Physical Activity Participation in Children with Autism Spectrum Disorders: An Exploratory Study

by

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A thesis submitted in conformity with the requirements for the degree of Master of Science

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2011

ABSTRACT

Introduction: Little is known about the physical activity [PA] habits of children with Autism Spectrum Disorders [ASD]. ASD specific PA barriers and facilitators have not been investigated. Purpose: To describe the PA habits of children with ASD and the barriers and facilitators to optimal PA participation. Methods: Twenty-three parents of children with ASD reported on their child’s PA habits, perceived barriers to PA participation, and functioning. A rating scale was applied to score responses and children were classified into functional level groups and PA level groups. Results: On average, children were reported to meet or exceeded national PA frequency guidelines, belonged to active families and participated in a variety of physical activities. Parents identified several barriers to optimal PA for their children. Conclusions: Children with ASD can attain optimal PA. Exposure to a variety of PA opportunities and experiences aids in identifying the ideal activity for each individual child.

Key Words: AUTISM SPECTRUM DISORDER, CHILDREN, PHYSICAL ACTIVITY, BARRIERS
This thesis is dedicated to the (once) little boy who inspired me to embark on this endeavor, and continues to inspire me today
ACKNOWLEDGEMENTS

I wish to express my gratitude to my supervisor, Dr. Katherine Berg, for her integral role in seeing me to where I am today. From start to finish, your commitment, time and patience throughout this experience have been so helpful. Above all, I thank you for helping me to discover just how capable I really am.

My sincere thanks to my Professional Advisory Committee members, Dr. Helene Polatajko and Dr. Virginia Wright for your support, guidance and constructive feedback. You have served not only as reviewers of my work and committee members, but as true teachers, and for that I am grateful. It has been a pleasure to learn from you both.

To Dr. Dina Brooks, who has been my guide, mentor and listening ear; thank you does not suffice. The fact that you always seemed to have the right answers was invaluable, but the fact that you genuinely cared is what counted most.

Avi, you have stood by me and supported me through the ups and downs of this project. Your countless sacrifices, constant encouragement and unwavering confidence that I would succeed are the reasons behind this accomplishment. If ever I succeed in returning even half of the kindness you have shown, then I will truly know I have achieved greatness. I have not enough words to thank you.

Uriel and Eliana, you are the lights of my life and you teach me more than any academic program ever could. You have been the driving force behind my motivation to complete this endeavor. I hope that as you grow I will continue to make you proud, and to inspire you to shoot for the moon.

A wise man once said: “Invest in your kids, they pay the best dividends.” The same man also said: “Give them roots, and give them wings.” Mom and Dad, you have invested in me with your heart and soul and never stopped believing in me. You have given me both “roots” and “wings” and that has made all the difference.

To my caring siblings, who encouraged me when the going got tough and were there for me when I needed you most. You have always been my role models in all facets of life and I thank you.

With great appreciation to my mother-and-father-in-law, and siblings-in-law for the countless hours spent watching the kids so that I could work on this thesis.

Above all, my deepest gratitude to the Creator, for giving me the strength and insight to complete this work and for abundant goodness always.
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Chapter 1: Introduction

Physical activity [PA] is universally regarded as an important catalyst to enhancing and maintaining overall health (Kravitz, 2007). Regular PA has been linked to numerous health related benefits such as the prevention and treatment of cardiovascular disease and other serious medical conditions (Warburton, Nicol & Bredin, 2006) including diabetes, cancer, arthritis and obesity (Penedo & Dahn, 2005). The benefits of PA are widespread and extend well beyond enhancing physical functioning. Engaging in regular PA has the potential to improve general emotional well-being (Penedo & Dahn, 2005), mood (McPhail, 2006), and social skills (Terre & Drabman, 1992). These benefits are enjoyed by people of all ages who engage in regular PA (Pangrazi, Beighle, Vehige & Vack, 2003).

Regular PA has been increasingly emphasized as crucial for children due to the growing prevalence of childhood obesity and diabetes worldwide (Singh, et al., 2008; Janssen et al., 2005). One of the main causes of this recent epidemic is a sedentary lifestyle (Fenton, 2005) which has become an increasingly serious problem (Boon & Clydesdale, 2005). Excessive weight gain is easier to prevent than to reverse (Pitetti, Rendoff, Grover & Beets, 2007 p.1003) and so it is wise for children to be imbued with healthy PA attitudes, habits and skills which can be maintained throughout their lifetime.

There is a documented relationship between PA levels in childhood and those present in adulthood. Several retrospective studies have showed that participation in competitive sports in youth increases the likelihood that the individual will remain active in his or her adult years (Perkins, Jacobs, Barber & Eccles, 2004). PA awareness and skill development can work preventatively against inactivity that can lead to health risks.

Children with intellectual disabilities, including those with developmental disorders, are at greater risk for inactivity and the health risks associated with a sedentary lifestyle than typically developing children (Pitetti, Rimmer & Fernhal, 1993). Sedentary lifestyles among those with intellectual challenges are associated with motor and physical deficits
Children with autism may have some degree of intellectual disability (Reid & Collier, 2002), as well as difficulty with motor performance (Baranek, 2002; Klin & Volkmar, 1995; Peeters & Gillberg, 1999; Reid & Collier, 2002) placing them in this high risk category.

Autism Spectrum Disorders [ASD] represent a spectrum of conditions with deficits in social interaction, communication, restricted interests and repetitive behaviour (WHO, 2006). Autism is one of the most common diagnoses on the Autism Spectrum (Reid and Collier, 2002) and is typically diagnosed in early childhood, usually within the first three years of life (Hewetson, 2002). The social and behavioural challenges associated with the various diagnoses on the Autism Spectrum place these children at risk for inactivity due to decreased opportunities for PA participation as compared to their typically developing peers (Pan & Frey, 2006).

Little is known about the types of PA in which children with ASD participate, and there is no literature reporting on specific barriers to PA opportunities in children with ASD. Furthermore, the availability of general guidelines for PA of children with various manifestations of the disorder and varied levels of functioning is sparse. Since ASD is a disorder which encapsulates a wide range of functional abilities and characteristics, a one-size-fits-all approach to PA is likely inappropriate. If barriers to inclusion in PA exist, they must be clearly identified before they can be addressed.

The current study describes the PA habits of children with ASD, as well as the barriers to participation, as reported by their parents. Various aspects are explored such as activity type and reason for activity selections; frequency of physical activities; settings and context of PA [home vs. school, group vs. solitary]; parental and family influences on activity levels; parent reported levels of children’s success with various activities; and, parent-reported barriers to the PA participation of their children. Children’s functional levels are described based on parents’ report during telephone interviews.

The matters addressed by this study are timely and relevant to the current heightened awareness of public health issues concerning lack of regular PA among youth, including those with developmental disabilities. This study will inform future interventions to
encourage children with ASD to become active in the childhood years. The creation of healthy PA habits and skills in childhood should increase the likelihood that these children will become active adults with similar healthy lifestyles (Perkins, et al., 2004). Active adults impose less strain on the health care system due to the known health benefits associated with PA and a reduction of the risk factors related to inactivity.
Chapter 2: Literature Review

Autism Spectrum Disorders

Autism Spectrum Disorder [ASD] is a term used to represent a spectrum of conditions characterized by deficits in social interaction, communication, restricted interests and repetitive behaviour (World Health Organization, 2006). Each specific diagnosis on the spectrum is representative of varied levels of functioning and often differing manifestations of the disorder. The most common diagnoses on the autism spectrum are Classical Autism (generally referred to as autism), Pervasive Developmental Disorder (PDD) and Asperger Syndrome (AS) (Reid & Collier, 2002).

The terms Autism Spectrum Disorder and autism are often used interchangeably; however, ASD represents an umbrella term used to describe a set of disorders with similar autism related symptoms, while autism is a term that refers to one of the specific diagnoses on the ASD spectrum. For the purpose of clarity, this study will use the term autism in reference to an autism or Classical Autism diagnosis and will use the term ASD when information pertains to all disorders on the autism spectrum. Other specific diagnoses on the autism spectrum such as PDD and AS will be discussed where manifestations of that specific diagnosis differ from others on the autism spectrum in particular areas of functioning.

ASD was initially known only by the term autism which was coined by child psychiatrist Leo Kanner in 1943. He described the 11 children he observed as being socially isolated, having poor eye contact and presenting few expressive gestures. The children in Kanner’s group also lacked imaginative play skills and demonstrated obsessions with sameness and generally repetitive activity patterns (Reid & Collier, 2002). Kanner’s observations and descriptions of his particular group have stood the test of time, as many of the characteristics he noted are currently used to identify and diagnose various types of ASD in children.
In addition to the characteristics of autism identified by Kanner, the Diagnostic and Statistical Manual of Mental Disorders 4th edition-Text Revision (2000) has expanded on the list of possible characteristics that may be observed in children with autism such as; unusual motor behaviour, intellectual disability, hyperactivity, impulsivity, self-injurious behaviours, sleep disturbances and temper tantrums. In addition, some individuals with autism engage in destructive or aggressive behaviours and demonstrate extreme reactions to sensory stimuli (Reid & Collier, 2002).

According to Statistics Canada (2007), the most common disability in children ages 0-4 years is some type of developmental delay, and ASD is often part of this commonly occurring diagnosis. Autism is more prevalent in males, with a male to female ratio of 4:1. Autism occurs in 13 children per 10,000, PDD in 60 children per 10,000 and Asperger Syndrome in 3 per 10,000 (Fombonne, 2005).

Autism is generally diagnosed using the Diagnostic and Statistical Manual of Mental Disorders 4th edition-Text Revision (2000) and the ICD-10 (World Health Organization, 2006) criteria (Volkmar & Klin, 2005), and diagnosis of autism typically occurs within the first three years of life (Hewetson, 2002). The Autism Diagnostic Interview-Revised [ADI-R] and the Autism Diagnostic Observation Schedule-Generic [ADOS-G] are often used in tandem to affirm or clarify a diagnosis of autism (de Bildt, Sytema, Ketelaars, Kraijer, Mulder, Volkmar & Minderaa, 2004).

Some theorize that autism may occur as a result of a defect in the core systems of the brain, resulting in poor prenatal development of the neocortex and the sub-cortical sensory and motor systems. This is a serious problem as these parts of the brain are those that facilitate many crucial abilities after birth, such as awareness, gathering of information and coordinated behaviour (Trevarthen et al., 1997). Others theorize that autism results from genetic factors. This was first demonstrated in a study by Bauman and Kemper (1997) where 21 same-sexed pairs of identical and fraternal twins were studied where at least one twin matched the criteria for autism. Of the identical twins, 36% showed results of being concordant for autism, whereas none of the fraternal twins
were concordant for the disorder, where one twin met the criteria for autism (Bauman & Kemper, 1997).

2.1 Social Challenges

The Theory of Mind (Baron-Cohen, Leslie & Frith, 1985) is used to describe the inability of those with autism to understand the perspectives, beliefs, feelings and impressions of others. The Theory of Mind also illustrates how individuals with autism have difficulty making the connection between mental states and ensuing behaviours (Baron-Cohen et al., 1985). For example, children with autism often find it hard to understand complex social emotions such as guilt, pride, embarrassment, empathy, loneliness and surprise and do not usually understand implicit social norms and rules (Bauminger, 2002). Many children with autism seldom initiate or maintain social interactions and can have severe deficits in the areas of imitation, play skills and responsiveness to others (Maione & Mirenda, 2006). They often have impaired eye-gaze, difficulty with joint-attention, very few verbal initiations and an inability to develop age appropriate friendships (Dawson, Toth, Abott, Osterling, Munson & Estes, 2004). Fortunately for those with autism, “social interest expands and social skills continue to develop” during adolescence and adulthood (McGovern & Sigman, 2005, p. 402).

There is often a relationship between problem behaviours and poor social development (Licciardello, Harchik & Luiselli, 2008). The stereotypic behaviours common among those with autism frequently alienate peers due to the “highly unusual and stigmatized nature” of such behaviours (Lee, Odom & Loftine, 2007, p.67). This in turn impedes the child’s ability to develop proficient social skills due to limited exposure to social situations (Lee et al., 2007).

Even when children with ASD are in close proximity to their typical peers in the schoolyard, they will not usually join in their peers’ activities (Owen-DeSchryver, Carr, Cale & Blakeley-Smith, 2008) and generally prefer to engage in solitary activities (Anderson, Moore, Godfrey, & Fletcher-Flinn, 2004). Intervention is habitually necessary to acquire functional social skills. Social-skills training is a common
educational objective for school-aged children with ASD (Licciardello, Harchik & Luiselli, 2008).

Young individuals with PDD often have “aberrant social behaviour and excessive desire for sameness” (Hoeksma, Kemner, Verbraeken & van England, 2004, p. 341) as well as a limited range of language skills that hinder participation in social interactions (Thieman & Goldstein, 2004). For children with AS, an inability to consider the perspectives of other people is common and the child is often perceived as precocious or immature (Gillberg, 2002). Children with AS commonly display a near obsession with truth-telling and this habit often places the child in socially uncomfortable situations. The child with AS does not usually have the ability to differentiate between what is appropriate to say and what is not. Contextually-appropriate body language and facial expressions are also a common problem in youth with AS. It is not uncommon for a person with AS to appear “stone-faced” or depressed during an intense conversation and then laugh or smile once the conversation is over. Standing beside, behind or in unusual proximity to another person throughout a conversation is common (Gillberg, 2002). Children with AS typically do not have many friends, despite an increased interest in forming relationships in the adolescent years.

2.2 Communication and Language Challenges

Many children with autism have severe language delays and some do not develop language at all. It is estimated that 35-40% of children with autism do not develop functional use of language, but evidence suggests that with appropriate early intervention, some may acquire language by age 5 years (Chan, Cheung, Leung, Cheung & Cheung, 2005). When language is present, it is often in the form of echolalic speech (repetitively repeating auditory stimuli), monotone, or the child will reverse pronouns when speaking (Reid & Collier, 2002), such as saying “you” when the correct term would be “I.” Speech and language skills may begin to develop and then be lost. It may also be difficult for those with autism to imitate simple sounds or words (Autism Society of Canada, 2005).
Parents generally express concerns about their child’s development by 18 months of age (Reid and Collier, 2002) and language based concerns generally form the basis of their request for further investigation of the child’s development. For those with autism, language impairments are most apparent by the child’s second birthday (Barrett, Prior & Miniviona, 2004).

