children. Although IQ scores remained stable, significant *increases* were found in all three domains of the VABS over a one year period. The amount of change that was observed was related to IQ level. Children in the high IQ group showed greater improvement than children in the medium or low IQ groups in the communication and daily living skills domains of the VABS, but not the socialization domain. The authors reported that the children were involved in public school programs (Freeman et al., 1999).

The differences between the results of these studies may be related to the fact that authors do not always specify the type of intervention received by the participants, or even whether they received any form of treatment. This is important because treatment has been associated with increases in autistic children's adaptive behaviour scores. For example, Weiss (1999) reported a mean 33 point increase in composite VABS scores in children who had received an intensive home-based intervention for two years.

Long-Term Outcomes

As autistic children move into adolescence and adulthood, many of them continue to display symptoms of autism, and many continue to require substantial care (Pelios & Lund, 2001). Rumsey et al. (1985) sought to determine the types of impairments that were exhibited by adults with autism. Using parent interviews and standardized assessments, they evaluated fourteen autistic men between the ages of 18 and 39 years.

All participants were found to display residual symptoms of autism and many continued to receive special education services into adulthood. Repetitive behaviours were observed in 86% of the participants, and many participants displayed significant social difficulties, language impairments, flat affect, and chronic anxiety. One limitation to generalizing the results of this study is that all but one of the participants were admitted to a hospital for observation (Rumsey et al., 1985). It therefore unknown whether the observed behaviours and emotions were representative of the individuals' typical functioning at home.

Other researchers have examined the living and employment situations of autistic adults. Wolf and Goldberg (1986) conducted a follow-up study on autistic children who had been seen at a treatment centre. They found that 31% of the participants ($M_{\text{age}} = 20$ years) were living at home, independently or with their parents, and 69% were living in an institution or a group home. The authors evaluated the individuals' ability to perform several basic daily living tasks and reported that 85% of participants were able to feed themselves independently, 80% could dress themselves, and 60% were able to brush their teeth regularly on their own. Venter et al. (1992) reported on the employment status of 22 autistic individuals over the age of 18 years. All of the participants had IQs below 60. Six participants (27%) were competitively employed, 59% were in supervised employment or special school programs, and 14% were not employed or in school.

The results of more recent studies are not much more encouraging, and suggest that IQ may be predictive of long-term prognosis. Stein et al. (2001) assessed a group of 28 autistic adults ($M_{\text{age}} = 27$ years) who were hospitalized because of the severity of their

symptoms. The mean nonverbal IQ was 45, and many individuals had impairments in social interactions (82%) and displayed repetitive movements and behaviours (50%). Almost 60% of the sample had no spoken language, and 75% were being treated with antipsychotic medications in order to “manage” their hyperactive and aggressive behaviour.

Howlin and colleagues (2004) assessed a group of higher functioning (i.e., IQ > 50) adults with autism. Participants had been previously assessed in childhood ($M_{\text{age}} = 7.24$ years) and were re-evaluated approximately 20 years later. One-third of the participants were employed, either independently or on a sheltered or volunteer basis; however, few of these jobs provided adequate financial support to allow the participants to live independently. Only 10% of the adults were living independently with limited support, 40% lived with their parents, and 50% were living in a residence or hospital with little independence. Although 7% of the participants were completing or had received university degrees, the majority (78%) had left school before acquiring any formal qualifications. Over half of the participants were rated by parents as having no friends or acquaintances, and only one participant had been married. Repetitive or ritualistic behaviours were observed in 88% of the participants and were more common in individuals with lower IQs. Taking all of the measures into consideration, the authors concluded that the majority of autistic adults remained highly dependent, and those with higher IQs tended to have the best outcomes.

Treatment of Autistic Children

Psychoanalytical Approach

In the 1940s through to the 1960s, prevailing theories about the etiology of autism were psychodynamically oriented (Campbell et al., 1996; Matson, Benvanidez, Stabinsky, Paclawkyj, & Baglio, 1996; Schreibman & Anderson, 2001). The symptoms of autism were interpreted by psychoanalysts as a withdrawal on the part of the child from cold, unemotional parents (Matson et al., 1996). For example, Bettelheim (1967) believed that maternal attitudes were direct causes of autism. Specifically, he wrote that the “precipitating factor in infantile autism is the parent’s wish that his [or her] child should not exist” (p. 125). Psychoanalytic treatment, therefore, often included therapy for the parents (Mesibov et al., 1997). Play therapy was used for the children themselves, with a focus on creating a non-threatening environment where the children could express themselves freely (Campbell et al., 1996; Matson et al., 1996). Because parents were viewed as causing the disorder, psychoanalytic therapy often involved separating autistic children from their families (Mesibov et al., 1997). By the 1960s, psychodynamic treatments began to lose popularity in Europe and North America, and this approach is rarely used today in the treatment of autistic children (Mesibov et al., 1997).

Early Behavioural Interventions

Ferster (1961) proposed that learning theory could be used to explain the behaviour of autistic children. He noted the failure of autistic children to respond to social reinforcers, such as smiling or parental approval, and suggested that self-

stimulatory and maladaptive behaviour were maintained because of the reinforcing effects that they provided for the child. Consider tantrum behaviour as an example. When a child throws a tantrum, parents may be tempted to give the child treats or other desired items in order to get the child to stop. When this happens, the child's tantrum behaviour is actually reinforced, and more likely to occur in the future. The parents' behaviour is also reinforced because the aversive stimulus (i.e., the tantrum) is terminated.

Subsequently, researchers sought to confirm the utility of behavioural psychology in dealing with autistic children, and studies were designed to determine how the behaviour of autistic children could be modified through the use of reinforcement, extinction, and punishment. For example, Wolf et al. (1964) developed behavioural techniques to improve the behaviour of a 3-year-old autistic boy. Problem behaviours included difficulty sleeping, disruptiveness at meal times, and severe temper tantrums often involving self-destructive behaviours such as head-banging and face-scratching. The child was admitted to a hospital for treatment, and the frequency of problem behaviours was recorded by staff.

In order to deal with sleeping difficulties, the child was required to remain in his bed after being tucked in at night, otherwise his door would be closed. The door would be re-opened a short time later, and left open, if the child was quiet. If the child had temper tantrums, he was placed in his room and the door remained closed until the tantrum behaviour stopped. At meal times, if the child ate with his hands, his plate was removed; if he stole food from other children's plates, or threw food, he was removed from the

dining room. The child began to eat with a spoon and completely stopped stealing and throwing food after the first session. Within the first six days of treatment, the child no longer had sleeping difficulties, and after 2½ months of treatment, the more severe self-destructive behaviours stopped. However, the tantrum behaviour was not completely eliminated.

Wolf and colleagues (1964) also reported that positive reinforcement had been used to increase the autistic child's verbal behaviour. The child was rewarded for imitating words that were uttered by a trainer in the presence of pictures of those objects. Within three weeks, he was able to provide labels for approximately 10 pictures. The child's parents were trained to use the same teaching technique and were reported to have been successful in expanding his vocabulary to include requests, comments, and personal pronouns. The authors suggested that the fact that the child could already mimic the vocal sounds of the trainer was important to his rapid progress.

Lovaas, Berberich, Perloff, and Schaeffer (1966) attempted to develop speech in two children who were completely mute and unable to imitate any vocal sounds. The one-to-one intervention was provided 6 days per week for 7 hours per day. Early in the training, the children were rewarded simply for emitting any vocal sound within a certain time after a trainer had emitted a sound. Verbal behaviour was gradually shaped, and differentially reinforced, so that closer approximations to the target word were reinforced, and no reinforcement was provided for sounds that did not approximate the word. During the first two weeks of training, it took several days before the children

could reliably imitate simple words such as “we.” However, after 26 days of training, the children were able to imitate new words quickly and easily.

Schriebman and Carr (1978) developed a more specific intervention for two autistic children. They were interested in determining whether they could reduce the frequency of echolalic responding. Both children displayed immediate echolalia; in other words, they would immediately repeat phrases uttered by other people. Preliminary testing indicated that they could respond appropriately to a small number of known questions, such as “what is your name?” However, the children responded to 100% of the training questions, to which they had no known appropriate verbal response, by echoing the question. The researchers’ goal was to teach the children to respond to unknown questions with the words “I don’t know.” During training sessions, the experimenter would issue a question and then immediately prompt the child by saying, “I don’t know.” Initially, when the children *echoed* the correct response, they were reinforced. The trainer then gradually decreased the use of the verbal prompt until the children could correctly respond without it. On the first training question, both children required more than 35 trials to master the response. After approximately 15 sessions, the children could reliably respond correctly to new unknown questions.

Behavioural research in the 1960s through the 1980s included reports of improvements in autistic children’s language, communication, social, play, self-help, and IQ (for a review of behavioural research, see Matson et al., 1996). Whereas early studies often focussed on relatively simple behaviours, later interventions became more

comprehensive, addressing a greater variety of behavioural excesses and deficits (Mesibov et al., 1997; Schreibman & Anderson, 2001). One of the most influential of these interventions is known as the Lovaas method.

The Lovaas Method

O. Ivar Lovaas and colleagues (1980) developed a comprehensive treatment program which incorporated information gleaned from earlier studies and through clinical observations from ongoing interventions. For example, the ideal setting for intervention changed from an institutional one to the child's natural environment (e.g., home, school), where parents and teachers were expected to be involved in the child's treatment (Lovaas, 1993). It was anticipated that these changes would aid in the generalization and maintenance of skills because the children would be learning during "most of their waking hours" (Lovaas, 1987, p. 3). The treatment consisted of many separate teaching programs each of which targeted specific behaviours. Detailed descriptions of program targets and teaching methods are available from a treatment manual and instructional videos (Lovaas et al., 1980).

In the manual outlining the Lovaas method (Lovaas et al., 1980), it is suggested that the child should begin with only one or two programs which are intended to improve his or her ability to attend in learning situations. For example, the child is taught to sit in a chair on request and to make eye contact with the instructor. New programs are then added and run concurrently with previous ones as the child develops a repertoire of knowledge and skills. Subsequent programs are targeted toward imitation of gross motor

skills, visual matching of objects or pictures, following verbal requests, and verbal imitation. Advanced programs target play skills, complex language, concepts (e.g., shape, size, time), and self-help skills. Suggestions are also made for maintaining skills over time and generalizing them to new situations. There is a major focus on language development throughout.

The specific teaching method that is proposed by Lovaas et al. (1980) is known as discrete trial teaching (DTT). With this method, skills are taught on a trial-by-trial basis to ensure that the instructions are simple and clear, and so that the child can receive immediate and specific feedback on his/her behaviour. In order to maintain a child's interest and motivation, the teacher or therapist may *prompt* the child to give the appropriate response. Prompts can be very obvious; for example, a "hand-over-hand" prompt involves guiding the child physically through the correct response. The intrusiveness of the prompt is then *faded* so that the child learns to respond correctly without help. Prompting is used so that the child maintains a high rate of success, and thus, more access to reinforcers, while acquiring new skills. Reinforcement can take many forms, depending on what is most effective for a particular child, and may include edible treats, verbal praise, and access to preferred activities or toys. Motivation is also maintained by allowing the child to have frequent breaks from his/her learning at the table (Lovaas et al., 1980; Thibodeau, 2002).

The Lovaas Studies

In 1987, Lovaas published a study on the outcome of 19 autistic children who had

taken part in his intensive behavioural intervention for over two years. Children were initially assigned to one of three groups: the experimental group received an average of 40 hours per week of intensive therapy, one control group received 10 hours (or less) of therapy using the same instructional techniques, and a second control group consisted of autistic children who were not involved in the treatment program. Children's initial assessments and treatment began prior to age four years. Pre-treatment analysis of the experimental group indicated that 10% had normal intelligence scores, 37% functioned in the "moderately retarded" range, and 53% were described as severely mentally retarded. One participant in the experimental group had some appropriate speech, seven participants were echolalic, and 11 were mute. The author reported that the experimental and control groups were not significantly different from each other on a number of variables, including mental age, toy play, and abnormal speech. However, the mean chronological age of the experimental group ($M_{\text{age}} = 2.88$ years) was significantly lower than that of the control group ($M_{\text{age}} = 3.41$ years).

Children were re-assessed at age 6 or 7 years, after a minimum of two years of treatment. The author reported an average 30 point gain in IQ for the experimental group over the low-intensity intervention control group. Mean IQ scores for the two control groups were not significantly different at pre- and post-treatment. The number of children in the experimental group whose scores were in the normal range of intellectual functioning rose from two children (10%) to twelve children (63%) after treatment. An investigation into the educational placement of children in the experimental group

revealed that 47% had passed first grade in a regular classroom *and* scored within the normal range on IQ tests, 42% had passed first grade in special language classes, and 10% remained in classes for autistic children. The 9 children who had achieved normal intellectual scores as well as regular educational placement and advancement were described by the authors as “normal functioning” (p. 9). Eight participants from the experimental group and one participant from control group 2 achieved so-called normal functioning (Lovaas, 1987).

A follow-up study was conducted (McEachin et al., 1993) in order to determine whether the experimental group had maintained its gains over the low-intensity treatment control group, and to determine whether the participants who were reported to have attained normal functioning had any remaining autistic symptoms. The mean age of participants was 11.5 years. Follow-up assessments included measures of IQ, educational placement, and adaptive behaviour. Results indicated that the mean IQ score of the experimental group ($M = 84.5$) remained significantly higher than the mean IQ of the low-intensity control group ($M = 54.9$), and mean IQ scores for the two groups had not changed significantly since post-treatment. A full-scale IQ score of 80 or above was achieved by 58% of participants in the experimental group and 17% of participants in the control group. The experimental group scored significantly higher than the control group on the socialization, communication, and daily living skills domains of the VABS. The nine “best outcome” children were no longer receiving treatment, had been out of treatment for an average of 5 years, and 8 of them remained in regular classrooms. These

children attained a mean full-scale IQ score on the WISC-R of 111 and a mean composite score on the VABS of 101, scores which indicate average functioning. It was concluded that autistic children had made significant and long-lasting gains with this form of intensive behavioural treatment.

These results generated considerable interest and controversy among autism researchers. In the late 1980s and through the 1990s, several commentaries and critiques of the Lovaas studies were published. Authors identified important limitations which call into question the studies' validity and the extent to which the results can be generalized (e.g., Gresham & MacMillan, 1997a). Lovaas and colleagues published rebuttals to many of these arguments, systematically responding to specific criticisms and limitations addressed by other authors (Lovaas, Smith & McEachin, 1989; Smith & Lovaas, 1997; Smith, McEachin, & Lovaas, 1993). The following is a discussion of several of the most important and frequently addressed issues in the literature.

Criticism of the Lovaas Studies

The Lovaas studies (Lovaas, 1987; McEachin et al., 1993) have often been criticized because of the subject selection and assignment procedures that were used. First, participants were assigned to experimental and control groups based on staff availability (Lovaas, 1987). Several authors have argued that this procedure does not qualify as random assignment (Foxy, 1993; Gresham & MacMillan, 1997a; 1997b; 1998; Mesibov, 1993), suggesting that it is not possible to conclude with certainty that the results were due only to the effects of the treatment and not some extraneous variable.

However, Smith and Lovaas (1997) wrote that the assertion that their groups were not randomly assigned was “directly contrary to fact” (p. 204) and Baer (1993) argued that assignment could be considered “functionally random” (p. 374).

Another problem with subject selection concerned the representativeness of the sample. Some drew attention to the younger age of the children in the experimental group (Gresham & MacMillan, 1997a) and questioned the criteria (e.g., age, presence of echolalia) that were used to exclude certain participants from the analysis (Gresham & MacMillan, 1998; Mesibov, 1993; Schopler, Short, & Mesibov, 1989). Gresham and MacMillan (1997a) suggested that the experimental group may have contained children with higher than usual levels of intellectual ability, and Mundy (1993) thought that the control group had fewer high-functioning children than would be expected. Thus, it has been argued that the experimental group was not representative of all autistic children, and may have instead represented a group who already had a good prognosis before treatment began (Schopler et al., 1989).

A second set of criticisms concerns measurement procedures. Several different measures of intellectual functioning were used for the children’s initial assessments (Lovaas, 1987) and at follow-up (McEachin et al., 1993). However, research results indicate that comparisons over time are complicated when different methods of intellectual assessment are used (Lord & Schopler, 1989a; 1989b; Mottron, 2004). For example, Lord and Schopler (1989b) found that an increase in IQ over time was likely to be observed when children were initially assessed with the Bayley, whereas no change

over time was observed when the Merrill-Palmer or Leiter International Performance tests were used. Although the use of multiple IQ assessments has been criticized (Gresham & MacMillan, 1997a; 1997b; 1998), Smith et al. (1993) defended the use of different tests in the Lovaas (1987) study by explaining that the tests had been selected and administered by independent examiners who were not involved with the study. The use of several different IQ measures is a common practice in autism research (e.g., Anderson et al., 1987; Freeman et al., 1985; Freeman et al., 1991; Lord & Schopler, 1989a; 1989b; Piven, Harper, Palmer, & Arndt, 1996; Schatz & Hamden-Allen, 1995; Sheinkopf & Siegel, 1998); however, other researchers have chosen to utilize a single measure of intellectual ability (e.g. Fisch, Simensen, & Schroer, 2002; Harris & Handleman, 2000; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Liss, et al., 2001; Szatmari et al., 1994)

Finally, the appropriateness of the conclusions that were drawn by Lovaas (1987) and MacEachin et al. (1993) has been questioned. The major outcome measures that were used in both studies were IQ and educational attainment (although, in the follow-up study additional measures were included). Educational placement as an outcome measure has been criticized because the inclusion of an autistic child in a classroom with typical peers may be influenced by school board politics or parental requests to have their children in an inclusive educational setting (Gresham & MacMillan, 1997b; Schopler et al., 1989). Lovaas and colleagues (1989) admit that they did push for the participants to be placed in regular classrooms, for the benefit of the children, but explained that the children had

passed grade one on their own merits using the same criteria as the other children. However, no data was included to corroborate the claim that teachers graded the autistic children using the same standards as typical children.

It has been suggested that the gains in IQ that were reported could have been a result of improved test-taking skills or increased compliance rather than an actual improvement in intellectual ability (Gresham & MacMillan, 1997a; Schopler et al., 1989). Although this is a possibility, results from at least one study have provided evidence that these may not be the only factors which contribute to improvements in IQ scores after treatment. A group of researchers examined the profiles of 9 autistic children who had taken part in an intensive school-based behavioural intervention program (Harris et al., 1991). Analyses revealed a significant mean increase (18 points) in Stanford-Binet IQ scores over the course of one school year. The authors conceded that skills such as the ability to sit quietly and follow instructions likely contributed to improved performance on the IQ test, but added that these attending skills also likely helped the children to focus on classroom learning activities. Additionally, an in-depth analysis of sub-test scores revealed that autistic children showed the greatest improvements on tests of abstract ability (Absurdities and Pattern Analysis), whereas typically developing children did not show systematic changes in these two areas over the same time period. It was suggested that improvements on these sub-tests indicated that the autistic children had begun to process and organize information differently (Harris et al., 1991).

One last criticism of the conclusions drawn in the Lovaas studies concerns the use of the term “normal functioning.” This label was given on the basis of IQ and educational attainment only, in the original study, and some have argued that simply measuring performance in these two areas is insufficient to make claims of recovery (Gresham & MacMillan, 1997a; Mesibov, 1993; Mundy, 1993; Schopler et al., 1989). For example, even autistic children who score in the normal range on IQ tests may have difficulty on tasks requiring cognitive flexibility (Mundy, 1993), and these children often continue to display significant behavioural and social difficulties (e.g., Freeman et al., 1988; Freeman et al., 1991; Schatz & Hamden-Allen, 1995; Yirmiya & Sigman, 1991). Mesibov (1993) expressed the concern that the use of terms such as *normal* and *recovery* may have led readers to assume that the children had been cured of autism. Indeed, since publication of the Lovaas studies, several law suits have been filed, in Canada, the U.S., and the U.K., by parents who have requested that their autistic children receive interventions based on the Lovaas method (Hastings & Johnson, 2001; Jacobson, 2000; Nelson & Huefner, 2003). Mundy (1993) suggested that the term “high-functioning” might be more appropriate to describe the children who had made significant gains with the Lovaas method. Smith et al. (1993) disagreed and defended their use of the term normal functioning, but acknowledged that they should have included additional measures to better identify any residual signs of autism. Many researchers now advocate the use of multiple assessments and informants when evaluating the outcomes of autistic children (e.g. Bristol et al., 1996; Kazdin, 1993; Mundy, 1993; Storey & Horner, 1991).

Subsequent Empirical Replications

Both critics and proponents of the Lovaas method agreed that independent replications of the Lovaas studies were necessary (Bristol et al., 1996; Foxx, 1993; Gresham & MacMillan, 1997a; Kazdin, 1993; McEachin et al., 1993; Rogers, 1998; Sheinkopf & Siegel, 1998; Smith et al., 1993). Several groups of researchers have attempted replications. For example, Anderson and colleagues (1987) designed a home-based behavioural intervention hoping to obtain comparable results to Lovaas (1987). The children showed significant improvements in IQ, adaptive behaviour, and language ability. The authors noted that positive treatment effects were observed for the majority of children, but none of them achieved intelligence scores within the normal range, nor were in regular classrooms.

The goal of Birnbrauer and Leach (1993) also was to replicate the findings of the Lovaas studies. An intensive home-based treatment program was provided for 9 children with PDDs. The intervention was provided by parents and volunteers, and was supervised by a program co-ordinator. Parents were responsible for helping to design the program, hiring some of the volunteers, hosting team meetings, and supervising and training the volunteers. Pre- and post-treatment assessment instruments included IQ tests, and measures of adaptive behaviour and parenting stress. Children in the treatment group were compared to a control group of five children with PDDs who did not receive the intervention. After approximately two years of treatment, four of the nine children in the treatment group showed significant improvements in adaptive behaviour and IQ,

compared with only one child in the control group. Parents of children who received the intervention reported significant decreases in stress levels, whereas parents of control children showed no change in the child domain of the stress index and a significant increase in parenting related stress.

Sheinkopf and Siegel (1998) evaluated a group of 11 children diagnosed with autism or PDDNOS who were participants in a larger longitudinal study. This subgroup of children was selected because their parents reported having implemented Lovaas-based treatment programs in their homes with the guidance of one of three behaviour therapists. Children in the experimental group were matched to children in a control group of autistic children receiving “standard care” on chronological age, mental age, diagnosis, and length of treatment. After approximately 1½ years of treatment, the children were re-assessed. Children in the experimental group had a mean IQ score that was 25 points higher than the mean of the control group. All of the children in the experimental group and 54% of children in the control group achieved post-treatment IQ scores above 65.

Weiss (1999) assessed 20 children with PDDs who had received two years of an intensive home-based behavioural intervention ($M_{\text{age pre-treatment}} = 3.5$ years). Before the intervention began, the severity of autistic symptoms and the level of adaptive behaviour were assessed. Results showed a significant reduction in autistic symptoms, as measured by the CARS, from pre-treatment ($M = 45.9$) to post-treatment ($M = 27.2$). Before treatment began, all twenty children had CARS scores in the severe range. After

treatment, only three participants were in the severe range, and nine had scores in the “non-autistic” range. Improvements in adaptive behaviour were also noted. The mean VABS score was significantly higher at follow-up ($M = 83.6$) than at the initial evaluation ($M = 49.85$). The author concluded that her results supported the use of behavioural interventions for young children with autism.

The results of these studies suggest that early behavioural interventions can lead to significant and long-lasting improvements in the functioning of autistic children. Many children in the treatment groups improved in multiple areas including intellectual functioning, adaptive behaviour, autistic symptomology and educational placement. Consequently, early intensive behavioural interventions are considered by many to be the most demonstrably effective treatments currently available for autistic children (Anderson & Romanczyk, 1999; Jacobson, 2000; Mesibov et al., 1997; Rosenwasser & Axelrod, 2001).

Applied Behaviour Analysis

The intervention methods proposed by Lovaas and colleagues (1980) are based on operant learning theory, or behaviour principles. According to learning theory, reinforcement causes behaviour to increase in frequency, and extinction and punishment cause behaviour to decrease in frequency (Baldwin & Baldwin, 1998). The terms *behaviour modification* and *applied behaviour analysis* (ABA) are often used to describe the application of behaviour principles to improving people’s lives (Baldwin & Baldwin, 1998; Lovaas et al., 1980; Martin & Pear, 1999). Some believe that the behavioural

treatment of children with autism and other developmental disabilities represents one of the most important contributions of learning theory (Schopler et al., 1989; Schreibman & Anderson, 2001).

Many different types of interventions have been developed for autistic children based on behavioural principles. The Lovaas method actually represents only one way in which to apply behaviour principles to improve the functioning of autistic children. Other types of behavioural interventions may be referred to as ABA therapies, intensive behavioural interventions (IBI) or early intensive behavioural interventions (EIBI). Anderson and Romanczyk (1999) suggested that behavioural interventions tend to have the following characteristics in common (among others): 1) objective measurement of behaviour; 2) use of reinforcement to increase desirable behaviours; 3) focus on generalization of behaviour to new settings; 4) development of individualized curricula; and 5) use of functional analysis – i.e. determining which variables (e.g., reinforcers) control the expression of specific behaviours.

Alternative Therapies

Although behavioural treatments are widely used, many different interventions have been developed to improve the functioning and quality of life of autistic children. For example, the Son-Rise program is an intensive, home-based approach which encourages parents to be completely accepting of their child and his/her behaviours. With this method, instructors embed learning situations within daily activities of the child's choosing (see Kaufman, 1994). Sensory Integration Therapy (SIT) has also been used to

treat autistic children. This method involves engaging children in physical activities (e.g., swinging) which are intended to help the children to better process sensory information (Dempsey & Foreman, 2001; Hoehn & Baumeister, 1994). Results of one study indicated that 56% of children who were receiving an ABA intervention were also receiving SIT (Smith & Antolovich, 2000). Finally, several different types of medications have been used in the treatment of autistic children, especially for dealing with hyperactive, aggressive, and self-injurious behaviours (Campbell et al., 1996; Mesibov et al., 1997). Few studies have been published which clearly demonstrate the efficacy of any of these approaches (Kaplan, Polatajko, Wilson, & Faris, 1993). Further, no studies have provided direct comparisons of any intervention with the behavioural approach (Campbell et al., 1996; Kasari, 2002).

Factors Associated with Treatment Outcome

It is important to understand the characteristics of autistic children and their treatment programs that may be associated with improved outcomes. First, although early behavioural interventions have led to significant improvements in some children, they appear not to be equally effective for all children. For example, even in the Lovaas (1987) study, only half of the children in the high-intensity treatment group achieved IQ scores in the normal range and were in regular classrooms. It is important to understand why some children do not respond to behavioural interventions in a similar way. Second, as noted by Anderson and Romanczyk (1999), different behavioural program models tend to involve a broad range of techniques which may not be consistent across models.

Some of these techniques may be more effective than others. Third, as previously discussed, there is a great deal of variability within and among autistic children in terms of factors such as intellectual functioning and language ability. These factors have been found to influence children's responsiveness to treatment, and some may be more strongly related to outcome than others. If more is known about the relation of all of these variables to treatment outcome, then perhaps it will be possible to individualize treatment programs more efficiently and appropriately.

When treatment effects are studied, some of the most commonly used outcome measures include IQ, adaptive behaviour, and educational placement or achievement (e.g., DeMyer et al., 1974; Freeman et al., 1991; Gabriels et al., 2001; Harris & Handleman, 2000; Weiss, 1999). Interestingly, autistic symptoms are typically not assessed as outcome variables. For example, of the studies investigating the effectiveness of home-based behavioural interventions, only Weiss (1999) reported post-treatment scores on a measure of autistic behaviour. The following is a discussion of variables which have been found to predict scores on these outcome measures. The variables can be grouped conceptually into child characteristics (e.g., early IQ), program characteristics (e.g., treatment intensity), and therapist characteristics (e.g., therapist education).

Child Characteristics

Early intellectual ability. When autistic children are assessed on measures of intellectual ability, even at early ages, their scores tend to be stable over time. For this reason, early intellectual ability is a significant predictor of long-term outcome,

particularly when IQ is used as the outcome variable. Howlin and colleagues (2004) measured IQ as part of their follow-up study on adults with autism, and compared scores obtained in adulthood ($M_{\text{age}} = 29.33$ years) with those obtained in childhood ($M_{\text{age}} = 7.24$ years). The correlation between these sets of scores was significant ($r = .54$). Participants were divided into three groups according to their childhood IQ score (i.e., 50-69, 70-99, >100). Approximately 40% of the participants remained in their initial IQ grouping, twenty years after their initial assessment. Stability tended to be highest for individuals with higher IQs. Over three-quarters of the participants with initial performance IQs above 70 remained in this range. Educational and treatment histories of these individuals were not reported by the authors.

DeMyer et al. (1974) found that even with treatment, autistic children's IQ scores tended to be stable over time. This finding has been replicated in other studies. For example, in a 5-year and 12-year follow-up study of autistic children enrolled in a behaviourally-based educational program ($n = 62$ and $n = 53$, respectively), a group of researchers assessed intellectual functioning using either the WISC-R or the Stanford-Binet:IV (Freeman et al., 1985; Freeman et al., 1991). After the initial assessment ($M_{\text{age}} = 3.8$ years), the children were grouped into low, medium, and high IQ groups. Five years later, 87% of the children stayed in the same IQ groups, and twelve years later, 68% remained in their initial IQ group. Lord and Schopler (1989a) also reported that IQ at age 4 years was a significant predictor of IQ at age 10 years among children who were enrolled in TEACCH, a school-based behavioural program. Similarly, Harris and

Handleman (2000) found that, among children who received a behavioural intervention, IQ scores at intake and discharge were highly correlated ($r = .87$). Finally, Gabriels et al. (2001) found early IQ to be a significant predictor of post-treatment IQ for children who were receiving a variety of interventions.

Early IQ scores also tend to be associated with scores on other types of assessments. For example, adaptive functioning seems to be strongly related to a child's intellectual ability (Liss et al., 2001). Significant positive correlations have been found between scores on IQ tests and scores on measures of adaptive behaviour. (Freeman et al., 1988; Liss et al., 2001; Lord & Schopler, 1989a; Perry & Factor, 1989; Schatz & Hamdan-Allen, 1995; Stone et al., 1999; Szatmari et al., 1994). In one study, a group of autistic children with high IQs obtained higher scores on all three adaptive behaviour domains of the VABS than children in medium or low IQ groups (Freeman et al., 1991). Bolte and Poustka (2002) reported that autistic children with comorbid mental retardation scored significantly lower on all three domains of the VABS than autistic children without mental retardation.

Because of the relation between IQ and adaptive behaviour, early IQ scores may be useful for predicting treatment outcome when the outcome measure is adaptive behaviour. Gabriels et al. (2001) reported a significant correlation ($r = .57$) between pre-treatment IQ scores and follow-up VABS scores. Venter, Lord, and Schopler (1992) also found that IQ was associated with adaptive behaviour. Seventy percent of children who were initially categorized into the high IQ (> 70) group obtained VABS composite scores

above 40, whereas only 28% of the low-IQ (< 70) group obtained scores over 40. Liss and colleagues (2001) reported that early quantitative IQ scores accounted for 40% or more of the variance in scores on all three adaptive behaviour domains of the VABS at age 7-9 years. Szatmari, Bryson, Boyle, Streiner, and Duku (2003) found that children's nonverbal abilities, as measured by several different assessments, were significant predictors of scores on the communication domain of the VABS. Some researchers have suggested that the relation between IQ and adaptive behaviour may be stronger for lower-functioning autistic children (Liss et al., 2001).

Results of several studies have indicated that initial IQ scores also predict later educational achievement. For example, DeMyer and colleagues (1974) reported that initial performance IQ was the best predictor of educational placement. All children who were in "normal" classrooms at follow-up had an initial performance IQ greater than 70. In a later study, twelve years after receiving a behavioural/educational intervention, 60% of children initially categorized into a high IQ group had graduated from high school or were in regular classrooms, compared with only 12% of children who were originally in medium or low IQ groups (Freeman et al., 1991). Harris and Handleman (2000) also found that children who had higher IQs when they were admitted to a school-based behavioural treatment program were more likely to be in regular classes than children with lower IQs. Finally, Gabriels et al. (2001) reported a significant positive correlation ($r = .74$) between initial IQ scores and later scores on a measure of educational achievement.

Results of some studies suggest that a child's IQ may also be associated with the severity of the child's symptoms. DeMyer et al. (1974) reported that autistic children with the greatest number and most severe symptoms had the lowest IQs. Similarly, Schopler et al. (1980) found that children with more severe autistic symptoms also showed greater deficits in intellectual functioning. Wadden et al. (1991) reported a significant negative correlation ($r = -.42$) between IQ and ABC scores. Freeman et al. (1981) suggested that autistic children with high IQs tend to exhibit different behaviours than autistic children with low IQs. For example, they found that a higher percentage of low-IQ children engaged in behaviours such as excessive jumping, hand-flapping, and body-rocking.

Few studies have evaluated whether early IQ is associated with autistic behaviour, when autistic behaviour is measured as an outcome variable. In one of these studies, Gabriels et al. (2001) did not find a significant correlation between IQ at intake and post-treatment scores on the CARS. However, the children in that study were receiving a broad range of treatment programs in different combinations. Conversely, Szatmari et al. (2003) reported that non-verbal IQ at age 4-6 years was a significant predictor of ABC scores at the 6 year follow-up, but not at the 2 year follow-up. The authors did not provide information about the type of intervention or education that the children had received over the course of the study.

The results of these studies indicate that early IQ is a very important factor to consider when evaluating autistic children's responsiveness to treatment. Pre-treatment

IQ scores have been associated with follow-up scores on measures of IQ, adaptive behaviour, and educational placement, whether or not children have received treatment. Because of the importance of IQ in previous research evaluating outcomes, the relation between early intellectual functioning and behavioural treatment outcome was assessed in the current study.

Age at treatment onset. The majority of research investigating the effectiveness of comprehensive treatment programs for children with autism has involved children under the age of five (Rogers, 1998). Results of some studies suggest that children who enter treatment at a younger age tend to have better outcomes than children who are older when they begin treatment. Lord and Schopler (1989a) reported that children who were younger (i.e., 2 or 3 years of age) at the initial assessment tended to have higher IQ scores after behavioural treatment than children who were older (i.e., 4 or 5 years of age). Harris and Handleman (2000) found significant correlations between age at treatment intake and post-treatment IQ scores as well as educational placement. Younger children were more likely than older children to have higher IQs and to be placed in regular classrooms after treatment. Fenske et al. (cited in Rogers, 1998) provided behavioural treatment to groups of older (> 5 years) and younger (< 5 years) children. After three or more years of treatment, 67% of the younger children were living at home and attending public schools, whereas only 11% of the older group had achieved similarly positive outcomes.