Communication impairments in autism are seen in both verbal and non-verbal skills and significantly affect the child’s ability to use language in a communicative or conversational manner (Barret, et al., 2004). Even for those with a reasonable vocabulary, other uses of language in the form of idioms and sarcasm may be quite difficult to comprehend (Reid & Collier, 2002). AS is dissimilar from other diagnoses within ASD in that there is generally no language delay (Sansosti & Powell-Smith, 2006).

2.3 Stereotypic and Problematic Behaviours

Stereotypic behaviour in children with autism can be described as “rhythmic and uncontrolled repetitive behaviour that produces no immediately apparent adaptive effects” (Lee et al., 2007, p.67). Stereotypic repetitive behaviours are often referred to as “stims,” a short form for “self-stimulatory behaviours.” Some examples of common behaviours are hand-flapping, body rocking, head rolling, and repetitive object manipulation. Stereotypic behaviours may also be expressed in the form of oral/vocal sounds, such as repeating meaningless sounds or words, while some behaviours involve mouthing of objects (Lee et al., 2007). Gadow, DeVincenit, Pomeroy and Azizian (2004) noted that preschoolers with autism were at higher risk for compulsions, motor tics and vocal tics, relative to preschoolers with PDD. Koegel and Koegel (1990) concluded that some children with autism are capable of learning self-monitoring techniques to control their stereotypic behaviours.

Some individuals with autism will demonstrate behavioural deterioration during adolescence, such as increased ritualistic behaviour, compulsions and aggression. Other individuals with autism will become less rigid and exhibit fewer aggressive behaviours during their adolescent years (Cohen, 2002). Between 40%-80% of children with ASD
are also diagnosed with Attention Deficit Hyperactivity Disorder [ADHD] (Patel and Cutis, 2007) and a relationship between autism and Obsessive Compulsive Disorder has also been identified (Nash, 2002). Kim, Szatmari, Bryson, Streiner and Wilson (2000) found evidence that ADHD and Oppositional Defiant Disorder are common comorbid disorders among those with AS, ages 9-14. Farrugia and Hudson (2006) have identified a link between AS and Conduct Disorder.

Many school aged children with AS develop stereotyped movements and tics (Gillberg, 2002). Preschoolers with AS were rated as being more oppositional than preschoolers with autism or PDD (Gadow et al., 2004). Pre-adolescents and adolescents may develop catatonia. Some children with AS will commit antisocial acts, such as breaking and entering, fire-setting and violent crimes. Alcohol and drug abuse is rare, but occasionally occurs among adolescents with AS (Gillberg, 2002).

2.4 Emotional Functioning and Mood

Relative to typical peers, children with ASD have a higher prevalence of depression, bipolar disorder, anxiety and psychotic disorders. The rates of comorbidity for psychiatric disorders for those with ASD is 65%, with individuals diagnosed with AS or PDD being at particular risk of such disorders (Pearson, Loveland, Lachar, Lane, Reddoch, Mansour & Cleveland, 2006). One third of children diagnosed with ASD in the US take antidepressant medication (Boseley, 2007) while at least 1/3 of children who are diagnosed specifically with AS become depressed from the age of ten years (Gillberg, 2002). Irritability is common as well as feelings of identity crisis (Gillberg, 2002). Anxiety problems are also common in adolescents with AS (Farrugia & Hudson, 2006).
2.5 Sensory Challenges

Sensory sensitivity or sensory abnormalities are common among children with autism and are more prevalent in children with autism than in children with other developmental delays. Sensory abnormalities can be experienced by those with autism as a difficulty processing visual, auditory, tactile or olfactory input. Sensory abnormalities are common among children across the autism spectrum (Leekam et al., 2007).

2.6 Motor Performance

According to Baranek (2002), developmental motor delays are present from infancy in those with autism and become more apparent with age. In one of her studies it was concluded that babies later diagnosed with autism were significantly delayed in the development of gross motor milestones at six months and thereafter throughout the first year of life. This is serious, since a lag in motor development during the foundational years can impact the subsequent development of other such skills (Baranek, 2002).

Motor skills are critical since they serve as foundations for other skills such as perception, incorporation of outside stimuli and sequencing skills (Blakemore-Brown, 2002). According to Schmitz, Martineau, Barthelemy and Assainte (2003), motor problems in autism stem from difficulty organizing motor actions toward a goal as well as problems of anticipatory function. Official terms used to describe motor problems associated with autism are “apraxia,” “praxis” and dyspraxia,” all of which indicate the individual’s difficulty with motor planning and perception (Hewetson, 2002). Interestingly, children with autism do not always develop hand specialization, i.e., they do not have one dominant hand to use in motor tasks. This may play a role in social imitation difficulties as well as goal directed motor tasks, such as reaching and grasping (Hewetson, 2002).

Kanner described the first children with autism he observed as being “clumsy in gait and gross motor performance” (Reid & Collier, 2002, p. 26). Likewise, children with autism often experience challenges when trying to perform coordinated movements of
different parts of the body simultaneously (Peeters & Gillberg, 1999). Many children with autism demonstrate low muscle tone, oral-motor difficulties and repetitive motor movements (Baranek, 2002). Their motor skills can appear “awkward” (Nash, 2002, p.42), and motor deficiencies in autism are commonly misinterpreted as “general clumsiness” (Baranek, 2002, p.399). They often demonstrate unusual appearance with regard to posture and gait (Klin & Volkmar, 1995). On a social level, strange body language may be present during social interactions. Fine motor skills as well as gross motor skills show marked deficiency in those with autism and this is often a cause for anxiety when performing motor tasks (Peeters & Gillberg, 1999). Studies have suggested that games involving ball skills are exceptionally difficult for most children with ASD (Reid & Collier, 2002). Reid and Collier (2002) have noted that the movement skills of children with ASD are typically poorly developed or delayed.

Much of the research conducted on brain structure in autism has focused on the dysfunction of the cerebellum (Fatemi, Realmuto, Earle, Thuras & Merz, 2002). One of the cerebellum’s key functions is to regulate motor functioning and to correlate motor acts with emotional and motivational processes in the brain (Bauman & Kemper, 1997). According to Bauman and Kemper (1997), an individual with cerebellum dysfunction have impaired motor movements. In keeping with their theory, emotions and motivations within the individual’s thought process will be unable to “connect” with motor acts. In addition, they explain that possible cerebellum abnormalities in those with autism could cause an overshoot or inability of the motor system to perceive parameters of movement.

Considerable literature has described the motor delays and challenges associated with the specific diagnosis of AS. For children with AS, delays in motor development during the first year are common. These motor delays include late onset or absence of crawling, sitting unsupported, rising to a standing position and delayed onset of walking. General clumsiness and poorly coordinated gross motor movements are almost always present in children with AS at any age (Gillberg, 2002). As children get older, other motor delays often become apparent, such as poor balance and general lack of motor coordination. Motor skill deficiencies in AS can affect the child’s ability to
perform school related tasks such as writing, art, social skills and vocational skills. Children with AS may also have difficulty being involved in games with motor demands, keeping them from participating with their peers (Griffin, Giffin, Fitch, Albera & Gingras, 2006). Up until the age of ten, it may be extremely difficult for a child with AS to engage in common motor tasks, such as bicycle riding, swimming or catching and kicking a ball (Gillberg, 2002).

2.7 Impaired Play Skills

In children with ASD, play is often described as repetitive, sensory, isolated, concrete and lacking imagination. Toys are generally viewed in a concrete manner and are used atypically. For example, a child with ASD may simply spin the wheels on a toy car for an extended period of time, or line up blocks instead of building with them (Thomas & Smith, 2004). Play requires particular skills which pose difficulty for those with ASD, such as social motivation, social experience and understanding, use of functional language and flexibility (Thomas & Smith, 2004). Lack of play skills launches a vicious cycle for children with ASD, since their play methods do not entice other children to include them in their ‘typical’ play experiences. This is turn denies children with ASD the chance to learn appropriate play skills from ‘typical’ peers and perpetuates their style of concrete play (Thomas & Smith, 2004).

In comparison with typical same-aged peers, children with autism show significant deficits in symbolic play. Typically, children will evolve from functional play to using play objects symbolically, i.e. improvising to have the object represent something imaginary. Children with autism may be able to follow instructions as to how to use a play object but show a general inability to play with the object symbolically, in a spontaneous manner (Wong, Kasari, Freemand & Paparella, 2007).

2.8 Sleep Disturbances

Children with autism are susceptible to sleep disturbances that may include sleep-onset delays, waking frequently throughout the night and early awakening. Parents often report high frequencies of difficulty initiating and maintaining sleep, and difficult
transitions between sleep stages in the child. There is a strong association between sleep disturbances and destructive behaviour in children with developmental disabilities and sleep disturbances are also related to increased self-injurious behaviours (DeLeon, Fisher & Marhefka, 2004). Insufficient sleep during childhood has been linked with an increased risk of obesity in adulthood (Landhuis, et al., 2008).

2.9 Summary of Characteristics Present in Children with ASD

As discussed above, children with ASD often display considerable difficulty with various aspects of daily functioning. There are numerous skills required to participate in most physical activities, such as social skills, motor skills, communication abilities and emotional regulation. An inability to use these skills in an age appropriate manner can have serious implications in everyday activities. Since these areas can pose particular difficulty among children with ASD, these characteristics could present as challenges to PA participation within this population. The majority of children with autism also have some intellectual disability (Todd & Reid, 2006; Fombonne, 2003). Persons with disabilities, including intellectual disabilities, are less likely to participate in regular PA than those without disabilities (Bomjin, 2004; Todd & Reid, 2006) placing them at increased risk of chronic disease (Bomjin, 2004).
Physical Activity

Physical activity has been described as a set of body movements that use skeletal muscles and require the use of energy (Fahey, Insel & Roth, 2005). PA has been linked to numerous health related benefits (Warburton, Nicol & Bredin, 2006) and has a “well established and empirically demonstrated positive influence on the health and wellbeing of all individuals” (Perkins, Jacobs, Barber, & Eccles, 2004, p.495). Regular PA has been linked to decreased risk of developing cardiovascular disease, osteoporosis, hypertension, cancer, poor cholesterol profiles and obesity (Russell & Newton, 2008). Being physically active can play a role in preventing Type II diabetes and cardiovascular disease by decreasing body weight, improving the body’s use of insulin, overall glycemic control and can lower blood pressure (Hayes & Kriska, 2008). PA reduces the natural functional decline that occurs with age (Nelson, Rejeski, Blair, Duncan, Judge, King, Macera & Castaneda-Sceppa, 2007).

While aspects of one’s life such as nutrition and psychological wellbeing work in tandem to promote and maintain overall health, sufficient PA participation is regarded as one of the most essential determinants of overall health related quality of life (Kravitz, 2007).

Aside from the obvious physical benefits of PA, there are several health related benefits that go beyond improving physical strength and endurance, and preventing chronic disease. PA has been shown to improve psychological wellbeing (McPhail, 2006; Pangrazi et al., 2003) and PA levels have an undisputed effect on feelings of quality of life and overall satisfaction. PA also has direct implications with children in matters of self-determination (Reid & O’Conner, 2003) strength, self-esteem, body image and stress reduction (Poulsen & Ziviani, 2004).

General positive affect and mood have been consistently associated with PA (Biddle & Murtrie, 2001) which has also been noted to help prevent anxiety and depression (Russell & Newton, 2008). There are several chemicals responsible for positive emotions and decrease in depressive feelings that are released in the brain during PA. Notably, the chemical responsible for an increase in feelings of trust and stress reduction is most
commonly produced by the brain in PA situations where friendship and bonding occur (McPhail, 2006).

2.10 Physical Activity and Social Skills

Social skills are essential for developing positive peer relationships, which foster feelings of connection and a sense of belonging. Peer relationships allow children to learn and practice more progressively advanced social skills that will be essential later in life (Mervis, 1998). Social skill proficiency is a better predictor of future career success than academic attainment and success in future relationships is also greatly impacted by the social skills learned in childhood (Utay & Utay, 2005).

According to Smith & Gilles (2003):

“Achieving success in school, on the job, and in the community is contingent upon the ability to interact with others. Acquiring social skills and quality of life indicators (e.g., social competence) that lead to long-term positive social status can contribute to academic achievement, positive peer relations, inclusion in effective learning opportunities, and family harmony.” (p.30)

According to Terre and Drabman (1992), there is a positive relationship between sociability and peer-rated popularity, and levels of PA and general PA habits. Conversely, children who do not demonstrate socially appropriate behaviour are at high risk for depression, anxiety, emotional dysregulation, social withdrawal, low self esteem, loneliness, suicidal tendencies, avoidance of school and poor academic performance (Utay & Utay, 2005).

2.11 Motor Skills

The role of motor skill development has been neglected as an area of study with regard to PA levels. Competency in motor skills is defined by proficiency in two areas, known as Fundamental Motor Skills (Kovacs, 2008; Stodden & Goodway, 2007). These areas are: object control [such a being able to throw and kick a ball] and locomotor skills [running and hopping] (Kovacs, 2008; Stodden & Goodway, 2007). Many children do not achieve
sufficient skill in these areas which are needed for more complex PA in later years. Sodden and Goodway (2007) postulate that regularly engaging in PA is an important practice that will build these skills over time. Children with well developed motor skills are likely to choose more complex types of PA while less skilled children are more apt to choose less rigorous types of activities. Possessing a variety of sport and game specific skills is expected to influence overall activity levels.

2.12 Familial Supports and Role-Modeling

Parents play a key role in their child’s development of PA behaviours. For example, parents’ beliefs, attitudes and values regarding PA have a strong impact on which physical activities will be selected for the child (Bomjin, 2004). “Children of parents who are physically active are more likely to become physically active than children of parents who are sedentary” (Bomjin, 2004, p. 54). Activity levels of youth are highly impacted when a parent or peer participated in the same activities simultaneously (Beets, Vogel, Forlaw, Pitteti & Cardinal, 2006). In addition, youth will increase their levels of PA participation simply with the consistent encouragement of parents to do so. The PA habits of adults are often set at an early age (Bomjin, 2004). Moore et al. (1991) found that children who had two active parents were six times more likely to be active than children of parents who are sedentary.

The impact of sibling PA habits may be as important as the effect parents have on children’s PA habits, and it has been suggested that all family members, including siblings be involved in health promotion for children and youth (Bomjin, 2004). Sallis et al. (2000) demonstrated that the PA behaviour of adolescents is directly associated with that of siblings. Wold and Anderssen (1992) also showed a significant relationship between sport participation of a sibling and that of another child in the family.

2.13 Physical Education

Physical education plays several important roles in the development of healthy lifestyle habits in children. Skills obtained through participation in physical education include: increased PA levels, improvement in self-concept, self-efficacy and self esteem,
increased motor skills, and increase in motivation (Le Masurier & Corbin, 2006). Ridgers, Stratton and Fairclough (2006) describe the importance of physical education in the school system as a means of PA promotion. Physical education interventions have been effective at raising the short and long-term PA levels of elementary-aged children (Ridgers, Stratton & Fairclough, 2006).

2.14 Physical Activity in Children

Despite all of the benefits associated with it, lack of PA, especially in children, has reached epic proportions. Many have labeled the current obesity and general apathy of today’s children as an epidemic (Boon & Clydesdale, 2005). Although PA can have positive benefits for all, approximately 50% of American children do not participate in regular PA (Frary & Johnson, 2000). Some hypotheses for the increase in obesity rates are population-based changes in diet and PA, changes in lifestyle habits, and reduced sleep time (Landhuis et al., 2008).

According to the National Association of Sport and Physical Education [NASPE], 60 minutes of PA participation on all or most days of the week is recommended for children (Pangrazi, Beighle, Vehige & Vack, 2003), whereas as little as 30-40 minutes of PA 3-4 times per week can provide basic benefits and “enhance overall health” (Poulsen & Ziviani, 2004, p.71). Children should also participate in activities that promote bone growth, muscle strength, and flexibility twice per week (Poulsen & Ziviani, 2004). As shown with adults, there is a direct relationship between PA levels in children and overall health. Children who engage in regular PA usually have lower blood pressure and lipid profiles than sedentary peers. Children who are physically active also demonstrate better psychological and emotional health in the areas of self-esteem and reduced negative affect (DiLorenzo, Stucky-Ropp, Vander Wal, & Gotham, 1998).

It is also important for children to engage in regular PA because the greatest bone mineral accumulation occurs through weight-bearing PA during the early pubertal years. Risk factors for various serious conditions such as coronary artery disease, hypertension, non-insulin-dependent diabetes, and osteoporosis have been shown to originate at a young age (DiLorenzo, et al., 1998).
There has been a recent increase in the prevalence of Type II Diabetes among children and adolescents. However, there is also significant evidence that PA can improve insulin sensitivity in overweight children. In addition, PA in children has been shown to reduce the amount of bad cholesterol in the body and increase the healthy kind (Broderick, Winter & Allen, 2006).

2.15 Physical Activity in individuals with Intellectual and Cognitive Disabilities

Little is known about the PA habits of children with ASD and whether this population engages in optimal PA to maintain a healthy lifestyle. However, considerable literature has addressed the PA experiences and challenges associated with individuals with other types of intellectual and cognitive disabilities (Reid & Collier, 2002). Since ASD is included in this population, some of the findings concerning this group may be applicable to those with ASD as well.

Although the physical benefits of an active lifestyle have been clearly documented (Hayes & Kriska, 2008; Nelson, et al., 2007; Singh, Kogan, Siahpush & van Dyck, 2008; Warburton, et al., 2006), PA is often overlooked in individuals with disabilities (Todd & Reid, 2006). Children with disabilities are at risk for developing “sedentary lifestyles” (Ayvazoglu, Ratcliffe & Kozub, 2006, p.16).

The literature pertaining to children with cognitive and developmental disabilities indicates that there is a tendency within that population toward lower cardiovascular fitness, poorer motor skills, higher percentage of body fat and lower maximal heart rates compared to typical peers (Angulo-Barroso, Burghardt, Meghann & Ulrich, 2008). A vicious cycle of inactivity often occurs such that inactivity often results in poor motor skills which lead to further inactivity, since basic motor skills are often a prerequisite for participation in sports (Bomjin, 2004). According to Bomjin (2004, p. 21), “as a result of being more sedentary, less fit, and less skilled than their peers, children with intellectual disabilities may be less prepared to participate in school and community activities, and may experience fewer benefits when they do participate.”
Beyond the physical risks inherent in lack of PA, sedentary lifestyles in persons with cognitive disabilities often lead to fewer opportunities for socialization, fun, improving psychological well-being, and overall level of independence (Bomjin, 2004). Due to the tendency for those with cognitive disabilities to be sedentary, such individuals seem to be missing out on the chance to reap the various psychological, social and emotional benefits of PA, in addition to the physical benefits.

Although autism can also include an intellectual disability (Todd & Reid, 2006;; Fombonne, 2003), the disorder is more commonly referred to as a developmental disability. According to Pitetti, et al. (2007), “physical activity is an important contributor to health in populations with developmental disabilities” (p.997). There is evidence that those with developmental disabilities who lead a sedentary lifestyle and who do not practice sufficient health promoting behaviours such as PA, may be at greater risk for otherwise preventable morbidity and mortality (Pitetti et al., 2007).

2.16 Physical Activity Habits of Children with ASD

Children with ASD tend to choose passive types of activities during their free time, such as isolated play (playing alone), parallel play (playing beside, but not with, others) and orientation (observing others but not interacting) (Pan, 2007). In a study conducted by Pan (2007), activity levels during school recess were compared for children with and without ASD. Activity levels of children with autism were lower than the levels of their typically developing peers.

As much as we know about the PA habits of children with various cognitive and intellectual disabilities, little is known about the PA habits of those with ASD (Reid & Collier, 2002), and whether their activity levels meet the minimum guidelines as outlined by the NASPE. Todd and Reid (2006) remarked that it may be challenging to encourage children with autism to be physically active at a moderate level for even 30 minutes at a time (reflecting the bare minimum guidelines as set by the NASPE).
2.17 Barriers to Physical Activity for Children with ASD

Allison et al. (2005) defined PA barriers as “the obstacles individuals face in undertaking, maintaining or increasing physical activity” (p.156). Community PA programs are often competitive in nature, making it difficult for children with ASD to participate. There are few PA programs that are adapted especially for children with ASD and participating in integrated programs in the community often proves unsuccessful. Consequently, PA patterns of those with ASD are often different from those of typically developing peers who have had more opportunities for activity (Pan & Frey, 2006).

ASD is often associated with movement problems and adolescents with ASD do not score as well as peers without disabilities on measures of fitness (Reid & Collier, 2002). According to Todd and Reid (2006), it is often challenging for children with ASD to engage in PA, due to various deficits related to motor functioning, motivation, difficulty with planning and generalization and difficulty in self monitoring. Activities which demand the use of complex motor skills or occur in a team environment are likely to be too challenging for children with ASD (Todd & Reid, 2006). Often, social and behavioural deficits associated with autism make it difficult for children with the disorder to participate fully in PA (Pan, 2008).

2.18 Recommendations for Physical Activity for Children with ASD

There are a small number of existing PA recommendations for children with ASD (Reid & O’Conner, 2003; Stillman, 2003); and these recommendations stem from current understanding of the functional deficits associated with the disorder, and not from actual known experiences of children with ASD in a PA capacity. Although specific activities have been suggested, little is known about which activities children with ASD are actually involved in. While previous study findings have described children with ASD as participating in solitary types of activities (Pan, 2007), it is still not clear what varieties of activities these include.

Likewise, PA recommendations for children with ASD are often generalized to all children with ASD and do not take into account the individual and unique nature of each
child with the disorder. Although PA recommendations for typically developing children are usually universal in scope, the amount of variation in needs and characteristics seen in children with ASD makes generalization of recommendations to the group as a whole less than optimal. As explained by Reid and O’Conner (2003), “Autism Spectrum Disorders represents an extremely heterogeneous group of individuals…individualization is the key to working with children with ASD” (p.20). Selections for activity instruction and participation must be subjectively adapted to the individual with ASD (Reid & O’Conner, 2003).

Various strategies for engaging those with ASD in PA have been suggested. It is thought that activities that combine external reinforcement, self-monitoring, and verbal cueing from adults may be most effective (Todd & Reid, 2006). Stillman (2003) recommends that PA engaged in by those with ASD be “self-contained and non-competitive,” such as; walking, running, gymnastics and yoga (p.89). Other activities that have been recommended are ice skating, roller skating, trampolining and stationary bicycling (Reid & O’Conner, 2003). Horseback riding has also been recommended for children with ASD to help with balance, and motor coordination (Bass, Duchowny & Llabre, 2009; Stillman, 2003). Fragala-Pinkham et al (2008) suggest aquatic based low-impact aerobic PA for children with ASD and other developmental disabilities to improve cardiorespiratory endurance and muscle strength. Pan (2010) has recommended swimming for children with ASD to enhance aquatic and social skill development.

Reid and O’Conner (2003) have outlined several components of PA that may increase the chances of success with children with ASD. Activities should be age appropriate and teach skills that are applicable to the child’s family life and same aged-peer activities, and the social and cognitive demands of the activity should not surpass the capabilities of the individual in those realms. Activities should be cooperative rather than competitive in nature as they are more likely to be adhered to if they are meaningful and enjoyable and where the child with ASD is able to achieve some measure of success. Low student-to-instructor ratios are also thought to be important, as well as allowing the child to fully master one task before moving on to a new one. It is generally recommended that
individuals with ASD make choices and manage their own learning to the extent it is developmentally possible (Reid & O’Conner, 2003).

In a study involving nine children with physical or developmental disabilities (e.g. Pervasive Developmental Disorder, Developmental Delay, Developmental Coordination Disorder) comparing at home versus group PA programs, children who participated in the group program demonstrated improvements in two or more of the measured outcomes (e.g., energy expenditure, walking speed, hip abductor strength, knee extensor strength, ankle plantar-flexor strength, self perception and five components of the Presidential Fitness Test), while children in the home based PA program showed minimal improvement in any of the measured outcomes. Parents and children who participated in the study comparing home versus group PA programs also reported greater satisfaction with the group PA program. Parents reported children had greater motivation in the group setting, and children reported higher levels of enjoyment in the group setting, due to social satisfaction.

Group fitness programs geared toward children with disabilities may be optimal since they provide small instructor-student ratios, often occur in safe environments and are developed by pediatric experts familiar with the needs of children with disabilities (Fragala-Pinkham, Haley, Rabin & Kharasch, 2005).

Finally, recommendations have been made for parents to act as sources of information and to provide input into their child’s activity selections. It has been emphasized (Reid & O’Conner, 2003) that parents are an essential resource when planning physical activities for children with ASD, as “parents…can provide information related to interests, abilities, and motivation of individuals with ASD. Adapted physical educators should strive to include input from all people who can contribute to a greater understanding of the individual” (p.22).
2.19 Potential Benefits of Physical Activity for Children with ASD

Aside from the already known health benefits of being physically active, children with ASD can benefit from an active lifestyle in ways related directly to challenges associated with the disorder. PA participation in ASD can have a calming and relaxing effect (Reid & Collier, 2002) and helps reduce stereotypic and disruptive behaviours (Morressey, Franzini & Karen, 1992; Powers, Thibadeau & Rose, 1992; Rosenthal-Malek & Mitchell, 1997) as well as aggressive behaviours (Allison, Basile & MacDonald, 1991).

PA and sports participation in typically developing children have been linked to interpersonal trust, increased levels of social interactions observed in free play, peer-rated popularity and more frequent participation in social activities in general (Ayvazoglu, Ratliffe & Kozub, 2005). Likewise, children with cognitive disabilities can benefit socially from participation in group physical activities which will in turn increase the likelihood that they will participate outside of school in similar pursuits (Ayvazoglu, Ratliffe & Kozub, 2005).

As stated by Broderick, Winter and Allen (2006):

“Involvement in team sports is beneficial in promoting socialization skills and in enabling children to function in a team environment. PA and sport are also very important in children with chronic illness or disability, as a means of “normalizing” their lifestyle and improving quality of life” (p.297)

The entire family appears to play a role in the PA habits of children. Likewise, this appears to be true for children with ASD; if the family of the child is interested in the same PA that he or she enjoys, it is more likely that the child will continue to be reinforced for practicing the activity at home, leading to “lifelong recreation activities” (Reid & O’Conner, 2003, p.22).
2.20 Summary

As noted above, ample evidence (DiLorenzo et al., 1998; Le Masurier & Corbin, 2006; Sodden & Goodway, 2007; Terre & Drabman, 1992) has indicated that PA is useful in improving and enhancing functionality of typically developing children in various areas across the ICF (WHO, 2001) such as motor skills development, social skills, mood, and overall sense of wellbeing. Accordingly, it may be beneficial to engage children with ASD in PA, as a means to address these same areas as they often pose particular challenges to children with ASD (Reid & Collier, 2002; Schmitz, Martineau, Barthelemy & Assainte, 2003). At present we do not know enough about the PA habits and unique needs of children with ASD with respect to activity preference, barriers and facilitators of PA within the population and activities which can best lead to functional improvements among children with ASD.

2.21 Study Purpose and Objectives

The first objective of this study was to describe and quantify the PA habits of children with ASD as reported by their parents. Specifically, the objective was to describe what types of physical activities are the most commonly practiced by children with ASD as well as the frequency of participation; context of participation [team vs. solitary] and reasons for activity selection. The second objective was to describe barriers and facilitators of PA in children with ASD, as reported by their parents.

The above objectives correspond to several key aims in this study. Firstly, the study aimed to provide recommendations (e.g., suggestions for PA programs based on types of activities most enjoyed by children with ASD, as reported by their parents; to increase awareness of existing PA barriers within the community for the ASD population and suggestions for how they can be prevented; how community programs can be better adapted to meet the needs of children with ASD) to community PA providers and allied health professionals working with children with ASD based on findings regarding current patterns in PA among the children in this study, as reported by their parents. Barriers to attaining or maintaining optimal PA participation as reported by parents were to be
considered in these recommendations. This study aimed to serve as a pilot for future research exploring PA habits among children with ASD and to inform interventions and recommendations to foster habitual PA in children with ASD and general PA promotion within the ASD community.
Chapter 3: Methods

3.1 Study Design

This exploratory pilot study used a quantitative cross-sectional approach in which parents’ responses to interview questions were examined to describe PA habits and patterns among children with ASD, as well as parent perceived barriers and facilitators to PA in their children.