When Lord and Schopler (1989a) accounted for initial IQ scores in their analysis,

they found that age at intake did not contribute significantly to predicting post-treatment adaptive behaviour scores. Other studies have suggested that age at intake may not be related to outcome. For example, Gabriels et al. (2001) compared groups of autistic children who were categorized as either high- or low-outcome after treatment. They found no difference between the groups on mean age at diagnosis or age at treatment onset. Further, correlations between age at intake and measures of intellectual ability, academic achievement, autistic symptoms, and adaptive behaviour were all non-significant. Again, it should be noted that children in that study were receiving different interventions.

Language. Another factor that may be associated with treatment outcome is early language ability. Some believe that the presence of speech before the age of five or six is associated with more positive long-term outcomes (e.g., Szatmari et al., 2003). Lord and Schopler (1989a) found that children ($M_{age} = 4.6$ years) who did not have any language before treatment obtained lower scores on the Vineland scale at follow-up than children who had some initial language. Venter et al. (1992) reported that measures of early communicative speech predicted 43% of the variance in VABS composite scores. Ozonoff and Cathcart (1998) also indicated that good language skills were associated with better treatment outcomes. However, no data was included to corroborate this claim.

Other studies have not revealed significant relations between language ability and treatment outcome. Gabriels et al. (2001) did not find significant correlations between scores on early language assessments and scores on outcome measures including IQ,

adaptive behaviour, autistic symptoms, and academic achievement. There also was no difference between high- and low-outcome groups on a measure of initial language ability. Further, Birnbrauer and Leach (1993) reported that the presence of meaningful speech before treatment was not critical to a successful outcome. Of the 5 children categorized by the authors into the “high-improvement” group after treatment, 2 children had some speech before treatment and 3 children did not. Finally, Szatmari et al. (2003) attempted to predict VABS adaptive domain scores from measures of early language. Initial language ability did not predict scores on the socialization domain of the VABS, however it did predict scores on the communication domain.

Program Characteristics

Because such a great deal of variability is possible when applying behavioural principles to the treatment of children with autism, it is important to understand the effects of these differences on treatment outcome. Even among those who use the Lovaas et al. (1980) treatment manual, there is likely to be variability in the specific content of programs for individual autistic children. In the manual, parents and other instructors are encouraged to develop their own targets for treatment (Lovaas et al., 1980), and individual treatment providers may have different ideas about which skills and behaviours are most important. Further, results of some studies have indicated that there is also a great deal of variability among behavioural programs in terms of factors such as the intensity of treatment and the total length of time that behavioural interventions are provided.

One group of researchers conducted a study involving 75 autistic children in the U.K. who were receiving home-based behavioural interventions (Mudford, Martin, Eikeseth, & Bibby, 2001). They sought to determine how consistent the children's programs were with the guidelines outlined in the Lovaas studies (i.e., Lovaas, 1987; McEachin et al., 1993). For example, Lovaas and colleagues included only children under the age of 4 years, and provided therapy for approximately 40 hours per week. In contrast, Mudford et al. (2001) found that only 43% of the children in their study had begun treatment prior to age four years. The group received a mean of 32 hours per week of therapy, and only 7% of the sample had received 40 hours per week or more.

Treatment intensity. In the Lovaas (1987) and McEachin et al. (1993) treatment studies, children who received 10 hours per week of treatment had poorer outcomes than children who received 40 hours per week, suggesting that the children responded better to more intensive treatment. Results of subsequent behavioural treatment studies indicate that there is a great deal of variability in the intensity of children's interventions, but also that autistic children can still make important gains, even if they receive fewer than 40 hours per week of treatment. The average treatment intensity was only 30 hours per week in the Anderson et al. (1987) study, but significant improvements were observed in the children's language abilities, adaptive behaviour, and IQ. Birnbrauer and Leach (1993) wrote that the mean number of weekly treatment hours in that sample was 19 hours, and all children showed significant gains with treatment. However, none of the children had achieved "normal functioning".

In one of the only home-based behavioural intervention studies to empirically evaluate the effects of different treatment intensities, Sheinkopf and Siegel (1998) found that the number of hours per week of treatment that the children received was not related to follow-up IQ scores. Unfortunately, IQ was the only outcome measure used in that study. Gabriels et al. (2001) also examined the relation between treatment intensity and outcome. The correlations between treatment intensity and measures of intellectual ability, adaptive behaviour, autistic behaviour, and academic achievement were all non-significant. Also, the difference in the number of weekly therapy hours between high and low outcome groups was non-significant. However, the effects of treatment intensity may be more apparent when treatment methodology is more consistent across participants.

Intervention length. McEachin et al. (1993) reported that participants with the best outcomes had received a minimum of two years of intensive treatment; however, none of the replication studies evaluated the effects of different intervention lengths (Anderson et al., 1987; Birnbrauer & Leach, 1993; Sheinkopf & Siegel, 1998; Weiss, 1999). Gabriels et al. (2001) found that there were no significant correlations between the total number of treatment hours and post-treatment scores on measures of intellectual ability, language ability, academic achievement, adaptive functioning, or autistic behaviour. In addition, the difference between high and low outcome groups in terms of the total number of treatment hours was non-significant.

Therapist Characteristics

The characteristics of autistic children's therapists that were of specific interest in

the current study were (1) therapist qualifications, and (2) whether one of the child's parents worked as a therapist in the child's program. Behavioural intervention studies have included very little information about the individuals who provided day-to-day treatment for autistic children, and no studies have empirically evaluated the effects of these variables on behavioural treatment outcome.

Previous studies evaluating behavioural interventions have not included extensive information about treatment providers. For example, Lovaas (1987) simply reported that each child was assigned "several well-trained student therapists who worked (part-time) with the subject" and that parents were also "extensively trained in the treatment procedures" (p. 5). Birnbrauer and Leach (1993) explained that the therapists in their study were volunteers who had received information about autism and the program, observed the intervention, and received on-the-job training. In their study, Sheinkopf and Siegel (1998) reported that "a variety of paraprofessionals, as well as parents, acted as therapists with supervision from behaviourally-trained clinicians in the community" (p. 18).

Weiss (1999) provided slightly more detailed information about the therapists in her study. Although, no empirical data was provided, the author explained that many of the instructors were students or graduates of psychology or special education programs. In terms of training, therapists were reported to have participated in a two-day workshop led by a clinical psychologist, observed the instructional methods, and implemented the techniques with the target child. Each therapist was then paired with an experienced

therapist for an additional 18 hours of training before working with the child individually, and received follow-up training every 4-6 weeks. It was noted that the therapists varied in terms of their prior experience and knowledge (Weiss, 1999).

Birnbrauer and Leach (1993) suggested that some of the minimum requirements necessary for correct treatment delivery include a unified team and highly skilled program co-ordinators. In their review of behavioural program characteristics, Mudford et al. (2001) measured the frequency with which parents of autistic children consulted with a professional about the direction of their children's programs. Lovaas (1987) provided weekly program supervision by a highly skilled, UCLA-approved consultant; however, Mudford et al. (2001) found that there was a lot of variability among families with respect to the frequency of consultations. Ninety-four percent consulted with a professional at least twice per year, but only 7% consulted on a weekly basis. These results suggest that there may be a great deal of variability among behavioural intervention programs in terms of the background education and experience of the children's treatment providers. It would be useful to know whether this variability is related to children's responsiveness to treatment.

Another characteristic of a child's treatment team which may influence treatment outcome is the involvement of the parents in the child's intervention (Birnbrauer & Leach, 1993). Parents are often encouraged to take an active role in their children's behavioural intervention programs (Luiselli et al., 1999; Lovaas, 1987; Birnbrauer & Leach, 1993). Some suggest that parental involvement could be detrimental in some

circumstances, because it is an added source of stress to the parents' lives, and because some parents may not be able to comfortably take an active therapeutic role (Luiselli et al., 1999). However, Lovaas (1993) suggested that when a treatment is effective, parents may feel a sense of satisfaction because they are able to help their autistic child to grow and develop. In addition, parents who are involved in a child's treatment can help the child to generalize skills into the real world and to maintain those skills over time (Lovaas et al., 1980). No studies have reported whether behavioural treatment outcome is affected by whether an autistic child's parent acts as a therapist in his/her own child's program.

Purpose and Hypotheses

The main purpose of this study was to explore factors that may be associated with individual differences in the outcomes of autistic children who have received home-based behavioural interventions. The individual effects of some of these variables on treatment outcomes have been explored in a small number of previous studies. However, the results are somewhat inconsistent. Previous researchers, particularly those investigating behavioural interventions, have focused almost exclusively on IQ and educational placement in evaluating treatment outcome. However, as previously discussed, it may be important to evaluate the functioning of autistic children in a number of different ways (e.g., Bristol et al., 1996). Of the studies that have involved additional outcome measures, many have not included information about treatment history. The current study examined how child factors, program factors, and therapist factors are associated with treatment

outcome, specifically *behavioural* treatment outcome. Scores on assessments of adaptive functioning, autistic behaviour, and educational placement served as outcome measures. The following specific hypotheses were explored.

The child characteristics that were of interest in the current study were early IQ, early language ability, and the age at which the child began treatment. It was expected that higher IQs, the presence (vs. absence) of speech before treatment, and an earlier age at treatment onset would be associated with more positive treatment outcomes.

Some aspects of a child's behavioural treatment program were expected to be associated with outcomes. It was hypothesized that higher treatment intensity and more total months of intervention would be associated with more positive outcomes.

Finally, the effects of the characteristics of a child's therapeutic team on treatment outcome were also explored. It was hypothesized that children who had therapists with higher education levels and more previous experience working with autistic children would attain more positive outcomes. It was also expected that parental involvement (vs. non-involvement) in the child's treatment would be associated with more positive outcomes.

A secondary purpose of this study was to provide descriptive information about the characteristics of behavioural treatment programs and treatment providers in a Canadian sample, and to compare these characteristics with the U.S. (Anderson et al., 1987; Birnbrauer & Leach, 1993; Lovaas, 1987; Sheinkopf & Siegel, 1998; Weiss, 1999) and U.K. (Mudford et al., 2001) studies. In their review of program characteristics,

Mudford et al. (2001) concluded that very few behavioural treatment programs in the U.K. were being implemented according to Lovaas' guidelines. It is important to know whether autistic children can still make significant progress, even if their intervention is provided under different circumstances.

Method

Participants

Parents. The sample consisted of 16 parents of children with Autism. The majority of respondents (94%) were mothers. English was the first language spoken in the homes of all except two participants. One of these parents reported that the family's primary language changed to English when her child began the ABA program. Most parents had completed post-secondary education. One mother and one father had completed high school, 13% of mothers and 31% of fathers had a college diploma, 56% of mothers and 31% of fathers had a university degree, and 25% of mothers and 31% of fathers had a graduate degree.

Children. The mean age of the sample of children was 6.25 years (75 months, $SD = 24.35$ months), and the age range was 4 to 10 years. All of the children were male and were reported by parents to have received a diagnosis of Autistic Disorder. Most of the children (81%) were involved in a behavioural intervention (ABA/IBI) program at the time of data collection. Three children had received ABA therapy in the past, but were no longer involved in the program. These three children had been out of therapy between 2 and 11 months ($M = 5.3$ months). In terms of family composition, only children

accounted for 13% of the sample, 56% of the children had one sibling, 25% had two siblings, and 6% had three siblings. Of the children who had siblings, 14% were the oldest child, 21% were middle children, and 64% were the youngest child.

Procedure

An application to conduct this study was submitted to the Carleton University Ethics Committee for Psychological Research. Ethics approval was obtained on November 3, 2004 (Experiment Number 04-071).

The Autism Society of Ontario, Ottawa Chapter, included a ½ page recruitment notice in two issues of their newsletter. The notices were published several weeks apart. The recruitment text also was posted on four separate occasions on internet newsgroups (One List; Autism Support Ottawa) aimed at parents and treatment providers of autistic children. The recruitment text briefly informed parents about the nature of their involvement and invited them to contact the investigator to obtain an information package. In addition, a recruitment text was posted in various locations around the Carleton University and University of Ottawa campuses targeting student therapists. It was expected that therapists would provide information about the study to eligible parents; however, no parents were recruited using this method. E-mails were sent and telephone calls were placed to several individuals who were known to work with autistic children in the community, encouraging them to provide parents with information about this study. No eligible participants were recruited through this method.

A total of 36 questionnaire packages were distributed to parents and professionals

in the community. Fourteen questionnaire packages were distributed to eligible parents who requested them. Four of these parents eventually decided not to participate. An additional 14 packages were given to a local treatment provider, who distributed the packages directly to her clients. Eight parents responded and participated in the study. Four packages were mailed to psychologists whose names appeared on an on-line list of local service providers for people with autism (www.childrenatrisk.ca). Although three of the four psychologists agreed to provide their clients with information about the study, only one parent contacted the investigator to obtain further information. That parent was not eligible to participate as the child had not received a behavioural intervention. Four packages were given to the head teacher at *Thursday's Child*, a daycare service for children with autism spectrum disorders. No parents contacted the investigator to participate. It was not known how many clients of the psychologists or the daycare centre were eligible to participate in the study.

Of the 28 parents who received packages and were likely to be eligible, 18 eventually participated, representing a response rate of 61%. Data from 2 families were not usable and dropped from the study, leaving a total of 16 participants. One child had only been receiving a behavioural intervention for one month, and the other child was 12 years of age, well above the criteria for this study.

The information package included a letter of introduction, a description of the study, a consent form (see Appendix A), and copies of the questionnaires. The package was only sent to parents who contacted the investigator, except in the case of the parents

to whom the information package was given directly by the treatment provider. Parents were invited to complete the questionnaires at their convenience. The investigator contacted parents to determine whether they wished to participate, and to schedule an interview. Most of the interviews took place at participants' homes; two were conducted in public locations (i.e., local coffee shops), one was conducted at the respondent's place of work, and one was conducted over the telephone, at the request of the respondents. Two parents opted not to participate in the interview portion of the study, but instead provided their children's scores on the same measure from professional assessments that had recently taken place. Consent forms and questionnaires were collected at the time of the interview, and parents were provided with a debriefing letter and a \$10 gift certificate for Chapters at the end of the interview session.

Measures

Screening Questionnaire. The purpose of the screening questionnaire was to obtain contact information from parents and to determine a parent's eligibility to participate in this study (see Appendix B). In most cases, this information was obtained at the time of the initial contact between the parent and the investigator, otherwise it was collected at the time of the interview. The parent was asked to provide his or her name, mailing address, and telephone number (or e-mail address). The questions about eligibility were asked at the time of the initial contact in order to save on mailing costs, and to ensure that only parents who were actually eligible to participate were required to read the consent form and fill out the questionnaires.

Parent Background Questionnaire. Parents completed a 22-item questionnaire which included the following information: demographics, child's language history, educational placement, and behavioural intervention history (see Appendix C). The questionnaire required parents to circle or check their responses, or fill in the blanks.

Autism Behavior Checklist (ABC; Krug et al., 1993). This 57-item checklist was completed by parents in order to measure the overall severity of the child's current "autistic" behaviours. The ABC was developed in order to help clinicians and researchers to identify autistic individuals, to measure levels of autistic behaviour in children, and to facilitate diagnosis and placement into appropriate programs (Krug et al., 1980). The items on the ABC are organized into 5 symptom areas: Sensory, Relating, Body Concept, Language, and Social Self-Help. Informants indicate whether each of the items is present or absent in the child, and the items are weighted according to their importance in identifying autism. Total scores on the ABC can range from 0 to 158, and higher scores indicate more severe autistic behaviours. The ABC is a widely used instrument (Eaves et al., 2000).

Krug et al. (1993) reported a split-half reliability of $r = .87$ and an average inter-rater reliability of 95%, and other studies have found the ABC to possess adequate internal consistency (Sturmey et al., 1992; Volkmar et al., 1988). In support of the validity of the instrument in distinguishing autistic from non-autistic individuals, Krug et al. (1993) reported that mean sub-scale scores and total scores were significantly higher for an autistic group than for all comparison groups. In addition, 82% of the autistic

sample obtained ABC scores within one standard deviation of the total mean ABC score for that group. Other researchers have reported that autistic children obtain significantly higher mean scores on the ABC than groups of non-autistic children (Eaves et al., 2000; Volkmar et al., 1988; Wadden, Bryson, & Rodger, 1991).

Eaves and Milner (1993) reported a significant, but only moderate correlation ($r = .67$) between the ABC and CARS total scores. Three-quarters of the correlations between sub-scale scores on the two assessments were also significantly correlated. In contrast, Sevin, Matson, Coe, Fee, and Sevin (1991) did not find significant correlations between ABC and CARS scores. A more recent study revealed a significant positive correlation ($r = .80$) between the total scores on the ABC and the Pervasive Developmental Disorder Rating Scale (PDDRS; Eaves, cited in Eaves et al., 2000). Over 90% of correlations between sub-scale scores were also significant (Eaves et al., 2000).

Several studies have examined how well the ABC differentiates individuals with autism from others. Most children with a clinical diagnosis of AD are classified as autistic by the scale, and children who are *not* autistic are *not* classified as autistic by the scale (Eaves et al., 2000; Eaves & Milner, 1993; Volkmar et al., 1988; Wadden et al., 1991; Yirmiya et al., 1994). In further support of the validity of the ABC, Eaves and Milner (1993) reported a rate of agreement of 83%, for classification of children as autistic or non-autistic, between the ABC and the CARS. Eaves et al. (2000) determined that the ABC and the PDDRS agreed on the classification of 85% of their sample of 136 children.