3.2 Participants and Recruitment

Participants sought for this study were parents or regular caregivers of a child between the ages of 6-14 years inclusive, diagnosed with ASD. The age range for inclusion in this study began at 6 years, as literature has shown that interventions for children with autism are most effective in the early childhood years, since younger children are more likely to generalize and maintain gains made through early interventions (Lovaas, 1987). This study sought to describe the functioning of children with ASD post most early intervention treatments, as reported by their parents. Thus, including children of 6 years of age and above increased the likelihood that descriptions of the children would generally be typical of the child, and not in a state of rapid change. The cut-off age for inclusion in this study was 14 years, as the study aimed to focus primarily on elementary-school aged children, and less on adolescents. Still, there is a fine line between these stages, and children up until age 14 were included to permit participation of parents whose children are school-aged or on the threshold of adolescence, i.e. high school age. Children with ASD have been found to undergo another state of rapid change and development in adolescence and functioning in different areas can improve or decline during adolescence (Cohen, 2002; Farrugia & Hudson, 2006; Gillberg, 2002; McGovern & Sigman, 2005). The focus of this study was on children with ASD whose characteristics are fairly consistent and not in a state of rapid change during either early childhood or in adolescence.
Parents were recruited through online ASD-related discussion networks affiliated with the Yahoo website (www.yahoo.ca) where there are numerous specific groups dedicated to various discussion topics. Group members log in to the group of their choice and can type messages on online discussion boards for other group member to read. Members can respond to each others’ questions and comments about the specific group topic.

Information regarding the current study, including the recruitment letter (Appendix A) was posted to the discussion forum of 21 Yahoo Groups whose discussion topics pertained to ASD (Appendix B). Online groups were accessed through the Canadian Yahoo site where most group members are Canadian, although anyone internationally can join this network.

The researcher estimated the total membership of all groups to be 53,062, based on the sum of the total number of members listed in each of the 21 groups. There is likely overlap in membership between groups, making it difficult to determine the exact number of individuals accessed, however, even if everyone belonged to every group, it was clear that a large number of people had been accessed, i.e., more than 2000 members per group. In addition, one need not be a parent of a child with ASD to join and become a member of a group(s).

Group members who had children with ASD between 6 and 14 years of age, interested in participating in the study were asked to contact the researcher directly by email with their phone number. When a group member expressed interest in this research project, an informed consent letter was emailed by the researcher to the participant further elaborating on the purpose of the study and describing the involvement and rights of the participant (Appendix C). If the respondent did not identify him/herself via email as a parent/caregiver of a child meeting the inclusion criteria, the researcher asked for confirmation of eligibility prior to sending the informed consent letter. The information and consent document explained that the parent/caregiver would be asked a series of open-ended questions about their child’s functional abilities and PA habits. Finally, the letter explained that the participant would not benefit directly from this research and that he or she would be free to discontinue participation in this study at any time. The
information letter included a consent form to be signed and returned to the researcher. Once the signed consent form was received, a phone meeting was arranged by email at the participant’s convenience. In preparing the participant prior to the actual interview, the parent was told what to expect throughout the interview regarding types of questions to be asked and approximately how long the interview would last. Parents were reminded of their right to skip any questions of their choosing or to discontinue their participation at any time (Appendix D). This study had received ethical approval from the University of Toronto Research Ethics Board.

3.3 Procedure

Each parent participant in this study was interviewed by the researcher by phone using an interview guide developed by the researcher (see discussion below and Appendix E). Each participant was interviewed once, with the exception of two of the parents who were interviewed twice, so they could report separately on each of their two children with ASD. The length of each interview was approximately one hour.

3.4 Interview Guide Development: Content and Process

Although several standardized pediatric assessments were reviewed (e.g. Picture Exchange Communication System [PECS]- Frost & Bondy, 1994; Test of Gross Motor Development [TGMD]- Ulrich, 1985 ) there were no existing measures deemed suitable for this study as none addressed all the functional areas used to describe the children and the PA habits relevant to this study. Existing measures of functioning did not address all of the specific functional areas deemed particularly challenging to children with ASD, and existing measures of PA habits (e.g. TGMD) focused mainly on the proficiency of physical skills needed for PA rather than the variety of personal PA habits such as family involvement or personal preference as explored by this study. Therefore, an interview guide was designed to reflect the specific focus required for children with ASD and to address the study’s objectives. In addition, the method of data collection for this study was phone interviews, which ruled out the use of measures that would need to be administered face to face.
The interview guide consisted of twenty-two open ended questions, each with a set of specific probing sub-questions. The four key PA related areas of focus in the interview were: PA habits of the children and their families, parent perceived barriers to optimal PA participation, types of PA participated in by the child and frequency of PA participation, as reported by the parents.

In order to explore a number of areas related to PA habits, several PA themed open-ended questions were developed based on factors that are known to predict engagement in PA in typically-developing children (Beet et al., 2006; Bomjin, 2004; Sallis et al., 2000; Sooden & Goodway, 2007; Terre & Drabman, 1992). These questions explored areas such as: reasons for specific activity selections (q. 5); activity levels of other family members (q.8); how leisure time is spent in the family context (q.7); and motor skills of the child (q.19). Parents were also asked to describe any factors that they felt acted as barriers to their child participating in or adhering to various types of PA (q.9) and to list physical activities attempted by the child that were not successful (q. 5). Parents were asked to report what types of structured physical activities (i.e. instructor led programming, groups or teams) and unstructured physical activities (physical activities engaged in for leisure on a casual or spontaneous basis) their child participated in. Parents were asked to quantify the number of hours spent on each activity they reported.

In order to better explore the PA habits of the children as compared to their levels of activity, children were classified into three groups based on the overall hours of PA reported by parents. Activities that could not be quantified (i.e. parental reports that the child “goes outside on occasion to shovel snow”) were not included in the calculation of hours spent per week doing PA.

To assist with the selection of functional areas to include in the interview, literature was reviewed (Barret, et al., 2004; Bauminger, 2002; Chan et al., 2005; Gillberg, 2002; Lee et al., 2007; Maione & Mirenda, 2006; Reid & Collier, 2002; Thomas & Smith, 2004; Trevarthen et al., 1997) to help identify the key areas of functioning that are particularly challenging for children with ASD. Ten areas of functioning were identified: independent life skills (Kottorp et al., 2003; Pierce & Schreibman, 1994), social skills (Bauminger,
Open-ended questions were developed for parents to describe the personal characteristics of their children. To obtain comprehensive data and to quantify parent responses, each area of functioning addressed in the interview had a set of pre-selected indicators of functioning that were used as probes to expand on the information provided by parents’ responses to open-ended questions (Table 1). For example, some probes of functioning in social skills were questions about: the child’s ability to name at least one friend, having a close confidant, the child belonging to multiple friend networks, and the child attending parties or sleepovers of non-relatives.

Although the dialogue during the interview was individualized to the parent respondent due to the open-ended nature of responses and variation in the ways parents described their children, the probing questions/indicators that were consistently applied in the same way across each interview permitted identification of gradations of functioning in each of the key areas explored. Probing indicator questions were developed by the researcher and had between 2 and 7 response options, depending on the question (Appendix E). Some probe responses consisted of four, five and six-point gradations (e.g. six-point gradation for questions about the child’s performance of personal hygiene activities: Independent, Set up help only, With supervision, Limited assistance, Extensive assistance, Maximal assistance), where the literature/experts suggested that a range of functioning exists in that area, while others were best suited to a dichotomous ‘yes’ or ‘no’ response option (e.g., Can the child name at least one friend?). Each probing question was asked in the identical way for each parent interviewed, and responses were coded the same way across interviews. This ensured consistency across interviews and data collected from probing questions.
The functional indicators/probes for each interview question were derived from two sources. Probes were selected based on review of the literature which described common functional indicators of the areas asked about in the open-ended questions. As well, selection of probes was informed by a discussion panel of pediatric experts convened at the University of Toronto in 2005, at which the researcher was present. This discussion panel was held for pediatric experts to discuss assessment for children and youth with special needs for a project titled “A Study of the Feasibility of Developing an Assessment Instrument for Children and Youth with Special Needs” (Berg, et al., 2006). The panel of experts discussed possible indicators of functioning in various areas, and gradations of functioning. The researcher made note of some of the functional areas, indicators of functioning and gradations of functioning in each area as outlined by committee of pediatric experts. Attendance of the researcher at this meeting and careful and thorough review of the literature pertaining to functioning in ASD informed the development of the interview guide and the included functional areas, probing questions and gradations.
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<tr>
<th>Area</th>
<th>General Interview Question</th>
<th>Indicator Questions</th>
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| **Independent Life Skills** | How much help does your child generally need with daily activities like dressing, toileting, personal hygiene or bathing? Can your child perform these activities independently or degree of assistance required? | -How does the child perform with regard to personal hygiene [i.e. brushing teeth, washing face, combing hair]?  
-How does the child perform with regard to bathing?  
-How does the child perform with regard to dressing?  
- How does the child perform with regard to toileting? |
| **Cognitive Processes** | Can your child make minor decisions independently (i.e. what to wear, what snack to eat)?                                                                                                                                                                               | -Is the child able to perform multi-step tasks [e.g., pick up all his/her toys, put them in the appropriate container and put the container away]?  
-Does the child use toys in a spontaneous and imaginative way?  
-Does the child make minor daily decisions independently? |
| **Social Skills**     | In general, how would you describe your child’s social interactions?                                                                                                                                                                                                          | -Can the child name at least one friend?  
-Does the child have multiple networks of friends?  
-Does the child have a close confidant?  
-Does the child attend parties or sleepovers of non-relatives?  
-Does the child get along consistently well with teachers and peers?  
-Is the child at ease interacting with others? |
| **Communication**     | How does your child communicate with you or others? Does your child generally express his/her needs in a way you can understand them and does your child typically understand your attempts to communicate? | -Is the child consistently able to make him/herself understood?  
-Is the child consistently able to understand others? |
| **Behaviour**         | How would you describe your child’s behaviour?                                                                                                                                                                                                                           | -Does the child exhibit physical aggression?  
-Does the child engage in self-injurious behaviour?  
-Does the child exhibit outbursts of anger?  
-Does the child exhibit difficulty following classroom conventions?  
-Is the child easily distracted? |
| **Mood**             | On a typical day, what is your child’s mood like?                                                                                                                                                                                                                           | -Does the child demonstrate sad or worried facial expressions?  
- Does the child demonstrate crying or tearfulness?  
-Does the child make negative statements?  
-Does the child demonstrate irritability? |
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<th>Area</th>
<th>General Interview Question</th>
<th>Indicator Questions</th>
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<tr>
<td>Mood (continued)</td>
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<td>- Does the child demonstrate labile affect?</td>
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<td>- Does the child exhibit anxious concerns or fears?</td>
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<td>- Does the child exhibit persistent anger at self or others?</td>
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<tr>
<td>Sensory Issues</td>
<td>What can you tell me about your child’s tolerance of sensory experiences?</td>
<td>- Does the child exhibit particular likes or dislikes of specific types of foods, or food with specific textures?</td>
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<td></td>
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<td>- Does the child generally appear over-excited and/or hyperactive?</td>
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<td></td>
<td></td>
<td>- Does the child strongly dislike being touched by others, or dislike certain textures or sensations?</td>
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<tr>
<td>Motor Skills</td>
<td>What can you tell me about how your child moves? Do you have any concerns about your child’s physical abilities?</td>
<td>- Does the child have any difficulty with regard to manipulating common household objects?</td>
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<td></td>
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<td>- Does the child experience any clumsiness or balance issues?</td>
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3.5 Data Management Approach

The researcher wrote down all parent responses in note form to the questionnaire’s twenty-two questions during the course of the interview. The interviews were not audio recorded or written down verbatim since precisely transcribed responses were not needed for analysis. The interviews yielded nominal, continuous and open-ended response data as follows.

Continuous data yielded from parent interviews included age and hours of PA per week as reported by parents. Frequency distributions [counts and percentages] were tabulated for age. Hours of PA per week was written down as reported by parents. Parent reports of the children’s PA frequency [hours] per week were used by the researcher to classify the children into three groups, each reflecting ranges in levels of PA. The three groups were: High PA Levels (5-8 hours of PA per week); Moderate PA Level (3-<5 hours of PA per week); and Low PA Levels (0-<3 hours of PA per week). These PA level groupings were based on the NASPE’s PA frequency recommendations for children (Pangrazi, Beighle, Vehige & Vack, 2003).

Descriptors of type of PA (e.g., swimming, walking, bike riding) were categorized and tabulated, and counts and percentage were calculated to explore the relative frequency of specific PA habits within and among PA level groups. Parent-reported barriers to PA in their child were reviewed and classified into categories. Category names were selected using the barrier related terminology of the ICF (WHO, 2001). Verbal data (e.g., parents’ descriptions of aspects that appeared to motivate their child and sustained his/her involvement in PA) also yielded several factors identified a priori by the researcher as facilitators of PA, such as family involvement in physical activities, the availability of Physical Education in schools and activity levels of parents and siblings. Frequency counts and distributions were calculated and tabulated for these factors.
3.6 Coding and Ranking Open-Ended Descriptions of Functioning as Reported by Parents

Eight of the original ten areas were used to classify the children. Responses pertaining to sleep and academic functioning areas were not used to classify the children as there was little variability within the sample between scores. In addition to low variability between scores, these areas were also not selected as key areas in which to classify the children’s functioning as they were the least addressed in the literature as factors thought to be associated with PA levels.

As discussed above (p.29), each functional area asked about in the interview had several probing indicator questions and each probing question could be scored on a scale of 2-7 response options. To group the information and simplify the process of tallying composite scores in each area, response options with greater than 3 possible responses in their original format were reduced to three point response scales (Appendix E). Response options that indicated the child could always perform the given skill fully independently (e.g. dressing), or was reported to always demonstrate competence in a given area (e.g. reported as ‘always’ comfortable initiating contact with others) was accorded a score of 3 points. Response options that demonstrated the child’s ability to perform the task, but with assistance (e.g. dressing with supervision or set-up help) or to demonstrate competence in a given area on an inconsistent basis (e.g. reported to get along well with teachers and peers, but inconsistently) were allotted a score of 2 points. Response options such as “Never” or “with extensive assistance/maximal assistance” indicated the child’s inability to perform this task even semi-independently or to have fairly low competence in this area and were allotted a score of 1 point (Appendix E).