The authors of the ABC suggested that children with scores of 68 or higher are very likely to be autistic, as 90% of the standardization sample with previous diagnoses of AD obtained scores higher than 68. They further recommended that children with scores above 52 could be classified as possibly autistic, as 95% of autistic children obtained a score above 52 (Krug et al., 1993). Based on their own and previous research, Wadden et al. (1991) suggested that 52 might be too high, and instead proposed that a score above 44 might be more likely to reliably identify children with autism. In their study, 87% of children with diagnoses of AD obtained ABC scores above 44, while 96% of the non-autistic children scored below 44 (Wadden, et al., 1991).

The response format of the ABC was modified from the original version so that parents were simply required to circle “yes” or “no” depending on whether the item accurately described their child. The total score was then calculated using the weights indicated on the original version of the checklist. This modification has been used by previous researchers (Miranda-Linne & Melin, 2002; Volkmar et al., 1988; Yirmiya et al., 1994).

Vineland Adaptive Behavior Scales (VABS; Sparrow et al., 1984). One parent of each child was interviewed by the investigator (in one case, both parents were interviewed together). The interview typically took 45 to 60 minutes to complete. Items from the three domains of adaptive behaviour were administered (i.e., communication, socialization, daily living skills). A total of 225 behavioural items comprise these three scales, however, not all of the items needed to be scored during the interview because

basal and ceiling levels are established during administration.

Items on the VABS are assigned a score on a three-point scale according to how frequently the behaviour occurs (0 = never, 1 = sometimes or partially, 2 = usually). Some of the items may also be scored with an "N" if the child has never had an opportunity to engage in the behaviour (e.g., the items regarding telephone use may be scored N if there are no telephones in the child's home), or with "DK" if the respondent does not know whether the child engages in the behaviour. Composite scores are computed by adding the standard scores for each of the domains. The VABS composite score has a mean of 100 and a standard deviation of 15.

The authors of the VABS provided information about reliability and validity of the scale based on data obtained from a representative sample of 3000 children (Sparrow et al., 1984). For example, median split-half reliability coefficients across age groups were reported for the adaptive behaviour composite (.94), and for the communication (.89), socialization (.86), and daily living skills (.90) domains. Test-retest reliability checks (2-4 week intervals) were conducted with 484 individuals in six age groups. Median test-retest coefficients across age groups were .88 (composite), .86 (communication), .85 (daily living skills), and .81 (socialization). Finally, inter-rater reliability coefficients were calculated using data from 160 individuals. These coefficients ranged from a low of .62 (socialization) to a high of .74 (composite).

Several techniques were used to establish the validity of the VABS (Sparrow et al., 1984). Construct validity was built into the scale when the authors employed several

procedures during item development and selection. Factor analyses were performed which supported the appropriateness of the adaptive behaviour composite and the organization of the sub-domains. Further, it was found that the VABS correlates more strongly with measures of adaptive behaviour than with other types of measures (e.g., IQ). Additional studies, some of which are reported in the VABS manual (Sparrow et al., 1984) have provided support for the validity of the VABS (e.g., Perry & Factor, 1989).

The investigator was trained to conduct this semi-structured interview before data collection began. Relevant chapters regarding interviewing techniques were reviewed from Sattler's (2001), *Assessment of Children: Behavior and Clinical Applications*. The VABS manual was read in its entirety, and the sections on administration and scoring were reviewed many times. All relevant interview items and the specific criteria for scoring each item were intensively studied. The training video accompanying the VABS manual was viewed several times, allowing an opportunity to practice scoring the items. Dr. Joanna Pozzulo, a clinical psychologist who had previous experience with the VABS, was consulted about interviewing and scoring procedures, and helped the investigator to resolve questions and concerns. Four practice interviews were conducted with parents of typical children (Dr. Pozzulo recommended conducting 3 practice interviews). The fourth practice interview was videotaped with the written consent of the mother. The video was provided to Dr. Pozzulo who reviewed the tape and provided written feedback indicating that the investigator was proficient in the administration and scoring procedures.

Therapist Questionnaire. This short 11-item questionnaire was completed by

those who work directly with the child in his/her treatment program (see Appendix D).

The questionnaire asked about the therapist's education, training, and experience working with autistic children. Parents were asked to distribute the questionnaire to up to five of their child's therapists; therapists returned the completed questionnaires to the child's parents in sealed envelopes.

Early IQ. Information about children's IQ before treatment was collected from assessment reports provided by the parents. The age of the child at testing, the name of the test, and the child's score were recorded from the assessment reports. Unfortunately, this information was only available for 11 children. Parents of three children opted not to provide information about their child's IQ, one child only had an IQ test conducted after commencing the intervention, and one child was reported never to have been assessed. For the 11 children for whom data was included, all of the assessments had taken place before the children had started their behavioural interventions. The children had been assessed at a mean age of 27.5 months ($SD = 5.91$). The most commonly used assessment instrument was the Bayley Scales of Infant Development. Five of the children (63%) had been tested using this measure. One child had been tested with the Woodcock-Johnson, one with the WPPSI-3, and one with an unspecified assessment tool. Children's scores were reported as age equivalents or percentile ranks, and in two cases, only descriptive information was provided.

Results

Overview

The results of the current study are presented in four main sections. First, responses to the parent questionnaires regarding the characteristics of children's behavioural treatment programs were analysed. The second section comprises an analysis of responses to the therapist questionnaires. The purpose of these two sections was to provide descriptive information to characterize the current sample and to facilitate comparisons to other treatment evaluation studies regarding these characteristics. Following these descriptive findings is a section outlining the results that were obtained on the three outcome measures (i.e., ABC, VABS, educational placement) for the current sample of children. The final section describes the statistical analyses that were conducted in order to investigate the influence of child, program, and therapist factors on behavioural treatment outcomes.

Survey of Program Characteristics

The goal of these first analyses was to provide an overview of the characteristics of children's treatment programs. These results provided an indication of how much variability there was in the current sample in terms of how the behavioural interventions were administered. Mudford et al. (2001) also suggested that it is important to consider treatment integrity, and they investigated whether programs being conducted in the U.K. were similar to that provided by Lovaas (1987). A summary of program characteristics for children in the current sample is presented in Table 1, and includes a comparison to

Table 1. Summary of program characteristics of home-based behavioural treatment studies.

Study	Age at Onset (months)		Treatment Intensity (hours per week)		Months of Intervention		Supplementary Interventions	
	Mean (SD)	% under 40 mo.	Mean (SD)	% over 40 hrs.	Mean (SD)	% over 2 yrs.	Mean Hrs/wk	% receiving
Lovaas (1987)	34.2	100%	40.0	100%	-	100%	-	-
Anderson et al. (1987)	42.8 (11.8)	29%	20.0	-	12-24 ^a	-	-	-
Birnbrauer & Leach (1993)	24-48 ^a	-	18.7	-	21.6	-	-	-
Sheinkopf & Siegel (1998)	33.8 (6.2)	82%	19.4 (8.2)	9%	20.5 (8.1)	27%	7.6	-
Weiss (1999)	41.5	<65%	40 (approximately)	-	24.0	100%	-	-
Mudford et al. (2001)	-	43%	32.0 (6.0)	7%	21.0 (11.0)	-	-	-
Current Study	37.3 (7.7)	75%	36.3 (7.7)	50%	35.3 (21.7)	69%	2.1	56%

Note: Dashes indicate that the information was not provided by the authors or could not be calculated given the data provided.

^a Only a range was provided.

characteristics reported by Lovaas (1987), Mudford et al. (2001), and authors of the home-based behavioural treatment replication studies (Anderson et al., 1987; Birnbrauer & Leach, 1993; Sheinkopf & Siegel, 1998; Weiss, 1999).

Children in the current study began their behavioural interventions between the ages of 27 and 50 months, and the mean age of treatment onset was 37.31 months ($SD = 7.73$). All except one child began their interventions before the age of 4 years, and 44% of the children had begun treatment at or before the age of 3 years. The length of time that children had been involved in their programs ranged from 7 months to 75 months ($M = 35.3$ months, $SD = 21.7$). At the time of data collection, 88% had been in treatment for at least one year, 69% had at least 2 years of treatment, 38% had at least 3 years, and 19% had 4 years or more.

In terms of treatment intensity, parents were asked to indicate how many hours per week of behavioural treatment their children were receiving at the time of data collection. Parents whose children were no longer in treatment were asked to report the treatment intensity over the last 6 months of their child's program. Responses ranged from 10 hours per week to 40 hours per week, with a mean response of 25 hours per week ($SD = 9.6$). Half of the children were receiving at least 20 hours per week, and 38% were receiving 35 hours or more. Because many of the children were in school at the time of data collection (which may have resulted in a reduced number of behavioural treatment hours) parents were also asked to report the maximum number of weekly hours that their children had ever received over the course of their programs. Responses ranged

from 20 hours to 48 hours, with a mean response of 36.27 hours ($SD = 7.69$). All children had received a maximum of at least 20 hours per week, but only 50% had received 40 hours per week or more at some point during their treatment.

In addition to ABA/IBI therapy, 56% of the children were receiving other forms of treatment at the time of data collection. The most commonly reported supplementary intervention was occupational therapy (OT, 31%), followed by speech therapy (19%), social skills training (19%), and physiotherapy (13%). Two children (13%) were receiving biomedical treatments such as vitamin therapy or specialized diets. Of the children who were receiving supplementary interventions on a weekly basis, one was receiving 1 hour per week, two were receiving 1.5 hours per week, two were receiving 3 hours per week, and the remaining three children were receiving 4, 7, and 12 hours per week, respectively. Three children were reported to be receiving speech therapy and physiotherapy or biomedical treatment in addition to OT, two children were receiving OT only, two children were in social skills development groups only, and one child was receiving a biomedical treatment only.

Survey of Therapist Characteristics

Therapist questionnaires were completed by 35 therapists who are currently working with autistic children in home-based behavioural interventions. Responses on the therapist questionnaire were included for one child on whom data was collected, but who did not meet the eligibility criteria. The majority of therapists were female (85.7%). Five of the questionnaires were completed by parents who had worked as therapists for

their own children; however, most of the respondents (85.7%) were not related to the target child. The mean age of the therapists was 28.14 years ($SD = 7.15$). Ages ranged from 19 to 46 years, but 83% of the therapists were 30 years of age or younger.

Previous studies evaluating the effectiveness of home-based behavioural interventions were reviewed in order to determine the extent of the information currently available about the characteristics of behavioural treatment providers. Of particular interest were the therapists' levels of education and previous experience working with autistic children. Information was also collected about the individuals who provided training for the therapists, the methods with which the therapists were trained, and the intensity of the training. Also of interest was the intensity of therapist involvement in the children's programs, which was measured in terms of the number of hours per week that each therapist spent with the child, and the number of therapists on each child's treatment team. Finally, information was collected about the intensity of program supervision. Of interest were the frequency with which the children's therapists attended team meetings, and the frequency with which a professional was consulted about the direction of the children's programs. The results of this review were compared to the findings of Mudford et al. (2001) and the findings from the current study. Results regarding therapist education, experience and training are summarized in Table 2, and results pertaining to therapist involvement and supervision are presented in Table 3.

Table 2. Comparison across home-based behavioural treatment studies of therapist qualifications.

	Therapist Description	Previous Experience	Training Hours	Therapist Trainers	Training Methods
Lovaas (1987)	Students Parents	-	-	-	-
Anderson et al. (1987)	B.A.s & M.A.s Parents	-	30 hours (approximately)	-	Manuals Modeling Feedback
Birnbrauer & Leach (1993)	Volunteers Parents	-	-	Parents	"On-the-job"
Sheinkopf & Siegel (1998)	Paraprofessionals Parents	-	-	-	Manuals "Prior training"
Weiss (1999)	Students College graduates	"varied"	2-day workshop + 18 hours (approximately)	Clinical Psychologist	Workshop Modeling Practice/Feedback "Follow-up training"
Current Study	Students Parents Graduates	$M = 15.5$ months	$M = 40$ hours	Psychologists Senior Therapists Parents	Varied * see p. 69

Note: Dashes indicate that the information was not provided by the authors.

Table 3. Comparison across home-based behavioural treatment studies of therapist involvement and supervision.

Study	Intensity of Involvement	Length of Involvement	# of Therapists on Treatment Team	Frequency of Consultations			Frequency of Team Meetings		
				Weekly	At least Monthly	At least 2-3 times per year	Weekly	At least Monthly	At least 2-3 times per year
Lovaas (1987)	-	-	"several"	100%	-	-	-	-	-
Anderson et al. (1987)	<i>M</i> = 15 hrs/wk	-	1 + parent	-	-	-	100%	-	-
Birnbrauer & Leach (1993)	2.5 + hrs/wk	4 months (mode)	"up to 24" + parent	100%	-	-	0%	100%	-
Sheinkopf & Siegel (1998)	-	-	-	-	-	-	-	-	-
Weiss (1999)	-	-	-	0%	100%	-	100%	-	-
Mudford Et al. (2001)	-	-	-	0%	17%	94%	-	-	-
Current Study	<i>M</i> = 12 hrs/wk	<i>M</i> = 16.5 months	<i>M</i> = 2.2	0%	75%	88%	13%	100%	-

Note: Dashes indicate that the information was not provided by the authors.

Therapist education. Previous researchers did not include detailed information about the educational experiences of the therapists who provided behavioural interventions for the autistic children in their studies. The extent of the information provided is summarized in Table 2 under the “Therapist Description” heading. In the current study, approximately one-third (34.3%) of therapists indicated that they are currently students. Therapists were asked to indicate the highest level of education that they had completed to date. The majority of therapists had completed post-secondary education; however 25.7% had only completed high school. Eight of nine therapists who had only completed high school reported that they were students at the time of data collection. Of the therapists who had post-secondary education, 19% had completed college, 58% had a university degree, and 23% had a graduate degree.

Therapist experience. Therapists were asked to indicate how much experience they had working with autistic children *before* they began working with the target child. Approximately one-third ($n = 12$) of the therapists reported no previous experience. A closer examination of the therapist data revealed that five of the twelve (42%) inexperienced therapists were parents of one of the target children (i.e., all five parent-therapists did not have any previous experience working with autistic children before they began to work with their own child). Therapists who had some previous experience working with autistic children reported between 2 and 60 months of experience ($M = 23.7$ months, $SD = 18.9$). Just over half of the total sample of therapists (51%) had at least one year of experience, 83% had three years or fewer, and 91% had fewer than four

years of experience.

Therapist training. The next set of questions concerned the therapists' training experiences. First, therapists were asked to report total number of training hours they received. Respondents estimated the number of hours of training they received that was directly related to their work with the target child. Responses ranged from 3 to 225 hours. Several respondents ($n = 7$) did not report a specific number of hours, but indicated that their training is ongoing (e.g., through team meetings, workshops, etc.). The median number of training hours reported was 20 hours ($M = 40.46$, $SD = 50.34$). Four therapists indicated that they had received more than 100 hours of training; however, 85.7% reported 50 hours or fewer, 53.6% reported 20 hours or fewer, and 14.3% reported 10 hours or fewer.

Next, therapists were asked to indicate which of the following people were directly involved with their training: (1) behaviour consultant or psychologist; (2) senior therapist; (3) experienced therapist; (4) parent; and/or (5) other. One therapist did not provide this information. Two participants (6%) selected five categories, 20% selected four categories, 40% selected three categories, 23% selected 2 categories, and 9% selected only one category. No information was obtained about how many individuals in each category provided the training. Most commonly, therapists reported being trained by a behaviour consultant or psychologist (83%) or by a senior therapist (80%). Experienced therapists were involved in the training of 63% of the respondents, and 43% reported that a parent had provided some of the training. Finally, 14% indicated that another individual

had been involved in their training. Four of these individuals reported that an occupational therapist had been involved in their training, and one therapist (a parent) reported that she was self-trained.

A third factor of interest related to therapist training was the method used during training. Therapists were asked to check all of the following methods that applied to them: (1) discussion or verbal instruction; (2) written manual; (3) instructional video; (4) role play; (5) observation of the intervention being provided to the target child; (6) supervised work with the target child; and (7) other. All of the therapists (100%) reported that their training involved verbal instruction and at least one other instructional method; however, they varied in terms of the type and number of other methods used. On average, therapists were trained using 5 different methods. One therapist was trained using verbal instruction and one additional method, 20% were trained using three methods, 11% with four methods, 17% with five methods, 31% with six methods, and 17% with seven methods.

Aside from verbal instruction, other popular training methods were the written manual (77%), observation (89%), and supervised training (83%). Just over half of the respondents (57%) reported viewing an instructional video as part of their training, 57% reported role play, and 43% reported an additional method. Of the individuals who reported an additional method, 73% reported that they had attended a training workshop or seminar, 20% reported receiving ongoing supervised training, and one therapist reported having observed another child's intervention as part of her training.

Therapist involvement. In order to evaluate the intensity of the therapists' involvement with the children, participants were asked to indicate the number of hours per week that they work with the child. The mean number of hours per week was 11.94 hours ($SD = 4.61$); however, again, responses were quite variable. The minimum number of hours per week reported was 5 hours, and no therapist reported working with the child for more than 21 hours per week.

Therapists were asked to indicate for how long they had been involved in the child's behavioural intervention. Responses ranged from one month to 6 years, and the mean length of involvement was 16.51 months ($SD = 15.35$). Over half of the sample (54%) had been working with the child for less than one year, 46% had been working with the child for at least one year, 26% for at least two years, and 14% for three years or more.