Probing indicator questions that were originally scored as dichotomous or 3-point response options during the interview were used in the analysis in their original format for analysis (i.e. they were preserved as either 2-point, ‘yes’/’no’ response option or 3-point response option of ‘yes, usually,’ ‘yes, but inconsistently,’ ‘never,’ for example). Higher scores were favorable and indicated better functioning in the given areas. (See Appendix E for Interview guide, original response options for each probing question and
subsequent transfer of larger scales to a three point scale). Final scores (either 1, 2, or 3) in each of the probing indicator questions within each of the functional areas were summed for each child. This resulted in a range of final composite scores (representative of the overall functional level of each child in that particular functional area).

The range of possible composite scores was then divided into three groups to represent three levels of functioning in each area; **High, Moderate and Low**. It is important to note that the title given to each functional group is indicative of the child’s functioning relative to the rest of the sample. For example, a child classified to the high functioning group in the area of social skills was considered high functioning as compared to the rest of the sample, but may not be considered high functioning in social skills as compared to typical peers. Furthermore, the functional classifications of the children cannot necessarily be generalized to all children with ASD and results presented relate to this sample only.

Composite scores were divided into three groups with an equal number of scores where the range of composite scores permitted this type of division. For example, the area of Mood had a range of possible composite scores of 7-21, resulting in three groups each with a range of 5 scores. This range was divided into three groups such that 17-21=High functioning, 12-16=Moderate functioning and 7-11=Low functioning. However, where the range of scores in a given area could not be divided into three groups of equal number of scores in each, the extra score was arbitrarily allotted to the moderate group. For example, the range of possible scores for the area of Behaviour was 4-13. For the area of Behaviour, a final composite score of 11-13=High functioning, 7-10=Moderate functioning and 4-6= Lower functioning. The extra score was arbitrarily allotted to the moderate group since this group was the middle of two extremes [high/low] among the three possible group levels, and was deemed by the researcher to be most likely to represent the average child in the sample in most cases, and not those functioning at the extremes in any given area (i.e. higher functioning than the rest of the sample, or lower functioning than the rest of the sample).
Frequency distributions were evaluated for each of the functional areas and as can be noted in tables 4-10, the number of children who were classified into each of the functional level groups based on their composite scores varied across functional areas.

3.7 Analysis

Analysis began with calculating frequency distribution of counts and percentages resulting from parental reports of the children’s PA habits and functional abilities in the areas explored. The next step of the analysis consisted of observation of the distribution of counts and percentages across PA level groups to help describe the functional level and abilities of the children in each group.

Summarization of interview guide responses yielded summary scores for the probes/indicator questions to obtain levels of functioning in each area, enumeration of physical activities participated in by the children, classification of children according to activity levels, and PA level classification based on hours of PA per week. Parental reports about perceived barriers to PA for their children were categorized according to participation barrier categories identified by the ICF (WHO, 2001).
Chapter 4: Results

The primary aim of this study was to describe, based on parental report, the PA habits of children with ASD, e.g. type and frequency of PA, PA routines, context and environment of practice. The study also explored the barriers and facilitators of PA for children with ASD, as reported by their parents.

4.1 The Sample

Telephone interviews lasting approximately one hour were conducted with 21 mothers and 2 fathers of children with ASD. One mother and one father (from different families) were interviewed twice, once for each of their two children with ASD so that a total of 25 children were reported about. Due to paired data resulting from siblings in this sample, the data pertaining to one of the children reported about by each of the parents interviewed twice was excluded from the study results. One child of the sibling pairs from one family had a comorbid diagnosis of Cerebral Palsy [CP]. This sibling was excluded from the study results since it could not be determined whether the deficits reported about this child were reflective of the ASD diagnosis, or that of CP. The data pertaining to one of the siblings reported about from the second family was randomly excluded (by a coin-toss) from the study results. Because of these exclusions, study results reflect 23 of the 25 children reported about by parents.

The children were predominantly male (n=18) with ages varying from 6-14 years inclusive, with a mean age of 9 yrs (SD=3.54 yrs) (Table 2). Just over half of children were within the 6-9 year age range. Participants came from Ontario (n=19), Alberta (n=1), New Brunswick (n=1), Pennsylvania (n=1) and California (n=1). As noted in Table 2, parents reported a number of different diagnoses for their children, including some comorbid conditions such as Sensory Integration Disorder or Apraxia. While many parents (43%) reported a primary diagnosis of ASD [and used this term synonymously with Autism], some parents reported combination-type diagnoses (Table 2), such as reporting ASD in combination with AS, or Pervasive Developmental Disorder [PDD] in combination with AS and Attention Deficit Hyperactivity Disorder (ADHD). It is
important to note that the diagnoses reported by parents (especially those who reported a combination of diagnoses, or those that distinguished AS or PDD from ASD, although these are part of the ASD spectrum) are not typical of the nomenclature accorded to ASD and like conditions. Parent responses were recorded verbatim. It is possible that diagnoses reported by parents reflect diagnoses given by several clinicians over a span of time, but diagnoses could not be verified beyond the parents’ reports due to lack of access to their health records. A screening questionnaire for diagnosis was not used.

As reported by parents, nearly all of the children (91%) had one or more sibling(s) and were part of intact families. Most of the children attended mainstream schools with an Individualized Education Plan at school (65%) with three (13%) receiving no assistance. The remaining 22% attended Special Education school or programs. Almost all (91%) of the parents interviewed reported their child to have difficulties around sleep (Table 2). Most of the children received various types of therapies in the past, and many participate in various types of therapies currently (Table 2).
Table 2
Demographics and Diagnoses of the Children (n=23) as Reported by Parents

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-9 yrs</td>
<td>13</td>
<td>57</td>
</tr>
<tr>
<td>10-14 yrs</td>
<td>10</td>
<td>43</td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td>9 yrs (3.54)</td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18</td>
<td>78</td>
</tr>
<tr>
<td>Female</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td><strong>Diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autism Spectrum Disorder</td>
<td>10</td>
<td>43</td>
</tr>
<tr>
<td>Pervasive Developmental Disorder-Not Otherwise Specified</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Asperger Syndrome</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Pervasive Developmental Disorder</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Autism Spectrum Disorder/Global Developmental Delay</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Autism Spectrum Disorder/Neurological Disorder/Attention Deficit Hyperactivity Disorder</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Autism Spectrum Disorder/Apraxia</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Autism Spectrum Disorder/Asperger Syndrome</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Asperger Syndrome/Developmental Coordination Disorder/Apraxia/Sensory Integration Dysfunction/Attention Deficit Hyperactivity Disorder</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Pervasive Developmental Disorder-Not Otherwise Specified/Asperger Syndrome</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Have Sibling(s)</strong></td>
<td>21</td>
<td>91</td>
</tr>
<tr>
<td><strong>Attend Special Education school or program</strong></td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td><strong>Attends mainstream school with I.E.P</strong></td>
<td>15</td>
<td>65</td>
</tr>
<tr>
<td><strong>Attend mainstream schools; no assistance</strong></td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td><strong>Have difficulties around sleep</strong></td>
<td>21</td>
<td>91</td>
</tr>
<tr>
<td><strong>Physical Therapy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Present</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Occupational Therapy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past</td>
<td>16</td>
<td>70</td>
</tr>
<tr>
<td>Present</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td><strong>Speech Language Pathology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past</td>
<td>19</td>
<td>83</td>
</tr>
<tr>
<td>Present</td>
<td>10</td>
<td>43</td>
</tr>
<tr>
<td><strong>Applied Behaviour Analysis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past</td>
<td>8</td>
<td>35</td>
</tr>
<tr>
<td>Present</td>
<td>9</td>
<td>39</td>
</tr>
</tbody>
</table>

*Diagnoses in table were recorded verbatim as reported by parents and are not consistent with current ASD related nomenclature for possible diagnoses. Diagnoses reported by parents may be reflective of those given over time by different clinicians.*
4.2 Describing Areas of Functioning Reported about by Parents

Parental reports of the children’s levels of functioning in various areas yielded a range of abilities (Table 3) with regard to social skills, cognitive processes, motor skills, performing routine life skills, communication, behaviour, mood and tolerance of sensory stimuli. Specifically, there was considerable variation in the children’s performance of independent life skills (q.15) as reported by their parents (Table 4). Close to half (48%) of the children managed all aspects of their personal hygiene independently, and 57% were reported to get dressed and manage toileting tasks independently. More than half of the children required assistance with bathing (61%). Most of the children (74%) performed multi-step tasks without assistance, but 74% required assistance in making minor daily decisions. There were children who could perform multi-step tasks independently, but required assistance with minor daily decisions and vice-versa, and this 74% for each of these indicators do not represent the same children in all cases (Table 5).
<table>
<thead>
<tr>
<th>Area</th>
<th>Number of Probing Indicator Questions Asked</th>
<th>Range of Possible Scores in This Area</th>
<th>Actual Ranges of Scores in This Areas</th>
<th>Mean Scores of all children (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Skills</td>
<td>4</td>
<td>4-12</td>
<td>6-12</td>
<td>9.7 (2.01)</td>
</tr>
<tr>
<td>Cognitive Processes</td>
<td>3</td>
<td>2-7</td>
<td>2-7</td>
<td>4.3 (1.22)</td>
</tr>
<tr>
<td>Behaviour</td>
<td>5</td>
<td>4-13</td>
<td>8-13</td>
<td>10 (1.60)</td>
</tr>
<tr>
<td>Motor Skills</td>
<td>2</td>
<td>2-6</td>
<td>3-6</td>
<td>5.1 (0.79)</td>
</tr>
<tr>
<td>Mood</td>
<td>7</td>
<td>7-21</td>
<td>11-21</td>
<td>18.2 (3.07)</td>
</tr>
<tr>
<td>Sensory Issues</td>
<td>3</td>
<td>1-5</td>
<td>1-5</td>
<td>2.9 (1.39)</td>
</tr>
<tr>
<td>Communication</td>
<td>2</td>
<td>2-6</td>
<td>2-6</td>
<td>4.7 (1.15)</td>
</tr>
<tr>
<td>Social Skills</td>
<td>6</td>
<td>4-14</td>
<td>4-13</td>
<td>7.0 (2.51)</td>
</tr>
</tbody>
</table>
### Table 4
**Independent Life Skills as Reported by Parents**

<table>
<thead>
<tr>
<th></th>
<th>High Functioning n=13</th>
<th>Moderate Functioning n=8</th>
<th>Low Functioning n=2</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Personal Hygiene:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>11</td>
<td>85</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Requiring supervision or limited assistance</td>
<td>2</td>
<td>15</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>Requiring extensive or maximal assistance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bathing:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>7</td>
<td>54</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Requiring supervision or limited assistance</td>
<td>6</td>
<td>46</td>
<td>7</td>
<td>88</td>
</tr>
<tr>
<td>Requiring extensive or maximal assistance</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Dressing:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>12</td>
<td>92</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Requiring supervision or limited assistance</td>
<td>1</td>
<td>8</td>
<td>7</td>
<td>88</td>
</tr>
<tr>
<td>Requiring extensive or maximal assistance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Toilet use:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>11</td>
<td>85</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Requiring supervision or limited assistance</td>
<td>2</td>
<td>15</td>
<td>5</td>
<td>63</td>
</tr>
<tr>
<td>Requiring extensive or maximal assistance</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the possible range of scores
### Table 5
Cognitive Processes as Reported by Parents

<table>
<thead>
<tr>
<th></th>
<th>High Functioning n=1</th>
<th>Moderate Functioning n=17</th>
<th>Low Functioning n=5</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Performing multi-step tasks:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>100</td>
<td>16</td>
<td>94</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Making minor daily decisions:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>1</td>
<td>100</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Needs assistance</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>88</td>
</tr>
<tr>
<td>Never makes decisions independently</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Using toys in a spontaneous and imaginative manner:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistently</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inconsistently or can imitate basic play skills</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>82</td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>18</td>
</tr>
</tbody>
</table>

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the possible range of scores*
Parental interviews revealed low levels of social functioning (Table 6) among many of the children (q.11) with 65% of the children unable to name one friend and 43% unable to name someone close to them in whom they could confide. Most parents (74%) reported that their child never attends parties or sleepovers of non-relatives. Parent reports showed that more than half (52%) of the children were able to understand others (q.14) but that fewer children (35%) were consistently able to make themselves understood by others and to communicate their needs and feelings effectively (Table 7).

The most common behavioural issues (q.13) reported by parents were physical and/or verbal aggression (44%), difficulty following rules in class (72%) and general distractibility (80%). Parents reported few regularly occurring mood problems (q. 12) in their children, however those that did most often cited labile affect (26%) and general irritability (22%) as mood related concerns observed in their child on a regular basis (Table 8).