Given that half of the children were receiving more than 20 hours per week of behavioural treatment at the time of data collection, and no therapist reported working more than 21 hours per week with the same child, it is clear that many of the children had more than one therapist. One of the items in the parent questionnaire specifically addressed this issue. Of the parents whose children were currently involved in a behavioural treatment program, one parent (8%) reported that there was only one therapist currently working with her child, and the remaining parents indicated that their children had between 2 and 4 therapists working with their children. Six children (46%) had two therapists, 31% had three therapists, and 15% had four therapists.

Therapist supervision. Finally, parents were asked to report the frequency with which their child's therapists had team meetings, and the frequency with which they, or their treatment teams, met with a behaviour consultant or psychologist to discuss the direction of their children's programs (i.e., information about consultations and team meetings was obtained from parent questionnaires, not therapist questionnaires). All parents reported that they had team meetings at least once per month, 63% had meetings every 2 weeks, and 12.5% had weekly team meetings. In terms of professional consultations, only 2 parents (12.5%) reported that they did not consult with a professional, and another 12.5% consulted only two or three times per year. However, more than half of the parents (56%) reported that they consulted a professional once per month, and 19% had consultations every 2 weeks.

Treatment Outcome Assessments

Three measures were employed to evaluate the children's behavioural treatment outcomes. The *Autism Behavior Checklist* (ABC) provided a measure of the children's current levels of autistic behaviour. The composite score of the *Vineland Adaptive Behavior Scales* (VABS) provided an indication of the children's current levels of overall adaptive functioning in the domains of communication, socialization, and daily living skills. Finally, the educational placement measure provided an indication of the children's functioning in school settings. Means and standard deviations for these three outcome measures for the entire sample (one parent did not provide information about educational placement) are presented in Table 4.

Table 4. Means, standard deviations and ranges of scores on outcome measures.

Outcome Measure	Mean (SD)	Range
ABC ¹	45.94 (26.89)	5 - 95
VABS ²	61.63 (13.81)	34 - 81
CMN	76.75 (22.45)	42 - 116
SOC	64.06 (11.07)	48 - 80
DLS	60.69 (18.22)	20 - 86
Educational Placement	2.87 (1.19)	1 - 4

¹ ABC = Autism Behavior Checklist

² VABS = Vineland Adaptive Behavior Scales composite score, CMN = Communication domain score, SOC = Socialization domain score, DLS = Daily Living Skills domain score.

For the educational placement outcome measure, children were assigned a score between 1 and 4. These scores were assigned based on the type of classroom the child was in and whether he received classroom support from an education assistant (EA) or aide. Children were assigned a score of 1 if they were not in school at the time of data collection, 2 if they were in a classroom designed for children with special needs, 3 if they were in a “regular” classroom with typical peers *and* received full-time support, and 4 if they were in a regular classroom with only part-time support. Children were classified as receiving part-time support if they received support from an EA for only part of their school day, or if their EA was responsible for helping more than one child in the classroom. In order to facilitate group comparisons, the educational placement measure was treated as a continuous variable. Of the entire sample, three children were not in school, two were in special needs classrooms, four were in regular classrooms with full-time support, and six were in regular classrooms with only part-time support. Therefore, approximately two-thirds of the children in the current sample were in regular education classrooms.

It is noteworthy that 44% of the children scored below 44 on the ABC (the cut-off recommended by Wadden et al., 1991) and 81% of the sample scored below 68 (the cut-off recommended by Krug et al., 1993), after receiving a mean of 2.9 years of behavioural treatment. In terms of adaptive behaviour outcomes, on the communication domain of the VABS, 44% of the children in the current sample scored above 85 (i.e., greater than one SD below the standardized mean), 25% scored at or above the mean, and

one child received a score of 116 (over one SD above the standardized mean). However, none of the children received a VABS composite score or socialization domain score above 85, and only one child scored above 85 on the daily living skills domain.

Factors Associated with Treatment Outcome

The effects of 7 factors on treatment outcomes were evaluated. These factors were selected based on previous research results and speculation in the literature that they might be important in assessing the potential success of a behavioural intervention. The variables of interest were grouped conceptually into 3 areas. *Child factors* included pre-treatment IQ, early language ability, and the age at which the child began treatment. *Program factors* included the intensity and length of the intervention. Finally, *therapist factors* included the qualifications of the therapists (i.e., education and experience), as well as parental involvement in the child's program.

For each factor, the sample was divided into two groups. Details about the procedures that were used for group assignment are discussed separately for each variable in the sections below. Independent samples t-tests were conducted to compare the differences between groups for the three outcome measures. The t-test was selected due to the small sample obtained in the current study. In order for a regression analysis to be conducted, 6 to 10 participants are typically required for each predictor variable (Neter, Kutner, Nachtsheim, & Wasserman, 1996). On the other hand, the independent samples t-test can be used regardless of sample size (Hayes, 1994). The independent samples t-test also does not require equal sample sizes, as long as there is at least one

case in each sample (Hayes, 1994).

Comparison group mean scores and standard deviations on the outcome measures for child variables are displayed in Table 5. Results for program characteristics are shown in Table 6, and for therapist characteristics in Table 7. In consideration of the number of separate analyses conducted, a p -value of .01 was selected to signify significant group differences. Given the a priori directional hypotheses, one-tailed tests were used.

Finally, effect sizes for each t-test were calculated using the d statistic which provides a measure of the differences between the means of two groups, taking into account the variation within each of the groups (Hayes, 1994). According to Green, Salkind, & Akey (2000), regardless of the sign, d -values of .2, .5, and .8 represent small, medium, and large effect sizes, respectively. Absolute values of d are therefore reported in the text below. Values of d can range from zero, indicating no difference, to infinity (Green et al., 2000).

Child characteristics. The first child variable explored was pre-treatment IQ. Children were assigned to one of two groups based on their level of intellectual ability *before* they began their behavioural intervention. Participants ($n = 7$) were assigned to the “significant delay” group if they were reported to be un-testable (e.g., due to language delay), if their assessment reports described them as significantly delayed, or if there was greater than 20 months difference between their chronological age and their age-equivalent score on the IQ test. All other children ($n = 4$) were assigned to the “mild

Table 5. Child variables: Mean scores (standard deviations) of comparison groups on outcome measures.

Outcome Measure	IQ		Age at Onset		Pre-treatment Language	
	Mild Delay	Significant Delay	< 36 months	> 36 months	Present	Absent
ABC ^a	34.3 (24.9)	51.7 (30.4)	51.3 (34.0)	40.6 (18.1)	54.0 (15.8)	41.1 (31.6)
VABS ^b	72.8** (8.1)	59.7 (14.1)	60.9 (15.0)	62.4 (13.6)	64.3 (14.4)	60.0 (14.0)
Educational Placement	4.0*** (0.0)	2.4 (1.1)	2.5 (1.3)	3.3 (.95)	2.8 (1.3)	2.9 (1.2)

* p < .10, one-tailed ** p < .05, one-tailed *** p < .01, one-tailed

^a ABC = Autism Behavior Checklist total score.

^b VABS = Vineland Adaptive Behavior Scales composite score.

Table 6. Program variables: Mean scores (standard deviations) of comparison groups on outcome measures.

Outcome Measure	Treatment Intensity		Length of Intervention	
	<u>High</u>	<u>Low</u>	<u>> 30 months</u>	<u>< 30 months</u>
ABC ^a	41.4 (25.6)	52.0 (31.1)	36.8* (24.7)	55.1 (27.4)
VABS ^b	59.4 (16.8)	65.3 (10.7)	58.6 (16.3)	64.6 (11.1)
Educational Placement	3.4* (.53)	2.4 (1.5)	3.4** (.74)	2.3 (1.4)

* $p < .10$, one-tailed ** $p < .05$, one-tailed *** $p < .01$, one-tailed

^a ABC = Autism Behavior Checklist total score.

^b VABS = Vineland Adaptive Behavior Scales composite score.

Table 7. Therapist variables: Mean scores (standard deviations) of comparison groups on outcome measures.

Outcome Measure	Therapist Qualification		Parent Therapist	
	<u>High</u>	<u>Low</u>	<u>Yes</u>	<u>No</u>
ABC ^a	42.3 (32.7)	48.6 (26.6)	49.3 (32.6)	44.8 (26.3)
VABS ^b	71.0*** (3.90)	56.6 (15.1)	59.8 (14.3)	62.3 (14.2)
Educational Placement	3.0 (1.4)	2.6 (1.1)	2.8 (1.5)	2.9 (1.1)

* $p < .10$, one-tailed ** $p < .05$, one-tailed *** $p < .01$, one-tailed

^a ABC = Autism Behavior Checklist total score.

^b VABS = Vineland Adaptive Behavior Scales composite score.

delay” group. One of these children was described in his assessment report as having a “mild cognitive delay,” one received a WPPSI-3 score in the 25th percentile, and two children received age-equivalent scores that were 9 and 15 months below their chronological ages.

Independent samples t-tests were conducted in order to determine whether there were differences between the significantly delayed group and the mildly delayed group on the three outcome measures. On the ABC, the mean score of the significantly delayed group was higher (indicating a lower level of functioning) than that of the mildly delayed group ($d = 1.02$); however, this difference did not reach statistical significance, $t(9) = 1.63, p = .179$. On the measure of adaptive behaviour, mildly delayed children scored higher than significantly delayed children $t(9) = -1.95, p = .04$ ($d = 1.22$). Finally, a significant difference was found between IQ groups on the measure of educational placement, $t(9) = -3.67, p = .005$, with mildly delayed children scoring higher than significantly delayed children ($d = 2.30$). It should be noted that the assumption of homogeneity of variance was not met for either of these tests. In other words, the Levene’s test for equality of variances was significant ($p < .05$) for both analyses. As such, the more conservative “separate variance” estimate was employed, which does not assume that the population variances are equal (Green et al., 2000).

The second child variable examined was age at treatment onset. Following Lord and Schopler (1989a), and given that 94% of the sample had started their interventions prior to age 4 years, children were divided into early and late onset groups based on

whether or not they had begun treatment prior to the age of 3 years. The early onset group ($n = 7$) had started their interventions at or before 36 months of age, and the late onset group ($n = 9$) were 37 months or older when they began treatment. No significant differences were found between groups on the ABC, $t(14) = .262, p = .399 (d = .132)$, the VABS, $t(14) = -.475, p = .321 (d = .239)$, or the measure of educational placement, $t(13) = -.452, p = .330 (d = .121)$.

The final child variable that was explored was early language ability. Parents were asked to report whether or not their children had any understandable speech before treatment. Almost two-thirds (63%) of the children were reported by parents to have had no understandable language before their interventions began. Ten children were therefore assigned to the “no language” group and six children were assigned to the “some language” group. Again, no significant differences emerged between the groups on the ABC, $t(14) = -1.085, p = .149 (d = .560)$, the VABS, $t(14) = -.590, p = .281 (d = .305)$, or the measure of educational placement, $t(13) = -.148, p = .442 (d = .076)$.

Program Characteristics. The next set of analyses explored whether characteristics of the children’s intervention programs were related to treatment outcome. First, parents were asked to report how many hours per week their child participated in the behavioural intervention program, at the time when the child’s programming was as most at its most intensive. These analyses were conducted with 15 participants, because one parent did not report maximum treatment hours. The “high intensity” group ($n = 8$) had received 40 hours per week (or more) at some point over the course of their

intervention, and the “low intensity” group ($n = 7$) had always received less than 40 hours per week. Children in the low intensity group received a mean score on the ABC which was higher than that of the high intensity group ($d = .376$); however, this difference did not reach significance, $t(13) = -.726, p = .241$. On the measure of adaptive behaviour, the mean VABS score of the low intensity group was again not significantly different than that of the high intensity group $t(13) = -.797, p = .220 (d = .412)$. However, on the measure of educational placement, children in the low intensity group scored lower on the than children in the high intensity group $t(12) = 1.65, p = .07 (d = .854)$.

Another program variable that was expected to be associated with treatment outcome was the length of the child’s intervention. For this analysis, children were grouped according to whether they had received more ($n = 8$) or less ($n = 8$) than 30 total months of treatment (i.e. above or below the median number of months). On the ABC, children who had received less than 30 months of intervention scored higher than children who had received more than 30 months $t(14) = 1.41, p = .09 (d = .705)$. Mean scores of the two groups on the VABS were not significantly different, $t(14) = .861, p = .202 (d = .431)$. Finally, a difference was found between groups on the measure of educational placement, $t(14) = -1.865, p = .048$; children who received less than 30 months of treatment obtained a lower score than those who received more than 30 months ($d = .933$).

Therapist Characteristics. The final set of analyses was designed to explore whether characteristics of a child’s therapists might be associated with treatment

outcome. First, analyses were conducted to explore whether the qualifications of the therapists were related to outcome scores. Three parents reported that their children were no longer receiving behavioural treatment; two of these parents were unable to contact their previous therapists, and one parent asked her child's most recent former therapists to complete the questionnaires. Thus, the analyses for therapist qualifications were conducted using data from 14 participants.

The head therapist for each child was selected for this analysis, based on information from the therapist questionnaires. The head therapist was defined as the therapist who reported working with the child for the longest amount of time, and for approximately one year or more (two head therapists had been working with the children for over 11 months). For cases in which two therapists had been working with the same child for an equal amount of time, the therapist who reported working with the child for a greater number of hours per week was designated head therapist. Children were assigned to one of two groups based on the education level and previous experience of their head therapist. Those in the high qualification group ($n = 4$) had head therapists with a university degree who reported having had at least one year of experience working with autistic children *before* starting their work with the target child. Those in the low qualification group ($n = 10$) had head therapists without a university degree and with less than one year of experience working with autistic children.

Mean scores on the ABC of the high qualification and low qualification groups were not significantly different, $t(12) = .380, p = .356 (d = .225)$. However, on the

VABS, children with highly qualified therapists scored significantly higher than children with less qualified therapists, $t(12) = -2.787, p = .008$ ($d = 1.65$). Again it should be noted that the Levene's test for equality of variances was significant ($p < .05$). Finally, a significant difference between groups was not found on the measure of educational placement, $t(11) = -.609, p = .277$ ($d = .360$).

The second therapist variable that was explored was parental involvement in the children's programs. Parents were asked to indicate whether or not they had ever worked as a therapist for their own child. No significant differences were found between the group of children who had a parent therapist ($n = 4$) and the group who never had a parent therapist ($n = 12$) on the ABC, $t(14) = -.276, p = .394$ ($d = .159$); the VABS, $t(14) = .304, p = .383$ ($d = .176$); or the measure of educational placement $t(13) = .222, p = .414$ ($d = .128$).

Discussion

The goal of this study was to explore factors that may affect behavioural treatment outcomes for children with autism. The current research represents one of the only studies to attempt to systematically evaluate the association of multiple factors with autism treatment outcomes (Gabriels et al., 2001; Szatmari et al., 2003). This type of research is extremely important given the popularity of behavioural interventions internationally (Bowker & Wells, 2004; Hastings & Johnson, 2001; Nelson & Huefner, 2003) and that behavioural interventions are currently considered by many to be the treatment of choice for autistic children (Anderson & Romanczyk, 1999; Jacobson, 2000;

Mesibov et al., 1997; Rosenwasser & Axelrod, 2001). Results provided some preliminary support that certain child characteristics, program characteristics, and therapist characteristics are predictive indices of successful treatment outcome.

Although many of the factors assessed in the current study have been described in previous research regarding the effectiveness of behavioural interventions, there have been few attempts to empirically evaluate their associations with *behavioural* treatment outcomes. If factors can be identified that are associated with improved outcomes, clinicians and treatment providers may be able to more effectively plan treatment protocols for individual autistic children.

An important contribution of the current research is that several different outcome measures were employed. Many behavioural treatment outcome studies have focused, sometimes exclusively (e.g., Sheinkopf & Siegel, 1998), on post-treatment IQ scores. This is despite the criticism after the publication of the Lovaas studies that IQ may be a less than ideal outcome measure (e.g., Gresham & MacMillan, 1997a; Schopler et al., 1989) and the assertion that autistic children should be assessed in different areas of functioning (Bristol et al., 1996; Kazdin, 1993; Mundy, 1993; Storey & Horner, 1991). In the current study, children's treatment outcomes were assessed in terms of autistic behaviour (ABC), adaptive functioning (VABS), and educational placement. Moreover, important descriptive information about the sample (e.g., number and type of supplementary interventions) was included in the current study, which should be considered when evaluating the effectiveness of a treatment.

The current results pertaining to the associations of child characteristics, program characteristics, and therapist characteristics with behavioural treatment outcome (and the implications of these results) will be discussed in the following sections. Suggestions for future research are included for each factor. This section also includes comments relating to the variability within and among previous behavioural treatment outcome studies regarding descriptive information (or lack thereof) about child, program, and therapist characteristics. Following this discussion is a section outlining the major limitations to this study and some concluding remarks.

Child Characteristics

Early IQ. The results of the current investigation were consistent with many previous studies indicating that children with higher IQ scores before treatment tend to score better on outcome measures after treatment than children with lower pre-treatment IQ scores (DeMyer et al., 1974; Freeman et al., 1991; Gabriels et al., 2001; Harris & Handleman, 2000). A significant mean difference was found between the mildly and significantly delayed groups on the measure of educational placement, and potentially important trends in the expected directions were observed on the measures of adaptive behaviour and autistic behaviour.

Social dysfunction, one of the key features of Autistic Disorder (APA, 1994), may be an extremely important factor to consider when discussing the relation between IQ and autistic behaviour, adaptive behaviour, and educational functioning. First, a child's ability to perform successfully on an IQ test is influenced by many factors, including

social motivation. It is therefore difficult to define what an autistic child's IQ score really means. Second, social motivation is also likely to influence the ability of a child to learn important adaptive and educational skills from people in his or her environment. Third, social interest (or disinterest) may be an important factor in the degree to which autistic children engage in the abnormal (autistic) behaviours that are measured by the ABC. Thus, the relation between IQ, adaptive behaviour, educational functioning, and autistic behaviour is likely to be influenced by the degree to which an autistic child is motivated to interact socially.

Successful performance on an IQ test requires attention, motivation to communicate and interact socially with the test administrator (e.g., joint attention, imitation), and, on some subscales, specific knowledge of age-appropriate social conventions. It has been noted that autistic children may perform poorly on IQ tests because they are not motivated to engage appropriately with the test administrator (Stone et al., 1999). In support of this notion, Beglinger and Smith (2005) found that autistic children who were more socially aloof also tended to have lower IQ scores than autistic children who were more socially receptive. In a review of the literature on the intellectual abilities of high-functioning autistic children, Yirmiya and Sigman (1991) found that autistic children tended to perform most poorly on subscales requiring social understanding. Social disinterest may therefore diminish autistic children's capacity to attend to and understand IQ test tasks, leading them to perform poorly on IQ tests relative to typical children. Autistic children with particularly low social motivation (i.e., relative

to other autistic children) may perform even more poorly on intelligence tests.

In the current study, children with less significant intellectual delays obtained a higher mean adaptive behaviour composite score on the VABS than the group of children with more significant delays. In addition, children who were reported to have had less severe delays before treatment also scored significantly higher on the measure of educational placement than children with very severe delays. All of the children (100%) in the mild delay group were reported to be in regular classrooms with only part-time or shared assistance. In comparison, only 57% of the significantly delayed children were in regular classrooms (all receiving full-time support); one child was in a special needs classroom with full-time support, and two children were not in school at the time of data collection.

The factors that influence a child's ability to obtain a higher IQ test score (i.e., attention, compliance, social motivation, social understanding) may also influence how much a child will benefit from treatment, because these factors would also be important in therapeutic and educational situations (Gresham & MacMillan, 1997a; Harris et al., 1991; Sattler, 2001; Schopler et al., 1989). As mentioned previously, Lovaas et al. (1980) recommended that some of the first skills that should be targeted in behavioural interventions are those that are intended to help the child to attend in learning situations (e.g., making eye contact with the therapist). Only after a child is able to attend appropriately to a therapist can the therapist can begin to teach the child. An autistic child who already possesses these skills when treatment begins, or who is able to learn these

skills more quickly, *and* who is more highly motivated to engage socially with a therapist (i.e., those who obtain higher IQ scores), will likely also be able to progress more rapidly through treatment.

Children with higher IQs may be able to process information more quickly and efficiently than children with lower IQs, allowing them to develop adaptive skills more quickly. These adaptive skills may or may not be specifically targeted in treatment. However, as discussed above, if children who received higher IQ scores are also more sociable, then social motivation may have allowed these children to learn the adaptive skills that are assessed by the VABS (i.e., communication, socialization, daily living skills) more easily from the people in their environments. Children who are more sociable would naturally tend to score higher on the socialization domain of the VABS, but may also respond better to therapeutic programs targeting social skills. Children who are more sociable may also be more motivated to use and understand language (Aarons & Gittens, 1999), allowing them more opportunities to develop their communication abilities through treatment. Children with better social and communicative abilities are also likely to be able to engage with adults, including therapists and parents. This may allow parents and therapists to more easily teach the children important daily living skills. The socially aloof autistic children (who had lower IQ scores) in Beglinger and Smith's (2005) study tended to reject social contact, lack joint attention, and make little eye contact with caregivers. It would be more difficult for parents and therapists to teach adaptive skills to such children, than to children who are more socially engaging.

A similar argument could be made for the development of educational skills. More efficient information processing and higher sociability may have allowed high-IQ children to learn academic skills more easily through treatment. Teachers and therapists might be better able to develop educational skills in more sociable children. Autistic children with higher social motivations would therefore be likely to function more successfully in a typical school setting, with relatively little additional support in the classroom, leading them to attain higher scores on the educational placement outcome measure.

In summary, children with higher IQs may obtain more positive adaptive and educational outcomes both because they process information more effectively *and* because these children are more socially responsive to therapists, parents, and teachers. However, it would be very difficult to determine whether children with higher IQs achieve more positive outcomes specifically because they respond better to behavioural treatment or because they would have achieved more positive outcomes regardless of treatment. As reported previously, early intellectual ability has been associated with follow-up scores on measures of IQ, adaptive behaviour, and educational placement, whether or not the children receive treatment (e.g., Freeman et al., 1999).

Although the difference in ABC scores between the mildly and significantly delayed groups was not statistically significant, there were potentially important differences between the groups in terms of the recommended cut-off scores. For example, the mean ABC score of the mildly delayed group was 34.3, well below any recommended

cut-off score. Of the children in the mildly delayed group, half scored below 44, the cut-off recommended by Wadden et al. (1991), 75% scored below 52, and none of the mildly delayed children scored above 68, the lower and upper cut-off scores recommended by Krug et al. (1993). In contrast, the mean score of the significantly delayed group was 51.7, well above the cut-off score recommended by Wadden et al. (1991), and just under the lower cut-off recommended by Krug et al. (1993). Of the children in the significantly delayed group, only 29% scored below 44, 43% scored below 52, and one child (9%) scored above 68.

Results of several previous studies have indicated that IQ and autistic behaviour are negatively related, such that high levels of autistic behaviour are related to lower IQ scores (e.g., DeMyer et al., 1974; Schopler et al., 1981; Stone et al., 1999; Wadden et al., 1991). One possible explanation for the relation between IQ and autistic behaviour is that such behaviour can be maladaptive in some contexts. It has previously been noted that self-stimulatory behaviour can interfere with a child's ability to attend to educational tasks (Lovaas et al., 1980; Sparrow et al., 1984). If the children in the present study who currently display higher rates of autistic behaviours also displayed high rates of such behaviours before treatment, it may be that these behaviours interfered with their performance during the initial testing session, leading them to obtain low IQ scores. Moreover, these disruptive behaviours also could also have interfered with their ability to acquire adaptive and educational skills, both in therapeutic settings and in daily life. Therefore children who achieved lower pre-treatment IQ scores may also have achieved

lower scores on the adaptive behaviour and educational placement outcome measures at least partly because they displayed high rates of autistic behaviour, during treatment and in their daily lives.

One assumption is that autistic children engage in “autistic” behaviours (e.g., hand-flapping, spinning wheels on toys, observing patterns of light) due to abnormalities in sensory perception (Anzalone & Williamson, 2000). However, social disinterest may also play a role in the expression of self-stimulatory and other autistic behaviours (e.g., inattention, aggression). For example, it may be difficult for autistic children to attend to the behaviour of other people because they do not find social interactions to be rewarding. Autistic children with particularly low social motivation may be especially likely to engage in aggressive behaviours because they lack the motivation (or the ability) for social perspective-taking.

In terms of self-stimulatory behaviours, children with autism may engage in behaviours that stimulate their senses simply because such behaviours are more interesting and reinforcing to them. Typical children may prefer to engage in social behaviours, with the consequent social rewards, and tend to engage in sensory-stimulating behaviours when opportunities for social interaction are not available. On the other hand, many autistic children may engage in sensory stimulating behaviours because they are not interested in social interactions. In other words, *socially disinterested autistic children may engage in sensory behaviours by default*. This notion is supported by research which indicates that autistic children who are more socially aloof also tend to

display more socially inappropriate behaviours such as repetitive, stereotyped activities (Beglinger & Smith, 2001; Beglinger & Smith, 2005; Wing & Gould, 1979). Children with autism are also unlikely to be responsive to mild social punishers (e.g., strange looks from peers, a parent saying “stop doing that”) which would reduce the frequency of socially inappropriate behaviours in typical children.

The above discussion raises an important issue regarding the validity of IQ tests for this population: do IQ tests truly measure the innate or potential intellectual capacity of autistic children, or are the tests really measuring something else? An autistic child’s score on an intelligence test could be more reflective of social motivation and understanding, or the child’s level of disruptive/autistic behaviour, rather than intellectual capacity (Koegel & Mentis, 1985; Koegel et al., 1997). Koegel et al. (1997) reported that autistic children obtained higher test scores when tested under non-standardized (vs. standardized) conditions, in which the examiner was sensitive to each child’s specific difficulties. For example, one child who would scream when asked to sit at the table was allowed to respond to the testing stimuli while sitting on the floor. Furthermore, autistic children may be more likely than typical children to provide non-standard answers on intelligence tests (Sattler, 2001) which would be scored as incorrect according to the strict, standard criteria, even if the answer might be considered appropriate.

The results of these studies suggest that the true intellectual abilities of autistic children may not be revealed when the children are tested under standardized conditions. Therefore, although intelligence tests may be useful for predicting the likelihood that a

child will benefit from a behavioural intervention, we should be cautious in terms of how an autistic child's IQ score is interpreted (Koegel et al., 1997). It is possible that early IQ scores are associated with more positive outcomes, not because children with high IQ scores are more intelligent, but because these children possess specific social skills that are required for successful performance on IQ test tasks *and* because these social skills also help them to develop adaptive and educational skills. Moreover, high IQs may be associated with positive outcomes, regardless of treatment. If this is the case, then it would be useful to identify other factors which are associated with positive outcomes after treatment.

Age at treatment onset. Autistic children tend to develop adaptive skills at a slower rate than typical children, and, thus, tend to fall further behind their peers as they get older (Fisch et al., 2002). If it is assumed that behavioural interventions allow children with autism to learn at a rate more comparable to their peers, children who begin treatment at a younger age should have less time in which to fall behind, and should require less time to "catch up" to typical peers. However, results of the current study did not provide any empirical support for this notion. As suggested by some previous researchers, a very young age at behavioural treatment onset may not be critical to attaining positive outcomes (Mudford et al., 2001). In the current study the group of children reported by parents to have begun their interventions before the age of 37 months did not score significantly better on any of the outcome measures than the group of children who had begun their interventions later.

The idea that younger autistic children might benefit more from behavioural interventions was proposed by Lovaas (1987), who assumed that younger children would more easily generalize the skills acquired during treatment. Although, as discussed previously, the mean age of his experimental group was significantly lower than the mean age of the control groups, Lovaas (1987) reported that his analysis did not reveal a significant relation between age of onset and treatment outcome. Interestingly, in the follow-up article, McEachin et al. (1993) suggested that the children in the experimental group who did not attain “normal functioning” might have benefited more if they had begun their interventions at earlier ages. Other researchers have since attempted to further explore the association between age and treatment outcome, with some results suggesting that age of onset is important to outcome (Lord & Schopler, 1989; Harris & Handleman, 2000) and others suggesting no effects of age (Gabriels, 2001).

It is possible that an early age at onset is, in fact, important to behavioural treatment outcome but that age differences were not revealed in the current study due to the small sample size. It could also be that there is a critical age, other than 3 years, before which a child should begin behavioural treatment in order to achieve positive outcomes. In addition, there are a variety of uncontrolled factors may influence the age at which a child begins treatment. For example, some children might have been on waiting lists to receive services longer than others. Also, the age at which a child is diagnosed is likely to be directly related to the age at which the child starts treatment: a parent whose child has not received a diagnosis of Autistic Disorder will probably not seek behavioural

treatment for autism. Further, the severity of a child's symptoms may be related to the age at which the child is diagnosed. Children with more noticeably aberrant behaviours might be more likely to be diagnosed at an early age, and thus start treatment at an earlier age (Eaves & Ho, 2004; Short & Schopler, 1989). These children may also be less amenable to treatment. If this is the case, it could explain the unexpected result that children who started treatment at an earlier age received a higher mean ABC score and a lower score on the measure of educational placement. Future researchers should control for important factors such as IQ, age at diagnosis, and symptom severity when evaluating the importance of age at treatment onset.

Early language ability. It was expected that children who had at least some understandable language before beginning treatment would have more positive outcomes than children who did not have any language before treatment. This position makes intuitive sense. Given that behavioural interventions are highly focused on language development and that instruction is provided verbally (Lovaas et al., 1980), a child who does not have any communicative ability will need to be taught to understand language before he/she can begin to learn other important skills. Previous studies on the effects of autistic children's language abilities on treatment outcome have yielded mixed results. Some results have indicated that children who have language before treatment tend to have better outcomes after treatment (e.g., Lord & Schopler, 1989a; Ozonoff & Cathcart, 1998), whereas other results suggest that early language ability is not critical to successful treatment outcome (Birnbrauer & Leach, 1993; Gabriels et al., 2001).

Unfortunately, the results of the present study do not suggest a clear resolution to this issue. In the current sample, children who had some language abilities before they began treatment did not score significantly higher on the outcome measures than children who did not have any language before treatment.

As mentioned in the previous section, one possible reason for the non-significant results could have been the small sample size. Although the mean differences between group scores on the VABS and the measure of educational placement were quite small, for the VABS the difference was in the expected direction. However, for the ABC, the (non-significant) results were contrary to expectations, such that the children who had some language before treatment actually received a higher score on the current measure of autistic behaviour. There are several other possible explanations for the lack of significant findings for this factor.

First, early language ability was assessed simply by asking parents whether or not their children had any understandable language before they began treatment. It may be that language ability is related to treatment outcome, but the language measure used in the current study was not sensitive enough. For example, it is possible that children whose parents reported some early language ability only knew and used a few words, and were not much more advanced than children who did not use any language whatsoever. However, Gabriels et al. (2001) used standardized language assessments and still did not find significant associations between early language ability and any outcome measures.

A second possibility is that once children have been taught to understand and use

language, they progress at a rapid rate and “catch up” to other children who already had some language. Even some of the earliest studies on behavioural interventions have shown that autistic children who do not have any speech can literally be taught how to use language (e.g., Lovaas et al., 1966). It is noteworthy that although 63% of the children in the current sample were reported by parents to have had no understandable language before they began their interventions, according to parental responses on the ABC, only 13% of the children are now using fewer than 5 words per day.

A third possibility is that autistic children’s use of language reflects social motivation, rather than linguistic ability (see Aarons & Gittens, 1999). In other words, some autistic children may be more motivated to communicate with other people and thus be more likely to want to learn and use language. The latter two explanations would suggest that, consistent with Birnbrauer and Leach’s (1993) findings, autistic children’s use of language before beginning treatment is not really important, in itself, to obtaining a positive outcome. Future research is required to further explore these possibilities.

Program Characteristics

Table 1 provides a summary of the program characteristics for the children in the current sample, and compares them to the characteristics described by Mudford et al. (2001) and authors of other home-based behavioural treatment studies (Anderson et al., 1987; Birnbrauer & Leach, 1993; Lovaas, 1987; Sheinkopf & Siegel, 1998; Weiss, 1999). Information about age at treatment onset, treatment intensity, the length of time that the children had been in treatment at the time of outcome data collection, and supplementary

interventions was compared across studies. Although “age at onset” was conceptualised as a child variable in the current study, following Mudford et al. (2001), it was included with the program variables for comparison purposes.

A visual inspection of the age of onset and treatment intensity data seems to indicate that the program characteristics of the children in the current sample were roughly comparable to those in previous studies, at least in terms of group averages. However, the data also suggest that there may be a great deal of variability among individual children with respect to these two factors. First, the mean age of onset ranged from 34 months to approximately 43 months (range of 9 months) across studies, and the mean treatment intensity ranged from 19 hours per week to 40 hours per week (range of 21 hours) across studies. Second, an inspection of the few standard deviations that were available from previous researchers suggests that there is also variability with respect to these factors *within* studies. In other words, even children who participated in the same treatment study started their interventions at different ages and received different treatment intensities. The variability within studies is also apparent when examining the percentages of children in each sample who began treatment before the age of 4 years. These differences between and within studies could result from any number of factors, such as the preference of the treatment provider, the wishes of the parents, the age at which the child is diagnosed, or the availability of public funding for the programs.

This variability in program characteristics both among and between studies is important in terms of the generalizability of outcome results. This is especially true for

studies which have not included a control group and which provide scores only on pre- and post-assessments. For example, it may be that mean differences in pre- and post-assessments are due entirely to changes in scores of children who received more intensive interventions. If factors such as treatment intensity are important to outcome, then it would be important to control for such factors when evaluating the effectiveness of treatment. However, even if these factors are controlled (e.g., treatment and control groups are not significantly different in terms of mean weekly treatment hours), this still does not provide information about whether children who receive more intensive interventions achieve more positive outcomes. Within an experimental treatment group, it may be that children who received more intensive interventions achieved more positive outcomes than children who received less intensive interventions. It will be necessary to conduct further research to specifically evaluate the contributions of treatment intensity to outcomes.

Compared to children in previous studies, children in the current sample had been receiving behavioural treatment for a longer period of time. Post-treatment assessments were conducted in all previous studies approximately 2 years (or less) after the onset of treatment. In contrast, children in the present study had been in treatment for a mean of 35 months (2.9 years), and about three quarters of them had been in treatment for longer than 2 years. This comparison draws attention to the fact that behavioural treatment outcome studies have focussed almost exclusively on very young children. The McEachin et al. (1993) study was the only home-based behavioural treatment study to

include long-term follow-up data. It is not evident why other authors have not done so. Clearly, more research is needed to evaluate the long-term effects of behavioural treatment. Long-term follow-up data could also provide information about whether there is a critical age at which behavioural treatment is no longer effective, or whether children can continue to benefit from this type of one-to-one treatment at older ages. Research should also be conducted to determine whether continuing the child's education in a more typical group setting would be equally (or more) effective than a one-to-one intervention.