With regard to motor skills (q.19), nearly half (43%) of parents reported their child to need supervision or set-up help manipulating common household objects (e.g. utensils), while 52% reported the presence of clumsiness or balance issues on an inconsistent basis (Table 11). Sixty-four percent of parents described their child as having limited or rigid food choices (often due to food textures). Likewise, about half of parents described their child as hypersensitive to tactile sensory input (52%). Close to half (43%) reported that their child regularly demonstrates hyper-active behaviour (q.17) (Table 9).
### Table 6
Social Skills as Reported by Parents

<table>
<thead>
<tr>
<th></th>
<th>High Functioning n=1</th>
<th>Moderate Functioning n=6</th>
<th>Low Functioning n=16</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child consistently gets along with teachers and peers</strong></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Consistently</td>
<td>1</td>
<td>100</td>
<td>4</td>
<td>67</td>
</tr>
<tr>
<td>Inconsistently</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Child is consistently at ease interacting with others</strong></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Consistently</td>
<td>1</td>
<td>100</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>Inconsistently</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td><strong>Child attends parties or sleepovers of non-relatives</strong></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Rarely</td>
<td>1</td>
<td>100</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td><strong>Child has multiple networks of friends</strong></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Has multiple networks</td>
<td>1</td>
<td>100</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>Does not have multiple networks of friends</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td><strong>Child can name at least one friend</strong></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Can name</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Cannot name</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Child has a close confidant</strong></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Has a close confidant</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Does not have a close confidant</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the possible range of scores.*
Table 7
Communication as Reported by Parents

<table>
<thead>
<tr>
<th></th>
<th>High Functioning n=6</th>
<th>Moderate Functioning n=13</th>
<th>Low Functioning n=4</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makes self understood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always understood</td>
<td>6 100</td>
<td>2 15</td>
<td>0 0</td>
<td>8 35</td>
</tr>
<tr>
<td>Often or usually understood</td>
<td>0 0</td>
<td>11 85</td>
<td>0 0</td>
<td>11 48</td>
</tr>
<tr>
<td>Rarely or never understood</td>
<td>0 0</td>
<td>0 0</td>
<td>4 100</td>
<td>4 17</td>
</tr>
<tr>
<td>Understands others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always understands</td>
<td>6 100</td>
<td>6 46</td>
<td>0 0</td>
<td>12 52</td>
</tr>
<tr>
<td>Often or usually understands</td>
<td>0 0</td>
<td>7 54</td>
<td>3 75</td>
<td>10 43</td>
</tr>
<tr>
<td>Rarely or never understands</td>
<td>0 0</td>
<td>0 0</td>
<td>1 25</td>
<td>1 4</td>
</tr>
</tbody>
</table>

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the possible range of scores*
Table 8
Mood as Reported by Parents

<table>
<thead>
<tr>
<th></th>
<th>High Functioning (n=17)</th>
<th>Moderate Functioning (n=5)</th>
<th>Low Functioning (n=1)</th>
<th>All (n=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Sad or worried facial expression:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>2</td>
<td>12</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Not present</td>
<td>15</td>
<td>88</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Crying or tearfulness:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Not present</td>
<td>16</td>
<td>94</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Made negative statements:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Not present</td>
<td>16</td>
<td>94</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Irritability:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>2</td>
<td>12</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>3</td>
<td>18</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Not present</td>
<td>12</td>
<td>70</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Labile Affect:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>2</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Not present</td>
<td>14</td>
<td>82</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Anxious concerns or fears:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>3</td>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Not present</td>
<td>14</td>
<td>82</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>Persistent anger at self or others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>2</td>
<td>12</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>Not present</td>
<td>15</td>
<td>88</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the possible range of scores.
<table>
<thead>
<tr>
<th></th>
<th>High Functioning n=3</th>
<th>Moderate Functioning n=12</th>
<th>Low Functioning n=8</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Hypersensitivity to touch</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td>Not hypersensitive to touch</td>
<td>3</td>
<td>100</td>
<td>7</td>
<td>58</td>
</tr>
<tr>
<td>Hyperactive behaviour:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present daily or on 1-2 of the last 3 days</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>Present, but not in the last 3 days</td>
<td>1</td>
<td>33</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>Not present</td>
<td>2</td>
<td>67</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Limited or rigid food choices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does not have limited or rigid food choices</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>100</td>
<td>5</td>
<td>42</td>
</tr>
</tbody>
</table>

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the possible range of scores.*
Table 10
Behaviour as Reported by Parents

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>High Functioning</th>
<th>Low Functioning</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=9</td>
<td>n=14</td>
<td>n=23</td>
</tr>
<tr>
<td></td>
<td>n   %</td>
<td>n   %</td>
<td>n   %</td>
</tr>
<tr>
<td>Physical Aggression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>0   0</td>
<td>4   29</td>
<td>4   17</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>1   11</td>
<td>4   29</td>
<td>5   22</td>
</tr>
<tr>
<td>Not present</td>
<td>7   78</td>
<td>6   43</td>
<td>13  57</td>
</tr>
<tr>
<td>Self-Injurious Behaviour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>0   0</td>
<td>2   14</td>
<td>2   9</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>0   0</td>
<td>1   7</td>
<td>1   4</td>
</tr>
<tr>
<td>Not present</td>
<td>9   100</td>
<td>11  79</td>
<td>20  87</td>
</tr>
<tr>
<td>Outbursts of Anger</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibited daily or on 1-2 of the last 3 days</td>
<td>0   0</td>
<td>3   21</td>
<td>3   13</td>
</tr>
<tr>
<td>Present but not exhibited in the last 3 days</td>
<td>0   0</td>
<td>3   21</td>
<td>3   13</td>
</tr>
<tr>
<td>Not present</td>
<td>9   100</td>
<td>8   57</td>
<td>17  74</td>
</tr>
<tr>
<td>Child consistently demonstrates difficulty following classroom conventions</td>
<td>5   56</td>
<td>11  79</td>
<td>16  70</td>
</tr>
<tr>
<td>Child does not consistently demonstrate difficulty following classroom conventions</td>
<td>4   44</td>
<td>3   21</td>
<td>7   30</td>
</tr>
<tr>
<td>Child is easily distracted</td>
<td>5   56</td>
<td>14  100</td>
<td>19  83</td>
</tr>
<tr>
<td>Child is not easily distracted</td>
<td>4   44</td>
<td>0   0</td>
<td>4   17</td>
</tr>
</tbody>
</table>

*There were no children within the sample who met the criteria for Low functioning in Behaviour, as per parent reports. Parent reports described children with High and Moderate Levels of Behaviour only, and as such Behaviour as reported by parents has been expressed in only two groups, High and Low functioning (as compared to the sample).

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the rest of the sample.*
<table>
<thead>
<tr>
<th>Manipulating common household objects:</th>
<th>Higher Functioning n=7</th>
<th>Moderate Functioning n=15</th>
<th>Lower Functioning n=1</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Requiring supervision or set up help</td>
<td>7</td>
<td>100</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Requiring extensive or maximal assistance</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>71</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clumsiness or balance issues:</th>
<th>Higher Functioning n=7</th>
<th>Moderate Functioning n=15</th>
<th>Lower Functioning n=1</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always present</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Present, but inconsistently</td>
<td>2</td>
<td>29</td>
<td>9</td>
<td>60</td>
</tr>
<tr>
<td>Not present</td>
<td>6</td>
<td>86</td>
<td>3</td>
<td>21</td>
</tr>
</tbody>
</table>

*Children were classified into High, Moderate and Low functioning groups based on their functioning relative to the possible range of scores.
4.3 Physical Activity Habits of the Children

As per parent reports (q.4) the number of hours of PA participation by the children varied from 0.5 hours per week to 8 hours per week, with a mean of 4.2 hours (SD = 2.1). Children who engaged in PA for 5-8 hours per week were considered to have high levels of PA (n=8); those who were physically active for 3-<5 hours per week were classified as moderate levels of PA (n=11); and those who participated in 0-<3 hours of PA per week or less were classified as having low levels of PA (n=4) (Table 12).
Table 12
Children Classified by Parent reported Hours of Physical Activity over a 1 Week Period Using NASPE categories

<table>
<thead>
<tr>
<th>Group</th>
<th>Range of Hours of Physical Activity per Week</th>
<th>Mean number of hours (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Physical Activity Levels</td>
<td>5-8</td>
<td>6.6 (1.1)</td>
</tr>
<tr>
<td>(n = 8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate Physical Activity Levels</td>
<td>3-&lt;5</td>
<td>3.7 (0.5)</td>
</tr>
<tr>
<td>(n=11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Physical Activity Levels</td>
<td>0-&lt;3</td>
<td>1.1 (0.9)</td>
</tr>
<tr>
<td>(n = 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (n = 23)</td>
<td>0.5-8</td>
<td>4.2 (2.1)</td>
</tr>
</tbody>
</table>
Almost all children (96%) participated in some sort of solitary PA, and approximately half (52%) participated in team sports (Table 13). Parent reports revealed a large variety of physical activities engaged in by the children with swimming (78%), biking (52%) and walking (39%) presenting the highest frequencies in solitary activities and hockey (17%) and basketball (22%) showing the highest participation levels for team sports. The children who were classified as having moderate levels of PA participated in the most team sports, while only one participant classified in the low PA group participated in team sports. The high and moderate level PA groups demonstrated a broader repertoire of PA than those classified as having low levels of PA, showing greater variety in the types of activities chosen (Table 14).
Table 13
Categories of Physical Activity Participation as Reported by Parents

<table>
<thead>
<tr>
<th></th>
<th>High Physical Activity Levels (5-8 hrs/wk)</th>
<th>Moderate Physical Activity Levels (3-&lt;5hrs/wk)</th>
<th>Low Physical Activity Levels (0-&lt;3 hrs/wk)</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=8</td>
<td>n=11</td>
<td>n=4</td>
<td>n=23</td>
</tr>
<tr>
<td></td>
<td>n  %</td>
<td>n  %</td>
<td>n  %</td>
<td>n  %</td>
</tr>
<tr>
<td>Solitary Activities</td>
<td>7  88</td>
<td>11  100</td>
<td>4  100</td>
<td>22  96</td>
</tr>
<tr>
<td>Paired or Group Activities</td>
<td>1  13</td>
<td>2  18</td>
<td>1  20</td>
<td>4  17</td>
</tr>
<tr>
<td>Team Sports</td>
<td></td>
<td></td>
<td></td>
<td>12  52</td>
</tr>
</tbody>
</table>
Table 14
Types of Activities Selected as Reported by Parents
*First 17 cells represent solitary or paired physical activities, while final 6 cells represent team sports

<table>
<thead>
<tr>
<th>Activity</th>
<th>High Physical Activity Levels (5-8 hrs/wk)</th>
<th>Moderate Physical Activity Levels (3-&lt;5 hrs/wk)</th>
<th>Low Physical Activity Levels (0-&lt;3 hrs/wk)</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Swimming:</td>
<td>5</td>
<td>63</td>
<td>10</td>
<td>91</td>
</tr>
<tr>
<td>Biking:</td>
<td>4</td>
<td>50</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td>Walking:</td>
<td>6</td>
<td>75</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Tobogganing:</td>
<td>1</td>
<td>13</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>Horseback riding:</td>
<td>2</td>
<td>22</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Skating:</td>
<td>1</td>
<td>13</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Martial Arts:</td>
<td>1</td>
<td>13</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Rollerblading:</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Skateboarding/Scooter:</td>
<td>1</td>
<td>13</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Skiing:</td>
<td>2</td>
<td>25</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Gymnastics:</td>
<td>1</td>
<td>13</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Hiking:</td>
<td>3</td>
<td>38</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bowling:</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Organized fitness program:</td>
<td>1</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Golf:</td>
<td>1</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dance</td>
<td>1</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Regular use of community gym facilities, i.e. YMCA:</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td><strong>TEAM OR PAIRED SPORTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basketball:</td>
<td>2</td>
<td>25</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Hockey:</td>
<td>1</td>
<td>13</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Soccer:</td>
<td>2</td>
<td>25</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Baseball</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Football:</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Badminton:</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
</tbody>
</table>
As shown in Table 15, many (70%) of the children participated in Physical Education (PE) programs in school. Seventy-five percent of children classified as having high levels of PA had access to PE programs in school, while 50% of those classified as having low levels of PA experienced PE as part of their curriculum. The majority of children (83%) participated in three or more activities and participated in PA with their family. The majority of children have siblings who are active (83%) and nearly all (91%) of the children have at least one active parent, participate in physical activities that take place outdoors, and activities that are free to no cost. Reasons for activity selection varied among PA level groups. Few (7%) children classified as having low levels of PA were reported to have selected physical activities based on enjoyment of the activity, and half of this group made activity selections due to parental or sibling influence. Among the children classified as having high levels of PA, 38% were reported to have selected physical activities based on preference and enjoyment and 64% were said to have selected their physical activities based on parental or sibling influence.
Table 15
Descriptors of Physical Activity as Reported by Parents

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>High Physical Activity Levels (5-8 hrs/wk)</th>
<th>Moderate Physical Activity Levels (3-&lt;5hrs/wk)</th>
<th>Low Physical Activity Levels (0-&lt;3 hrs/wk)</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=8</td>
<td>n=11</td>
<td>n=4</td>
<td>n=23</td>
</tr>
<tr>
<td>Child regularly participates in team/group based sports or physical activities</td>
<td>3 38</td>
<td>7 64</td>
<td>1 25</td>
<td>11 48</td>
</tr>
<tr>
<td>Child regularly participates in Physical Education at school</td>
<td>6 75</td>
<td>8 73</td>
<td>2 50</td>
<td>16 70</td>
</tr>
<tr>
<td>Variety of 3 or more activities</td>
<td>7 88</td>
<td>9 82</td>
<td>3 75</td>
<td>19 83</td>
</tr>
<tr>
<td>Participating in family-oriented activities</td>
<td>6 75</td>
<td>9 82</td>
<td>4 100</td>
<td>19 83</td>
</tr>
<tr>
<td>Participating in outdoor activities</td>
<td>7 88</td>
<td>10 91</td>
<td>4 100</td>
<td>21 91</td>
</tr>
<tr>
<td>Participating in activities that are generally no-cost</td>
<td>7 88</td>
<td>10 91</td>
<td>4 100</td>
<td>21 91</td>
</tr>
<tr>
<td>Have active parent(s)</td>
<td>7 88</td>
<td>10 91</td>
<td>4 100</td>
<td>21 91</td>
</tr>
<tr>
<td>Have active sibling(s)</td>
<td>6 75</td>
<td>9 82</td>
<td>4 100</td>
<td>19 83</td>
</tr>
<tr>
<td>Selected or adheres to activity because of enjoyment</td>
<td>3 38</td>
<td>5 45</td>
<td>2 7</td>
<td>10 43</td>
</tr>
<tr>
<td>Selected or adheres to activity because of parental/sibling influence</td>
<td>5 63</td>
<td>5 45</td>
<td>2 50</td>
<td>12 52</td>
</tr>
</tbody>
</table>
4.4 Descriptions of Children’s Functioning by Physical Activity Level

(Table 16)

Children within each of the physical activity levels showed variation in function. Children classified to the high PA level group had difficulty in the areas of social skills with none of the children classified to this group reported to be high functioning in this area. There were also some behaviour issues among the children classified to the high PA group (38%) reported by the parents. A quarter (25%) of the children classified to this group demonstrated moderate functioning in life skills and cognitive processes. More than half (63%) of the children in the high PA group have motor issues and function at a moderate level in this area as per parent reports.