Table 1 also reveals that previous researchers have failed to report whether the children in their studies had received any other types of treatment. Of the behavioural treatment evaluation studies (including Lovaas, 1987), only Sheinkopf and Siegel (1998) provided some data on supplementary interventions. Children in that study were receiving approximately 7 hours per week of additional treatment, including speech therapy and occupational therapy; however, it was unclear whether all of the children in the experimental group were receiving one or more of such services. Children in the current sample were receiving an average of 2.1 hours per week of supplementary interventions at the time of data collection; however, it is unknown whether the children were receiving similar interventions over the entire course of their behavioural interventions.

It seems likely that children in the other behavioural treatment evaluation studies (i.e., Anderson et al., 1987; Birbrauer & Leach, 1993; Weiss, 1999) were receiving

supplementary interventions along with behavioural treatment. Smith and Antolovich (2000) reported that autistic children ($n = 121$) who were enrolled in ABA programs were also participating in an average of 7 additional forms of treatment, most commonly speech therapy (85%). Interestingly, although few parents perceived these interventions to have negative effects, 38% felt that there were neither positive nor negative effects, and those who perceived positive effects (50%) reported that these effects were small and limited only to a few behaviours. Some of the parents who did not perceive the supplementary treatment to be particularly effective reported that their children continued with the treatment because they received funding for it (Smith & Antolovich, 2000).

It is vital that future researchers who seek to evaluate behavioural treatment effectiveness include information about whether or not the children received supplementary interventions. Otherwise, it is impossible to state with certainty that the outcomes reported are due to the behavioural intervention, to a supplementary intervention, or to some combination of treatments. Future researchers should also objectively evaluate common supplementary interventions to determine their individual effectiveness, specifically with autistic children, as well as their effectiveness as supplements to behavioural interventions. It would be important to determine whether supplementary interventions tend to enhance or hinder the effectiveness of behavioural interventions.

Surprisingly, few studies have included objective evaluations of the effects of different program characteristics on behavioural treatment outcome. Few to no studies

have considered the effects of treatment length, and only Sheinkopf and Siegel (1998) attempted to evaluate the effects of different treatment intensities. They found no effect of treatment intensity on IQ, their only outcome measure. In the current study, groups of children who had received different treatment intensities and who had been in treatment for different lengths of time were compared on measures of adaptive behaviour, autistic behaviour, and educational placement.

Treatment intensity. Although Lovaas (1987) suggested that children who received more than 40 hours per week of behavioural treatment achieved better outcomes, this finding has not been replicated in other studies evaluating the effects of intervention (i.e., Gabriels et al., 2001; Sheinkopf & Siegel, 1998). In the current study, children who received more than 40 hours per week at some point over the course of their interventions did score higher ($p = .07$) on the measure of educational placement than children who had never received more than 40 hours per week, although the difference did not reach statistical significance. Therefore, the current study may be the first to provide empirical support for the notion that a higher behavioural treatment intensity is related to more positive outcomes.

The most conspicuous conclusion to draw regarding the difference between treatment intensity groups on the educational placement outcome measure is that children have more opportunities to develop academic skills with more intensive exposure to the behavioural intervention. Many of the concepts (e.g., matching, shapes, time) that are taught in behavioural interventions (Lovaas et al., 1980) are similar to those which would

be taught as part of regular educational curricula. Moreover, as mentioned previously, behavioural interventions also target skills related to attending, communication, and positive social interactions, which would be beneficial in a classroom setting.

The differences in mean scores between high and low intensity groups on the VABS and ABC were not statistically significant, although the pattern of scores observed on the ABC is noteworthy (see Table 6). Children in the high intensity group obtained a mean ABC score which was 11 points lower than the mean score of the low intensity group. The high intensity group obtained a mean score of 41, a score which is below the cut-off criteria suggested by both Wadden et al. (1991) and Krug et al. (1993). In contrast, children who were in the low intensity group obtained a mean score of 52, which is above the cut-off suggested by Wadden et al. (1991) and exactly at the lower cut-off recommended by the test authors (Krug et al., 1993).

There may be an important association between the level of autistic behaviour displayed by a child and educational outcomes. If more intensive interventions are also associated with lower levels of autistic behaviour, as is suggested by the pattern of results that was observed on the ABC, then it may be the case that children who achieve low ABC scores can be more easily integrated into regular schools. Children who display lower levels of abnormal or aggressive behaviours would be less likely to disrupt other children in the classroom. Further, children who engage in less self-stimulatory behaviour also may be more likely to have the ability to attend and learn in a typical educational setting. In order to test this assumption, the correlation between ABC and

educational placement scores was calculated for the current sample. The correlation was negative ($r = -.414$), but not statistically significant.

Critics of the Lovaas method have suggested that the outcome results obtained by Lovaas (1987) and McEachin et al. (1993) could have been due to the intensity of the adult contact and attention that were received by the children in the high intensity experimental group, rather than due to the treatment procedures (Gresham & MacMillan, 1997a; Schloper et al., 1989). The results of the current study are not entirely inconsistent with evidence that contradicts this notion. Results of some studies have indicated that children who receive fewer than 40 hours per week can still make important progress with behavioural treatment (Anderson et al., 1987; Birnbrauer & Leach, 1993). This suggests that the instructional methods used in behavioural interventions may be more important than the mere intensity of treatment. However, the question of whether 40 hours represents a critical minimum number of hours required to achieve optimal outcomes is yet to be resolved. More studies which include large samples of children who have received varying treatment intensities (e.g., between 10 and 50 hours) are needed to determine whether there is in fact a critical number of hours, and also whether higher treatment intensities are generally more effective.

Treatment length. A second program variable that was hypothesized by Lovaas and colleagues to be important to achieving optimal treatment outcomes was the length of time that a child spent in treatment. McEachin et al. (1993) noted that children who obtained the best outcomes were those who had received a minimum of two years of

treatment. However, no statistical analyses were conducted to evaluate the effects of the length of the children's interventions, nor did any of the replication studies discussed in this paper measure differences among children in terms of the length of their interventions (Anderson et al., 1987, Birnbrauer & Leach, 1993; Sheinkopf & Siegel, 1998; Weiss, 1999). Gabriels et al. (2001) found that children's total treatment hours were not significantly correlated with the outcome measures; however, the children were receiving different interventions. The current study is therefore one of the first studies to evaluate whether children who stay in home-based behavioural treatment for longer periods of time attain more positive outcomes than children who have been involved for shorter amounts of time.

Potentially important (but non-significant) group differences were found on the measure of autistic behaviour and the measure of educational placement between groups of children who had received more as compared to less than 30 months of treatment. Children who had been in treatment for longer periods of time were reported to have less restrictive educational placements and to display significantly less severe autistic behaviour (i.e., lower mean ABC score) than children who had been in treatment for less time. Also noteworthy were the means of the two groups with respect to recommended cut-off scores on the ABC. Children in the current study who had received more than 30 months of treatment received a mean score ($M = 36.8$) which was well below the cut-off scores recommended by Krug et al. (1993) or Wadden et al. (1991). Conversely, children who had received fewer than 30 months of treatment obtained a mean ABC score of 55, a

score which is well above the criterion suggested by Wadden et al. (1991) and also above the lower cut-off score of 52 recommended by Krug et al. (1993).

One possible explanation for the mean differences in ABC scores that were observed in the current study for both treatment intensity and treatment length is that children who receive more treatment are able to build a larger repertoire of alternative behaviours which replace autistic behaviours. In behavioural psychology, DRO or DRI procedures are used both to reduce the frequency of inappropriate behaviour and to increase the frequency of appropriate behaviour. DRO refers to differential reinforcement of *other* behaviours, and DRI refers to differential reinforcement of *incompatible* behaviours (Martin & Pear, 1999). Differential reinforcement can be defined as “systematically rewarding or reinforcing desired behaviours, and ignoring, redirecting, or discouraging inappropriate behaviours” (Thibodeau, 2002, p. 3).

Differential reinforcement is used in behavioural interventions for autistic children. Consider an example of a low-functioning autistic child who receives edible reinforcement (e.g., M&Ms) for successful performance on a teaching trial. Recall that discrete trial teaching (DTT) involves providing the child with reinforcement for each correct response to a single stimulus, instruction, or request (see p. 23). When the child sits quietly at the table, attends to the therapist’s instructions, and engages appropriately in the teaching tasks, he is likely to get his M&M. However, if the child is instead flapping his hands, he will not receive an M&M until he has stopped engaging in that behaviour, and again becomes focused on the task. In many cases, behaviours required

for engaging in the teaching tasks (e.g., pointing to a picture or object) are *incompatible* with behaviours such as hand-flapping. When using DRI, the “autistic” behaviour (hand-flapping) is *not* reinforced, and the incompatible desired behaviour (pointing) *is* reinforced. In this way, the autistic behaviour extinguishes (reduces in frequency) and is replaced by other behaviour. This reduction in autistic behaviour during therapy may generalize to other settings. When attending behaviour is reinforced and autistic behaviour is extinguished in this manner, the children’s ability and motivation to attend to teaching tasks may also be increased over time (i.e., with more treatment), allowing them to learn more effectively in classroom settings.

It is possible that the non-significant results on the VABS pertaining to treatment intensity and length are due to the small sample size. However, it may also be true that behavioural treatment programs need to focus more on teaching and generalizing adaptive skills. Parents could also be encouraged to help their children to develop these skills in their daily interactions. This may or may not require specific training for parents in how to effectively teach these skills. For example, parents may become accustomed to performing daily living skills tasks for their autistic children, and neglect to realize when their children become able to perform such tasks on their own. In response to some of the daily living skills items, some parents informally reported that their children probably *could* perform those tasks, but that they had never specifically taught their children or allowed them the opportunity to do so. The VABS interview protocol specifically requires that items be scored based on what the child actually does in his/her daily life,

rather than what he/she is able to do. It is also possible that some autistic children take longer to perform some tasks (e.g., getting dressed) and busy parents simply perform these tasks for their children in order to save time. Therefore, it may be that children who have received longer or more intensive interventions are able to perform these adaptive skills, but are not given an opportunity to do so.

Therapist Characteristics

The survey of ABA therapists in the current study was one of the first in-depth investigations into the characteristics of individuals who are providing home-based behavioural interventions to autistic children in the community on a daily basis. As demonstrated in Tables 2 and 3, most previous studies have failed to provide detailed information about these individuals. Further, the information that has been provided is often vague and descriptive in nature rather than objectively determined. This is surprising considering that many writers have talked about the importance of highly trained and capable therapists (e.g., Lovaas, 1987; Weiss, 1999).

Table 2 provides information from previous home-based behavioural intervention studies about the reported qualifications of the therapists. All studies included at least a general description of who the therapists were. As can be seen in the second column, parents served as therapists in the majority of studies, including the current study. Given the fact that most of the intervention studies employed parents as therapists, it is unknown why previous researchers have not evaluated whether parental involvement is a key component to behavioural interventions.

Some authors have reported that therapists were students or other individuals with varying levels of post-secondary education. The fact that many behavioural therapists are students could have important implications. For example, it is conceivable that employee turnover rates may be higher when students are employed, as some students may go on to find other employment when they graduate. This could affect the amount of time and money that is invested in training new therapists. It could also have an effect on the individual children, as it is not known whether frequent changes in a child's therapists are harmful, neutral, or beneficial. On the other hand, there may be benefits to hiring students. For example, they might be willing to work for less money than individuals with more formal qualifications.

Only Weiss (1999) made mention of the previous experience of the therapists, but simply indicated that the amount of experience varied across therapists. Therapists in the current study reported a mean of 15.5 months of previous experience working with autistic children; however, there was a lot of variability in responses on this question. Previous experience could be important because it may be related to the skill levels of the therapists. Presumably, skilled therapists would continue to be employed by the children's families; whereas unskilled therapists would not. However, it may be difficult and expensive for parents to find and train therapists, so some families may continue to employ less skilled therapists because they feel that they do not have a choice. Further, it is not known whether therapists' skill level is an important factor in the effectiveness of behavioural interventions. More research is needed to explore these issues.

The last 3 columns in Table 2 provide information about the reported training experiences of therapists. Lovaas (1987) stated that the therapists who provided the intervention in his study were “well trained” (p. 5) but provided no further information about how much training the individuals received, who trained them, or how they were trained. Only Anderson et al. (1987) and Weiss (1999) included information about the intensity of the therapists’ training. Both authors provided information to suggest that the therapists received at least 30 hours of training, but the figures given were approximations, and there is no way to determine how much variability there was among therapists in terms of their training hours. Results of the current study suggest that there is quite a bit of variability in the amount of training received by therapists, even among those who work with the same child. This variability in training intensity could affect the efficacy with which therapists administer the intervention.

Two out of five studies included information about who provided the therapists’ training. Therapists in Weiss’ (1999) study were trained by a clinical psychologist with background training in behavioural interventions. Birnbrauer and Leach (1993) reported that parents were responsible for training their children’s volunteer therapists. No detailed information was given about who trained the parents. Clearly, there is a possibility here of rather extreme differences in the skill level of the therapist trainers in terms of background experience and knowledge, skill in applying the intervention, and in their ability to train others in the same methods. These differences could potentially have a profound influence on the efficacy of the intervention.

Most behavioural intervention studies included at least some information about the methods with which the therapists were trained, with the exception of Lovaas (1987). Again, training methods could affect the skill level of the therapists. For example, a therapist who has been able to observe the intervention being provided to the child and who has had the opportunity to practice his/her skills before working directly with the child may be more effective than a therapist whose training is conducted on-the-job. Little to no published research has been conducted to determine which training methods, if any, are more effective than others.

Table 3 shows a comparison across behavioural intervention studies of the degree of therapist involvement in the children's programs as well as the level of supervision of the child's intervention. Only two studies included information about the intensity of the therapists' weekly involvement in the children's programs, as well as the number of therapists who work with the child. Lovaas (1987) simply stated that children were assigned "several" therapists. Anderson et al. (1987) reported that one therapist was assigned to each child. Each therapist worked for 15 hours per week with the child and the parents worked with their children for an additional 5 hours (approximately) per week. Birnbrauer and Leach (1993) reported that each child was assigned "up to 24" therapists (p. 67) and that each therapist worked for a minimum of 2.5 hours per week. However, this information seems to contradict their assertion that the intensity of the children's interventions ranged from "8.7 to 24.6" hours per week (p. 68). The number of therapists involved in a child's program and the intensity of their involvement could

affect the child's responsiveness to treatment. Perhaps autistic children learn better when they work closely with only one or two particular therapists because many are sensitive to changes in routine (Aarons & Gittens, 1999) or because the teaching methods are more consistent when the child is exposed to fewer therapists. However, another possibility is that children respond better when they have more therapists because they have more opportunities to generalize their skills with other individuals and in other settings.

Therapist qualifications. Given the substantial variability among therapists on a number of characteristics assessed by the therapist questionnaire, it was conceivable that some of these characteristics could have been associated with children's treatment outcomes. Two therapist variables were selected for this analysis (education and experience), and combined to provide a measure of therapist qualifications. No differences were found between therapist qualification groups on the ABC or in terms of educational placement. However, the therapist qualification variable was the only factor, aside from early IQ, to be significantly related to adaptive behaviour outcomes. Children with highly qualified head therapists scored significantly higher on the VABS than children with less qualified head therapists.

It may be that the more education a therapist receives, the greater the opportunities he/she will have for skill development. Therapists who have received higher education may also be more skilled as therapists due to motivational factors related to both education and employment. In other words, therapists who are highly motivated to educate themselves might also be more motivated to develop themselves as

therapists. Similarly, therapists with more previous experience have had more opportunities to become adept at encouraging children to develop adaptive skills, even those skills that are not specifically targeted in the children's programs. Furthermore, as discussed previously, therapists who are less skilled in their work with children may be less likely to continue to be employed by families, so the more effective therapists are also more likely to be the ones with more previous experience.

Parental involvement. Children whose parents acted as therapists in their behavioural intervention programs were not more likely than other children to attain positive outcomes in the current study. Although several writers have suggested that parental involvement might be important (Birnbrauer & Leach, 1993; Lovaas et al., 1980; Lovaas, 1993), this claim has not been empirically evaluated by previous researchers. In the current study, no mean differences were found between the groups on any of the three outcome measures.

There may have been differences between parent therapists and non-therapists that were not measured in the current study and that somehow influenced the results. One possibility is that parents who had children with more severe symptoms were more likely to decide to become therapists for their own children. Thus, the severity of the children's symptoms could have confounded the results pertaining to parental involvement. Future researchers who attempt to evaluate the effects of parental involvement should consider matching participants on symptom severity. It is also conceivable that parents who actually work with their child in therapy could have responded to the questionnaires

differently than parents who are not directly involved with their children's treatment program. This may have essentially "hid" any true differences that existed between the groups.

Lovaas (1993; Lovaas et al., 1980) suggested that parental involvement in the child's treatment should allow for better generalization of skills. This may be true; however, perhaps parental involvement is not best measured by whether a parent acts as a direct treatment provider. For instance, parents' understanding of how to apply behaviour principles to their children's daily lives could be more important. In addition, parents' awareness of their children's current program targets and their specific needs may allow parents to appropriately guide their children's daily activities. This type of parental involvement could be measured in future studies in terms of parental perceptions of the importance of natural environment teaching, or how often the parent attends team meetings, for example. It may also be the case, however, that parents who simply act as "regular" parents provide the best possible environment (i.e., real life) in which a child can generalize the skills learned in therapy. More research needs to be conducted to evaluate these possibilities.