Almost all (91%) of the children classified as having moderate levels of PA were reported to function at a low level in the areas of social skills and behaviour. The majority had moderate level functioning in cognitive processes (82%), communication, and motor skills (73%). Half (50%) of the children classified to the low PA level group were reported to function at a moderate level in the areas of life skills, motor skills, communication, and cognitive processes. The majority (75%) of children classified to this group were reported to be low functioning in social skills.
Table 16
Functional level of the Sample in Various Areas as Reported by Parents and Physical Activity Levels

<table>
<thead>
<tr>
<th></th>
<th>High Physical Activity Levels (5-8 hrs/wk) n=8</th>
<th>Moderate Physical Activity Levels (3-&lt;5hrs/wk) n=11</th>
<th>Low Physical Activity Levels (0-&lt;3 hrs/wk) n=4</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of functioning in Life Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>5 63</td>
<td>7 64</td>
<td>1 25</td>
<td>13 57</td>
</tr>
<tr>
<td>Moderate</td>
<td>2 25</td>
<td>4 36</td>
<td>2 50</td>
<td>8 35</td>
</tr>
<tr>
<td>Low</td>
<td>1 12</td>
<td>0 0</td>
<td>1 25</td>
<td>2 9</td>
</tr>
<tr>
<td>Level of functioning in Cognitive Processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0 0</td>
<td>1 9</td>
<td>0 0</td>
<td>1 4</td>
</tr>
<tr>
<td>Moderate</td>
<td>6 25</td>
<td>9 82</td>
<td>2 50</td>
<td>17 74</td>
</tr>
<tr>
<td>Low</td>
<td>2 25</td>
<td>1 9</td>
<td>2 50</td>
<td>5 22</td>
</tr>
<tr>
<td>Level of functioning in Social Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0 0</td>
<td>1 9</td>
<td>0 0</td>
<td>1 4</td>
</tr>
<tr>
<td>Moderate</td>
<td>5 63</td>
<td>0 0</td>
<td>1 25</td>
<td>6 26</td>
</tr>
<tr>
<td>Low</td>
<td>3 38</td>
<td>10 91</td>
<td>3 75</td>
<td>16 70</td>
</tr>
<tr>
<td>Level of functioning in Behaviour</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>5 63</td>
<td>1 9</td>
<td>3 75</td>
<td>9 39</td>
</tr>
<tr>
<td>Low</td>
<td>3 38</td>
<td>10 91</td>
<td>1 25</td>
<td>14 61</td>
</tr>
<tr>
<td>Level of functioning in Mood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>8 100</td>
<td>6 55</td>
<td>3 75</td>
<td>17 74</td>
</tr>
<tr>
<td>Moderate</td>
<td>0 0</td>
<td>4 36</td>
<td>1 25</td>
<td>5 22</td>
</tr>
<tr>
<td>Low</td>
<td>0 0</td>
<td>1 9</td>
<td>0 0</td>
<td>1 4</td>
</tr>
<tr>
<td>Level of functioning in Communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>3 38</td>
<td>3 27</td>
<td>0 0</td>
<td>6 26</td>
</tr>
<tr>
<td>Moderate</td>
<td>3 38</td>
<td>8 73</td>
<td>2 50</td>
<td>13 57</td>
</tr>
<tr>
<td>Low</td>
<td>2 25</td>
<td>0 0</td>
<td>2 50</td>
<td>4 17</td>
</tr>
<tr>
<td>Level of functioning in Motor Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>3 38</td>
<td>3 27</td>
<td>1 25</td>
<td>7 30</td>
</tr>
<tr>
<td>Moderate</td>
<td>5 63</td>
<td>8 73</td>
<td>2 50</td>
<td>15 65</td>
</tr>
<tr>
<td>Low</td>
<td>0 0</td>
<td>0 0</td>
<td>1 25</td>
<td>1 4</td>
</tr>
<tr>
<td>Level of functioning in Sensory Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>3 38</td>
<td>0 0</td>
<td>0 0</td>
<td>3 13</td>
</tr>
<tr>
<td>Moderate</td>
<td>3 38</td>
<td>7 64</td>
<td>2 50</td>
<td>12 52</td>
</tr>
<tr>
<td>Low</td>
<td>2 25</td>
<td>4 36</td>
<td>2 50</td>
<td>8 35</td>
</tr>
</tbody>
</table>
4.5 Facilitators of Physical Activity Selection and Participation as Reported by Parents

Parents were asked to explain the reasons behind their activity selections, and these reasons are described below for the most commonly practiced activities. Parents’ reasons for engaging their child in swimming included the preference of the child, the benefit of teaching their child a lifelong skill that will provide safety in water-related situations, and financial reasons such as the low cost or lack of cost of swimming. Walking and tobogganing were reported as activities engaged in simply because the child enjoys them, and because the family often participates in these activities together.

Reasons for engaging the child in gymnastics were the potential to improve gross motor skills through the activity, and the reduction of self-stimulatory behaviours. Skiing and biking were described as something the family enjoys and something easily accessible at alternate times of the year.

Parents whose children engage in team sports listed reasons such as the social aspect of participating in teams and the subsequent potential to enhance social skills. Soccer was described as an activity that was chosen since the level of competitiveness is low, and it was viewed as something that could assist in improving motor coordination. With regard to horseback riding, parents felt it had the ability to improve coordination, balance and self-esteem in their child and could also “imbue the child with a sense of tranquility.” Some parents listed the convenience of certain activities as a strong factor for their selection, such as easy accessibility within the community.

4.6 Barriers to Selecting and Participating in Physical Activities

As demonstrated in table 16, parents reported a variety of barriers to their child’s ability to attain optimal levels of PA or selecting a variety of activities. Barriers to PA participation as reported by the parents were classified into five categories; Restrictions, Participation Barriers, Sensory Functions, Attitudes and Other. These categories were
named as per the language used by the ICF to classify barriers to participation. Each barrier named by the ICF encompasses a number of factors that fall within that category, also named by the ICF. For example, The ICF includes factors such as “societal attitudes,” and “individual attitudes of people in positions of authority” in their category of barriers to participation named Attitudes (See appendix F for further elaboration on the factors included in each category named by the ICF). Barriers reported by parents were classified into each of the five barrier categories using the barrier categories of the ICF and its related factors listed as examples in each area.

Restrictions as Barriers

Parents listed a variety of Restrictions that act as barriers to their child’s PA participation. Parents viewed restrictions that do not permit them to attend or observe PA programs with their child as serious obstacles to their child’s participation. Parents reported that this policy, commonly enforced in community recreation programs, prevents them from prompting or redirecting their child where necessary to assist him or her to follow along with the activity in question.

Parents reported that programming within the community is not easily adapted to meet the diverse needs of their children, and that very few programs offer the small student-instructor ratios that their child needs. Furthermore, parents noted that many community programs have strict age restrictions that exclude children with ASD who may not be at a developmentally appropriate level despite their chronological age.

Parents also reported lack of knowledge, or “ignorance” in others with regard to ASD, as well as a general lack of awareness among mainstream program instructors as to how to be inclusive to, and manage the difficult behaviours of, some children on the Autism Spectrum. One parent also noted that mainstream programming is rarely offered in a safe, enclosed environment, and often takes place in open fields, near water or busy intersections, or near other potentially hazardous conditions that could pose a risk to their child’s safety.
Some parents listed scheduling conflicts or discontinuation of any given PA program as reasons why their child did not adhere to the activity in the long term.

**Participation Barriers**

One of the most widely reported challenges by parents was related to Participation barriers. For example, the cost of programming and of hiring one-on-one support for the child is often prohibitive. In addition, the high cost of expensive programs and necessary sporting equipment was emphasized by some parents as particularly prohibitive, given that they face already high expenditures around their child’s needs, such as therapy sessions and the special materials purchased for those sessions. Parents also cited time constraints as being a serious logistical obstacle to their child’s participation in PA programs. Parents noted that there was a general lack of time in their child’s schedule to accommodate formal PA, since much of their child’s schedule is occupied with school related commitments. Although various types of therapies mentioned by parents involve PA, parents felt that there was no time to involve their child in formal PA pursuits outside of these sessions. Some parents also indicated that they would not have the time to escort their child to physical activities due to already busy schedules. Finally, several parents listed difficulty finding and retaining a one-on-one support person as a significant Participation Barrier.

Also reported by parents were a lack of “fit” of their child in the activity group, due to the child being older than the other group participants, not being guided accordingly by instructors, or having strict rules in place that did not allow parents to observe the activity and provide prompts to their child.

**Sensory Barriers**

Several parents noted that high noise levels of many PA programs, the feeling of wearing sporting equipment, or the feeling of immersing in water are disturbing to their children, due to various types of sensory sensitivity. Specifically, karate and t-ball were each listed by one parent in the study as activities where loud noise and a “general
overwhelming environment” acted as sensory related barriers to their child’s participation.

**Attitudes as Barriers**

Parents reported negative attitudes, stereotypes and the general feeling of intolerance of others as a significant hindrance to their child’s inclusion in most group activities. Parents also mentioned a feeling of general intolerance of children who display problematic behaviours in the mainstream community and a sense that there is a general belief among some mainstream parents that “children with special needs do not belong in regular programming.”

**Other Barriers**

All parents reported a number of additional factors that did not fit into any of the previous ICF barrier categories and these have been classified as the ICF’s ‘Other’ category. These factors appear to be unique to the child’s needs and as per parent report, stand in the way of optimal PA participation. Parents’ descriptions of ‘Other’ barriers reflected such themes as anxiety, special learning needs and physical challenges.

Parents described their children as experiencing various forms of anxiety. Specific examples were a general feeling of being overwhelmed in novel situations, fear of the unknown, fear of failure, fear of being embarrassed in front of peers and social fears about appearing different in front of others. Physical challenges in the children were reported to prevent optimal PA participation, such as coordination issues, low muscle tone, weak upper or lower body strength, awkward or clumsy motor patterns, being accident prone, or simply not being physically on par with same aged peers. The most commonly cited reason that parents reported for their child’s lack of optimal PA were the child’s unique learning needs. Parents frequently described their children as having difficulty following and respecting rules and instructions, difficulty in competitive situations or difficulty functioning in a group setting [either due to inability to cooperate with others or becoming overly controlling in such contexts]. Parents described other
needs such as requiring constant reinforcement and immediate feedback, the need to observe the activity for long period before participating and the need for regular ‘down-time’ during activities as problematic. Parents also addressed such child-subjective issues as communication problems, limited attention span and trouble performing multi-step tasks as hindrances to optimal PA level attainment.

Parents reported a number of specific physical activities that did not work for their child and listed the reasons behind their child’s lack of success in these areas. Activities such as gym programs, karate, skating and team sports were started but later stopped since the child did not enjoy participating or could not follow the instructions necessary to perform the activity. One parent tried to engage her child in skating and basketball, but the child did not enjoy either one and refused to participate. Soccer was listed as being problematic for some children due to an inability to follow the progression of the game and difficulties with motor coordination to perform the sport. Coordination issues were also cited as a reason that rollerblading was not feasible for some children. A few parents reported that their child has significant difficulty participating in any type of activity requiring coordinated movements, such as “ball-sports” or bike riding.
Table 17  
Parent Reported Barriers to Attaining Optimal Physical Activity Levels in their Children; Selecting, Participating in and Adhering to Physical Activities

<table>
<thead>
<tr>
<th></th>
<th>High Physical Activity Levels (5-8 hrs/wk)</th>
<th>Moderate Physical Activity Levels (3-&lt;5hrs/wk)</th>
<th>Low Physical Activity Levels (0-&lt;3 hrs/wk)</th>
<th>All n=23</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=8</td>
<td>n=11</td>
<td>n=4</td>
<td>n=23</td>
</tr>
<tr>
<td>Restrictions</td>
<td>6 75%</td>
<td>9 82%</td>
<td>2 50%</td>
<td>17 68%</td>
</tr>
<tr>
<td>- Lack of trained instructors; lack of programming that is properly adapted to meet the needs of children with ASD; strict age restrictions for enrollment, regardless of developmental level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation barriers</td>
<td>1 13%</td>
<td>10 91%</td>
<td>4 100</td>
<td>15 60%</td>
</tr>
<tr>
<td>- Financial constraints, time constraints, program location and travel constraints</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory Functions</td>
<td>0 0%</td>
<td>5 45%</td>
<td>0 0%</td>
<td>5 20%</td>
</tr>
<tr>
<td>- Discomfort wearing sporting equipment, discomfort with loud and crowded environments, discomfort with immersing in water, i.e. swimming</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>1 13%</td>
<td>1 9%</td>
<td>2 50%</td>
<td>4 16%</td>
</tr>
<tr>
<td>- General impression of mainstream parents that children with difficult behaviours “do not belong” in mainstream environments; lack of instructors with inclusive attitudes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>8 100%</td>
<td>11 100%</td>
<td>4 100%</td>
<td>23 100%</td>
</tr>
<tr>
<td>- Difficulty understanding rules, anxiety about being embarrassed or appearing different; fear of water or large groups; lags in motor development; boredom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Parents included in the count for each cell provided one or more of the reasons noted in the category description.
Chapter 5: Discussion

The objectives of this study were to describe and quantify the PA habits of children with ASD based on parental reports. The study also described the barriers and facilitators to children with ASD participating in and adhering to PA.

The Physical Activity Habits

The results of this study yielded some unexpected findings about the PA habits of the children in the sample. The majority of children were reported to be quite active, and met - or came fairly close to meeting - the guidelines for PA in children described by the NASPE. On average, the children in the sample engaged in 4.4 hours of PA per week, which is reasonably close to the recommendations of the NASPE of approximately 6 hours of PA per week. Not meeting the exact guidelines of the NASPE does not necessarily indicate that children with ASD are at a particular disadvantage when it comes to physical fitness, as typically developing children on average also do not meet these PA guidelines (Belanger, Gray-Donald, O’Loughlin, Paradis & Hanley, 2009; Belanger, Gray-Donald, O’Loughlin, Paradis, Hutcheon, Maximova & Hanley, 2009; Meriwether, Lobelo & Pate, 2008; Roemmich et al., 2008; Story, Nanney & Schwartz, 2009). This may be a positive finding, as it demonstrates that there are indeed children with ASD who can attain adequate-or near adequate- exercise levels. However, the lack of congruency with the literature describing low fitness levels of children with ASD (Pan, 2008; Pan & Frey, 2006; Pitetti, Rendoff, Grover & Beets, 2007) may bring the representativeness of this sample into question. This issue is discussed below.