Limitations

There are several limitations of this research, the most important of which are related to the small sample size. Unfortunately, only 16 parents who met the eligibility criteria participated in all portions of this study. Four parents who had requested information packages, and who were eligible to participate in the study, indicated that

they no longer wanted to participate when they were contacted to schedule the interview. They did not report whether or not they had completed the questionnaires. It may have been the case that, although parents were informed that they were free not to participate in specific portions of the study, some of them may not have wanted to provide information about their child's intellectual abilities. Some parents who did participate had concerns about how this information would be used. Other parents may have perceived a one-hour interview to be too burdensome on their schedules, and simply decided not to participate in the study at all. Several parents reported that they had recently participated in one or more other research studies, and one parent indicated that this would be the last autism study in which she participates. Perhaps, given the small population of autistic individuals, we are asking too much in terms of requesting their parents' participation in research.

The small sample size has clear implications regarding the utility of these research results. For example, it may be inappropriate to generalize the results reported here to all autistic children, given that they are based on a sample of 16 children. Further, considering that all of the child participants had received diagnoses of Autistic Disorder, the results certainly should not be generalized to children with other Autism Spectrum Disorders (ASDs), such as Asperger's syndrome or PDDNOS. However, previous published studies on behavioural treatment outcomes have also involved fairly small sample sizes (see Table 1), and have included children with other ASDs (Birnbauer & Leach, 1993; Sheinkopf & Siegel, 1998; Weiss, 1999). Therefore, although the small

sample size in the current study was not ideal, it is not inconsistent with the literature extant in this area.

Sample size could also impact generalizability due to the fact that many of the group differences were not statistically significant. Although several differences in the mean outcome scores between comparison groups were in the expected directions, these differences often did not reach statistical significance. The large amount of variability in scores on the outcome measures within the comparison groups, along with the small number of participants in each group, could have contributed to non-significant results. In other words, some of the mean differences between comparison groups may have reached statistical significance had the sample been larger. The implication is that the non-significant differences reported in this study should not be interpreted as indicating that the factors are definitely not related to treatment outcome. Further research should be conducted with larger samples. A larger sample size could allow for the assignment of participants into extreme groups, for at least some of the variables, rather than simply dividing the entire sample into two groups, as was done in the current study. Assessing differences between extreme groups may allow for more definitive conclusions to be drawn regarding the associations of the factors with treatment outcome.

Another difficulty with the small sample size is that it imposed a limit on the number of variables that could be tested. Data was collected on a large number of factors that could have been related to treatment outcome, given the variability found for these factors in the current sample. For example, it would have been interesting to investigate

whether additional child factors such as pre-treatment echolalia or family size (i.e., number of siblings) were related to outcome. Program and therapist factors that could be important include the number, type, and/or intensity of supplementary interventions, the frequency of team meetings, the intensity of therapist involvement, and the number of therapists on each treatment team. Unfortunately, due to the sample size, only a subset of these factors was selected to be assessed for their relation to treatment outcome.

Similarly, future research with larger samples could include analyses with each domain of the VABS, and include additional outcome measures to formally assess skills in the areas of play, receptive and expressive language, and academic performance.

Another potential limitation of the study concerns the wide age range of the child participants. Although a larger age range could be considered a strength in terms of generalizing the results to a larger population, the small number of children of each age is a limiting factor. For example, although children in the current sample ranged in age from 4 to 10 years, there were no eight-year-old children in the sample, and only one nine-year-old. This limits the generalizability of the results to these ages. Ideally, this study could have been conducted with children in a smaller age range; however, due to the low response rate, children could not be excluded due to age. An alternative would have been to conduct analyses separately for two different age groups. However, this would have increased the number of statistical tests required to an unacceptable level, given the sample size.

Some of the measures that were used to assess the factors of interest may not have

been sensitive enough to allow significant differences to be detected. This issue was discussed previously in the section on early language ability (i.e., parents were simply asked to indicate, yes or no, whether their child had any understandable language before treatment). A similar argument could be made for other factors. For example, for the measure of early IQ, some children were assigned to mild and significant delay groups based solely on descriptive information provided in assessment reports. Ideally, specific IQ scores would have been used; however, many parents were unwilling or unable to provide such information. The use of a retrospective study design limited the amount of specific information that could be obtained regarding pre-treatment factors. These issues could be avoided in future research with the use of prospective studies, in which formal assessments are conducted prior to treatment.

Overall Conclusions

In summary, this study investigated the influence of several different factors (categorized as child, therapist, and program variables) on behavioural treatment outcomes in the areas of autistic behaviour, adaptive behaviour, and educational functioning. At least one factor from each category was found to be associated with treatment outcome. Significant differences ($p < .10$) between comparison groups were found on one or more outcome variables for 4 of the 7 factors assessed. Higher IQs before treatment, higher treatment intensity, greater treatment length, and higher therapist qualifications were associated with more positive outcomes on at least one outcome measure. In addition, several non-significant trends in the hypothesized directions were

found regarding the differences between comparison groups.

The three factors conceptualized as “child variables” that were assessed in the current study were pre-treatment IQ, age at treatment onset, and early language ability. Consistent with results from previous studies, early IQ was found to be the factor most strongly and reliably associated with treatment outcome. Early IQ was one of only two factors for which significant differences between comparison groups were obtained on more than one outcome measure, and it was the only child variable found to be significantly associated with scores on outcome assessments. However, although IQ scores may be useful for predicting outcomes of behavioural interventions, the reason for the association between IQ and scores on outcome assessments may not be “intelligence” per se, but due to the influence of other factors, including social motivation. It will be necessary to conduct further research to assess the validity of IQ tests with ASD populations, as well as to delineate the specific reasons that IQ might be associated with treatment outcome.

Contrary to expectations, the results did not provide empirical support for the notion that children who begin their interventions at earlier ages and who have some language abilities before beginning their behavioural interventions achieve more positive outcomes. The results of the current study and several previous studies have indicated that early treatment onset and early language ability may not be critical to achieving positive behavioural treatment outcomes. Clearly, these issues need to be explored further, especially considering that age is one of the factors which determines whether an

autistic child's family is eligible to receive public funding for their intervention programs (autismsocietycanada.ca). If age at treatment onset is not a critical factor in predicting a child's likelihood of benefiting from a behavioural intervention, it would be highly inappropriate to deny treatment to some autistic children simply because they are older.

Two variables related to the characteristics of behavioural treatment programs were assessed: treatment intensity and treatment length. Significant results ($p < .10$) were found between comparison groups on at least one outcome measure for both of these program factors. Higher treatment intensity (> 40 hrs/week) and a longer intervention length were associated with higher scores on the measure of educational placement and with lower scores on the ABC. Given these results, it is clear that further research is warranted. If significant results were found with a small sample, it is likely that differences between comparison groups would be more apparent if a larger sample were to be used.

The review of the program characteristics of behavioural treatment studies (Table 1) indicated that there is a great deal of variability between and within studies with respect to several factors, suggesting that these are areas in which more research is needed. The presence, type, and intensity of supplementary interventions may be an especially important issue to address in future studies. More research is also needed to identify and evaluate the specific manner in which behavioural treatment programs are administered. For example, what are the specific program targets? What should be the criteria used to signify mastery of the skills targeted? What are the best types of

reinforcement to use? Is there an optimal procedure to use for skill maintenance and generalization? Studies should be conducted to determine the best practices so that specific guidelines can be established and applied across interventions.

Of the therapist variables that were assessed in the current study, only therapist qualification (i.e., education and experience) was found to be significantly associated with behavioural treatment outcome. A significant difference on the measure of adaptive behaviour was found, such that children who had a highly qualified head therapist achieved a significantly higher mean VABS score than children with less qualified head therapists. The differences between high and low qualification groups on the ABC and the measure of educational placement were in the expected directions, but did not approach significance. Perhaps more significant differences would have been found if the sample size had been larger, or if more sensitive measures were used.

Formal assessments may need to be developed and tested in order to objectively assess therapist skill level (Weiss, 1999) and parental involvement in behavioural treatment programs. If such measures are developed, researchers could better evaluate the relative importance of factors such as training method or intensity. At the very least, future researchers should report relevant therapist characteristics (i.e., previous experience, amount of training, frequency of supervision), so that appropriate comparisons can be made among intervention studies. The review of therapist variables (Tables 2 and 3) suggests that these factors are not consistent for all children who are involved in behavioural interventions, and it is possible that many of these factors could

influence behavioural treatment outcome.

In conclusion, more research is required to further evaluate the importance of child, program and therapist factors to behavioural treatment outcomes. It will be important to consider the large amount of variability among individual autistic children, their treatment programs, and their therapists, and to control for such variability, when evaluating treatment effectiveness. Ideally, this research should be conducted using large samples. Future researchers should also consider that there may be important interactions between some of these variables. For example, a child who has a low IQ score may benefit more by having a highly trained and experienced therapist, whereas children with higher IQs may perform equally well regardless of the qualifications of the therapists. Finally, long-term evaluations are necessary to determine (1) whether children who continue to receive behavioural interventions for long periods of time continue to benefit from such interventions; (2) at what age, if any, behavioural interventions cease to be effective; and (3) whether, and for how long, behavioural treatment gains can be maintained over time after treatment is terminated. The current study has identified some potentially worthwhile areas for future study; however, much more work remains to be done.

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Appendix A

Informed Consent

The purpose of informed consent is to make sure that people who participate in psychological research understand the nature of the study so that they can make an educated decision about whether or not they wish to participate. Please read this description of the study and indicate on the Consent Form whether you wish to participate in the Carleton University Autism Study.

All stages of this study will be conducted by the primary researcher for this project, and will be supervised by a developmental research psychologist. The researcher is a female graduate student in psychology who has training and experience working with autistic children in an ABA setting.

Parent Interview. The researcher will interview one parent with the Vineland Adaptive Behavior Scales (VABS). The interview takes about 20 to 60 minutes to complete, and it involves answering questions about your child's daily activities. An appointment will be scheduled for a time that is convenient for you and your family. The interview can take place in your home, or you may suggest another location. You will need to make arrangements for someone to supervise your child during this time, because the child should not be in the room while the interview is being conducted.

Parent Questionnaire. Parents are asked to complete a questionnaire (enclosed for your inspection) which mostly involves circling or placing a checkmark beside your answers. The questionnaire asks about your family, your child's behaviour, and your child's ABA program. The questionnaire will take approximately 10-15 minutes to complete, and you can fill it out whenever you wish. The researcher will pick up the completed questionnaire at the time of the interview

Therapist Questionnaire. This short questionnaire will be completed by individuals who work directly with your child in his/her ABA program. It consists of 11 questions and can be filled out in less than five minutes. You are asked to distribute the questionnaire to up to five of your child's ABA therapists. If you act as a therapist for your own child, you are asked to fill out one of these questionnaires yourself. Please ask the therapists to return the questionnaires to you, sealed in the envelopes provided.

Previous Assessment. Because your child will NOT be directly assessed for this study, you are asked to provide the results of your child's previous IQ assessment. The researcher requires only the name and date of the test and your child's overall score. You may be asked to sign a separate consent form which will allow a professional or organization to release your child's results to the researcher.

Research Personnel. The following people will be involved in this research project and may be contacted at any time:

Alberta Girardi, Principal Researcher
Phone: 520-2600, ext. 1723
E-mail: agirardi@connect.carleton.ca

Dr. Robert Coplan, Faculty Advisor
Phone: 520-2600, ext. 8691
E-mail: robert_coplan@carleton.ca

Confidentiality/Anonymity. The information that you provide will be stored in a secure location and will be available only to the research personnel who are directly involved in the project. After the Consent Form has been completed, your child will not be identified by name on any of the assessments; instead, a participant number will be assigned. Also, please note that the researcher is not interested in the results for individual children. Rather, information from all of the children in the study will be combined before any analyses are performed. Because of this, you will not be able to receive results specific to your child, but you will be able to receive information about the overall results of this study. If you are interested in having the results, you can indicate on the Consent Form a mailing address or e-mail address to which the results can be sent.

Ethical Issues. This project has been approved by the Carleton University Ethics Committee for Psychological Research. If you have any ethical concerns about this study, please contact Dr. Chris Davis (Chair, Ethics Committee, 520-2600, ext. 2251). If you have any other concerns about this study, you may contact Dr. Mary Gick (Chair, Department of Psychology, 520-2600, ext. 2664).

Right to Withdraw. After you have signed the Consent Form, you will still have the right to withdraw from the study at any time and for any reason. You may also choose not to participate in specific parts of this study, and you may choose not to answer specific questions if you don't want to.

Compensation. Participating families will receive a \$10 gift certificate for Chapters to thank you for your participation.

Resources. If you would like to learn more about autism, you may find the following resources useful:

Websites: www.autismsociety.on.ca
www.autismottawa.com
www.childrenatrisk.ca
www.autism-resources.com

Autism Society of Ontario
211 Bronson Street
Ottawa, ON K1R 6H5
(613) 230-6305

Recommended Reading: *Let Me Hear Your Voice*, by Catherine Maurice.

If you want to participate, please sign the Consent Form on the following page.

Consent Form

The information collected for this project is confidential and protected under the Municipal Freedom of Information and Privacy Act, 1989.

Date: _____

(name of child – please print)

(name of parent/guardian – please print)

Please check one of the following options:

_____ **I agree to participate in the Carleton University Autism Study.** I have read the description of the study and I understand what my participation will involve.

_____ **I do NOT agree to participate in the Carleton University Autism Study.**

(signature of parent/guardian)

If you wish to receive the results of this study, please indicate a mailing address or e-mail address to which the results can be sent:

Appendix B

Screening Questionnaire

Participant Information

1. Contact Parent's Name: _____
2. Phone: _____
3. E-mail: _____
4. Address: _____

5. Participant Number: _____

Eligibility

6. Is the child between ages 4 to 10 years? _____
7. What is the child's diagnosis? _____
8. Has the child received a behavioural intervention? Yes No
9. When did the child stop participating in the program? _____
10. Name of intervention: _____

7. Father's formal education completed (check one only).

- Elementary school _____
- High school diploma or equivalent _____
- Community college or equivalent _____
- University degree _____
- Graduate degree _____

(Note: If the child does not live with one mother and one father, please feel free to indicate this on the questionnaire, and fill out the information for one or both parents).

Child's Language History

8. Before starting the ABA program, did your child have any understandable language/speech?

_____ no _____ yes

9. Before starting the ABA program, did your child display *echolalia*? (i.e., did the child repeat or echo words or phrases spoken by others)

_____ no _____ yes

Child's Formal Education

10. How many days per week does your child attend school (i.e. outside the home)?

- a) none
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5

NOTE: If you answered "none" to the previous question, please go to question #14.

11. What grade is your child currently in?

- a) preschool
- b) junior kindergarten
- c) senior kindergarten
- d) grade one
- e) grade two
- f) grade three
- g) other (please specify) _____

12. What type of classroom is your child currently in?

- a) Classroom specifically for autistic children.
 - b) Special education classroom with other special needs children.
 - c) Regular classroom in a private or public school.
 - d) Other (please specify)
- _____

13. Does your child receive assistance from an education assistant (EA) or aide in the classroom?

- a) no assistance
- b) shared assistance (e.g., one EA for two or more children in the classroom)
- c) part-time assistance (e.g., assistance for only part of the child's day)
- d) full-time assistance
- e) other (please specify) _____

Child's ABA Intervention History

14. How old was your child when he or she began the ABA program?

_____ years _____ months

15. If your child is no longer receiving ABA therapy, how old was your child when he or she stopped receiving ABA services?

_____ years _____ months _____ Not Applicable

16. Over the past six months (*or the last six months of your child's program, if no longer receiving ABA treatment*) how many total hours per week did your child spend participating in the ABA program?

_____ hours per week

17. Aside from ABA therapy, does your child currently participate in any other forms of treatment on a weekly basis?

Type of Therapy	# of hours per week

18. How many ABA therapists currently work with your child on a weekly basis? (including yourself and your spouse, if applicable)

19. Do/did you act as an ABA therapist for your own child?

_____ no _____ yes

20. If you answered "yes" to the previous question, approximately how many hours per week do/did you provide ABA therapy for your child?

_____ hours per week _____ Not Applicable

21. Approximately how often do/did your child's therapists have team meetings?

- a) did not have team meetings
- b) once a year or less
- c) two or three times per year
- d) once a month
- e) every two weeks
- f) every week

22. Approximately how often do/did you or your therapist(s) meet with a psychologist, psychiatrist, or professional behaviour consultant to discuss the direction of your child's ABA program?

- a) did not have consultations
- b) once a year or less
- c) two or three times per year
- d) once a month
- e) every two weeks
- f) every week

Appendix D

Therapist Questionnaire

1. Gender: ____ Male ____ Female

2. Age: _____

3. Are you currently a student? ____ Yes ____ No

4. What is your highest level of education completed?

- a) Elementary school
- b) High school diploma or equivalent
- c) Community college or equivalent
- d) University degree
- e) Graduate degree

5. What is your relation to the target child?

- a) Parent
- b) Other relative (e.g. grandparent, aunt)
- c) Unrelated

6. Before you began training for your work with this child, approximately how much experience did you have working with autistic children?

_____ years _____ months

7. For how long have you been involved with this child's ABA intervention?

_____ years _____ months

8. Approximately how many hours per week do you provide intervention for this child?

_____ hours

9. Which of the following methods were used in training for your work with this child?
(Check all that apply)

- Discussion/Verbal Instruction
- Manual
- Training videotape
- Role play
- Observation of intervention being provided to target child
- Supervised training with target child
- Other (please specify) _____

10. Approximately how many total hours of training did you receive that was directly related to your work with this child?

_____ hours

11. Which of the following people were directly involved with your training?
(Check all that apply)

- Consultant/Psychologist
- Senior Therapist
- Experienced Therapist
- Parent
- Other (please specify) _____