Nearly all of the children in the sample participated in one or more solitary physical activities, such as walking or biking. Previous recommendations for individuals with ASD have suggested similar solitary, repetitive types of PA as most likely to be enjoyed by those with ASD (Reid & O’Conner, 2003; Stillman, 2003). It is positive to note that the children in the sample engage in these types of physical activities, since studies have shown that children who walk and bike regularly typically have high PA levels overall (Cooper et al., 2003).
According to the literature, participating in PA in a group or team context is challenging for most individuals with ASD due to social difficulties (Pan, 2004). Although there were parents in this study who did report group or team activities to be challenging for their children, close to half of the children in the sample participated in group or paired physical activities or team sports. Parents of children who participated in team sports, were seeking to integrate their child into a social context to enhance social skills.

**Physical Activity in the School Context**

Parents reported that the availability of Physical Education at school played an important role in the activity levels of many children in this study. Without engaging in Physical Education at school, many children in the study would have considerably lower levels of PA per week, since Physical Education accounted for the majority of their weekly PA. Research has shown the importance of Physical Education in schools, and how much it contributes to the overall health of children (Bailey, 2006; Bailey, 2005; Morgan & Hansen, 2008). Offering Physical Education classes to children with ASD is equally important as offering it to typical children, since it can encourage increased PA levels that may not occur elsewhere.

**Physical Activity in the Family Context**

The majority of children in the sample came from families who reported being fairly active. Family members seemed to engage in various types of physical activities as individuals, but also set aside time to be active as a family unit on weekends and other non-obligated time. Nearly all parents mentioned some type of PA when describing the family’s typical weekend routines. Many families enjoyed the outdoors together, through family walks in the local park or community, hiking on trails, swimming at the community pool, skiing or tobogganing. Parents in this study seemed to act as positive role models with regard to PA and often made attempts to incorporate PA into their daily lives, such as encouraging children to play outdoors and taking advantage of community parks and resources. Close to half of parents reported that their child engages in physical activities as a direct result of parent and sibling influence. Correspondingly, Quarmby
and Dagkas (2010) found that of their sample of typically developing children, beliefs and values concerning PA were transmitted and reinforced by family members in all children studied. Quarmby and Dagkas’ findings were particularly significant in two-parent intact families, much like the families of the children featured in the present study.

Almost all of the children in the study participated in physical activities that were low or no cost, and given that several parents reported financial constraints as a significant barrier to their child’s participation in physical activities, this is a resourceful way to attain optimal PA levels without overspending. It is likely that many families already contending with substantial expenses associated with ASD related interventions are seeking opportunities for physical activities that are fairly low cost.

Functioning of Children and Physical Activity Level Groups

Parents reported a variety of abilities and functional levels in their children, as demonstrated above (section 4.4). It was positive to note that regardless of functional level, the majority of children met, or came fairly close to meeting national guidelines for PA participation. This finding may indicate that children with ASD can have varying levels of PA, regardless of their functioning in other areas. There were some children with difficulties in many functional areas who attained optimal or near-optimal PA levels.

The Barriers and Facilitators

The most common barrier to selecting a variety of physical activities and adhering to them listed by all parents in this study were the child’s distinctive needs or characteristics that prevented them from participating with ease and acted as a deciding factor in activity selection. This is a common theme that seemed to prevail throughout parent responses, and it was clear that an activity that might work for one child will not necessarily work for another. For example, one parent listed soccer as the ideal sport for her son, stating that it provides “a non-competitive team environment that can help with coordination and social skills,” while another listed soccer as an activity that did not work
for her child because “the group environment was very overwhelming, it was too difficult [for him] to follow the rules of the game and it required too much motor coordination.”

As discussed in the results section, barriers classified as ‘Other’ were generally comprised of barriers pertaining to the child’s subjective needs and characteristic and were reported for every child in the study. Whether these child specific issues related to problems with anxiety, lack of age-appropriate skills, motor problems or personal likes and dislikes, parents reported a variety of subjective factors that appear to be obstacles to optimal PA participation. This illustrates that there cannot be a “one-size-fits-all” approach to PA planning for children with ASD. Programs need to recognize that children with ASD may have an array of challenges that make their participation difficult, and be prepared to be flexible for even further adaptations as necessary. Brunton et al. (2005), based on a UK-based sample, confirmed that while typical parents and children have clear views on the issues that constitute PA facilitators and barriers amongst youth, “their views rarely inform the development of interventions” (p.334). Likewise, the parents who reported about their children with ASD expressed clear views about PA related facilitators and barriers and have important opinions and ideas about what their children need, but these ideas do not typically guide program development in the mainstream.

Enjoyment of Physical Activity (facilitator)

Roemmich et al. (2008), identified enjoyment or “liking” of a PA as a factor associated with PA participation levels. Nearly half of the parents interviewed identified enjoyment of the activity as an important facilitator of PA participation in their child. Several studies have highlighted the need for physical activities to be enjoyable in order to ensure they will be adhered to throughout childhood and even up to and including adulthood (Roemmich, 2008; Sirard et al., 2006; Brunton, et al., 2005). Parents of typically developing children and the children themselves report “having fun and enjoying oneself” as the number one facilitator of adherence to physical activities, while “not enjoying the sport or PA” has been reported by both parents and children as the biggest barrier to participation (Brunton, et. al., 2005, p.329). Enjoyment is an important
attribute of youth sports programming, and enjoyment can be experienced from “intrinsic, extrinsic, achievement and non-achievement related sources” (Sirard et. al, 2006, p.701).

**Anxiety as Reported by Parents (barrier)**

Parents interviewed in this study reported anxiety [i.e., fear of being embarrassed; fear of appearing different in the eyes of others; fear of water], and various fears as a source of what they consider their child’s less than optimal PA participation. One might hypothesize that feelings of embarrassment with regard to PA participation would be more prominent in children with ASD, given that many children with ASD approach physical activities with pre-existing disadvantages (e.g. motor problems, social or communication difficulties) (Pan & Frey, 2006). However, according to a review conducted by Brunton, et. al. (2005), typically developing children and their parents reported anxiety about being embarrassed as one of the top three reasons that deter children from becoming physically active. According to Brunton et. al., (2005), parents and children report that participating in sports and physical activities “has the potential for shame or embarrassment, from ‘letting the team down’ or as a result of critical comments from friends” (p.329).

**Motor Problems Reported by Parents (barrier)**

Research on children with low motor competence [such as children with ASD] suggests that these children have a hard time learning basic motor skills, and subsequently are at risk of low activity levels and lack of age appropriate physical fitness development (Baranek, 2002; Blakemore-Brown, 2002; Cantell et al., 2008; Gidley Larson et al., 2008).

Research has shown that 90% of children with ASD have poor performance at games requiring motor skills (Reid and Collier, 2002). Likewise, Berkley et al. (2001) used the Test of Gross Motor Development with 15 children with ASD and determined that 73% of the children scored “poor” or “very poor” in gross motor performance. Thus it is not
surprising that parents listed motor skill issues as a significant hindrance to their child’s activity levels. Several children in this study experienced problems with general clumsiness, poor balance or poor motor coordination. Motor problems hinder a child’s participation in physical activities, especially those requiring spatial skills or coordination. Parents reported particular difficulty with sports involving ball throwing, catching or kicking, thereby ruling out their child’s ability to participate in soccer, tennis, baseball, basketball and so on. Interestingly, parents did not report any difficulty with bike riding, and reported this as one of the most common active pastimes of their children. This is surprising given some of the problems with motor skills and coordination often seen in autism. Pedaling a bike is generally seen as challenging for those with autism (Gidley-Larson et al., 2008).

A lack of age appropriate motor competence can also be detrimental to the health of children, since specific movement skills are needed in order to subsequently develop strength, power and endurance (Cantell et al., 2008). Finally, children who have motor development problems, or whose motor skills are not equivalent to same-aged peers often have a hard time engaging in PA with other children, and this is a significant barrier that is not isolated to children with ASD. As illustrated by Brunton et al. (2005, p.329), typical children and their parents listed “physique and coordination skills not well suited to sports” as the second most significant barrier to PA participation.

Contributions to the Knowledge Base

The present study expands on current knowledge about PA in children with ASD by deepening our understanding of several PA habits of children with ASD. Prior to this study, the literature’s main focus was theoretical and contained mainly speculation about the types of activities that might work for children with ASD. This study has described the types of physical activities children with ASD are participating in, as well as parents’ ideas on the reasons some of these have been successful. Prior to this study, it was hypothesized that children with ASD would not thrive in or enjoy team or group PA environments but this study described children with ASD who do succeed in such environments. Previous studies have suggested that children with developmental
disabilities may be disadvantaged when it comes to obtaining and maintaining optimal PA (Pan & Frey, 2006). Nevertheless, the present study has demonstrated that some children with ASD can achieve high levels of PA, and can participate in the same types of physical activities that typical children do. For some of these children, these activities occur in group contexts or other areas generally thought to pose difficulty.

This study has described the activity characteristics of families that active children with ASD come from and what the PA related habits of those families might be. Previous studies have not explored PA in children with ASD from this angle, and the family’s role in PA habits of children with ASD can be explored further in other studies.

Finally, the present study has increased our understanding of the various barriers and facilitators to optimal PA habits as indicated by parent reports. Barrier and facilitators to PA among youth have been addressed considerably by the literature, but these findings have not been specified to the ASD community. While some of the barriers and facilitators delineated by parents in this study likely overlap with those of typical children, there are barriers and facilitators that are specific to the ASD population, emphasizing the need for a particular focus on this population. What is not clear is if the barriers and facilitators are similar or different from children with other types of impairments (e.g., developmental delays, behaviour disorders).

Overall, parent reports revealed a group of children with ASD who are fairly active. This study did not establish any significant relationships between most of the variables studied and PA to identify factors that influence PA levels, but several commonalities in PA habits among the sample group were observed. These PA habits of this active group of children can serve as a useful model for PA promotion within the ASD community. The descriptors of PA and contexts in which they occurred help to paint a portrait of what an active child with ASD might look like and be able to do. Certainly, the evidence-based establishment of relationships between personal and family characteristics and PA levels must be addressed in future studies. However, the portraits of active children with ASD described in the present study allow the formulation of suggestions for parents of ASD children with respect to PA promotion.
Recommendations

The Role of Parents

Based on the PA habits of the children and the barriers to PA as described by parents, several recommendations have emerged for other parents of children with ASD seeking optimal PA participation for their child. First and foremost, parents of children with ASD should continue to consider their child’s unique needs and preferences. They might begin by looking the child’s interests and opportunities available. Then they might list the child’s fears, discomforts, motor challenges or any other factors that could be identified as barriers to participation for that child. Obtaining a clear understanding of what PA aspects would pose particular strain on the child versus those that would be better tolerated can assist in activity selection. Likewise, parents would be urged to seek physical activities that suit the needs of their child, and not to assume that what worked for another child with ASD would be fitting for their own. As reported by many parents in this study, several activities may need to be tried before the ideal one is found.

Another recommendation for parents of children with ASD is to aim for variety with regard to physical activities. Increasing a child’s repertoire of physical activities can allow them to practice skills in a variety of areas, to decide on what type of activities are most preferred, and to experience PA in a variety of contexts. Parents are also encouraged to help their child take advantage of the outdoors and the array of low-no cost activities available close to home, such as walking, running, biking, tobogganing, skating or rollerblading.

Parents serve as role models for their children in so many aspects of life. It is recommended that parents wishing to improve or maintain their child’s PA habits act as role models in PA in a number of ways. Parents can set an example by walking to the store instead of driving, suggesting physical activities for family leisure time, and incorporating a variety of PA into their own schedules. For many parents of children with ASD and other disabilities, however, this may be easier said than done, given that the
time demands associated with caring for the needs of a child with a disability rarely permit for much time for leisure and PA.

The Role of Specialists and Allied Health Professionals

It is important for health care providers and specialists, such as physiotherapists and occupational therapists who work directly with children who have ASD to identify aspects of the child’s functioning that may hinder his or her performance and ability to participate in community PA. Since most treatment plans aim to take a holistic approach to be sure to address the needs of the child in all areas of life, it is recommended that health care specialists address these needs in their care plans and include them in the overall objectives and goals for their client. Since foundational gross motor skills are necessary to participate in most physical activities, making gains in the area of physical performance and expanding the child’s activity repertoire is as important as improving skills in other areas.

The Role of Community Resources and Parks Programs

Many of the barriers described by parents suggested that available programs are not doing their part to be inclusive to children with different needs, and are not properly adapted to meet the needs of children whose skill levels or behaviours differ from those of children without ASD. It is recommended that community PA providers evaluate any special needs of the children accessing, or wishing to access their services, including children with ASD. Although programs exist that are geared primarily toward children with specific disabilities such as ASD, parents in this study expressed a strong desire for their children to be included in the mainstream rather than segregated to their own programs, which was often perceived as marginalizing by parents in this study. However, there may be merit to programs that specifically address the varied needs of children with ASD (Fragala-Pinkham, et al., 2005) and their families. Such programs have the potential to act as a support network for children with ASD and their parents and provide opportunities to meet others with similar experiences.
The Role of Government and Legislators

With regard to the financial burden of enrolling children in PA programs reported by parents, government bodies need to play a role in easing this challenge. Parents who are required to engage one-on-one support for their child in order to have them participate in physical activities could benefit from a subsidy or allotment of benefits toward this end. In the long run, facilitating the participation and inclusion of children with ASD in mainstream PA programming will likely result in healthier adults with ASD who have developed healthy lifestyle habits, thereby reducing the strain on the healthcare system overall. Investing in children with ASD is a worthwhile investment to bring long term stability to the healthcare system and reduce health care demands.

The Canadian government has recognized the need to augment and facilitate exercise in children by way of legislated mandatory daily physical activities in schools, in most Canadian provinces (Public Health Agency of Canada, 2009; PLAY [Positive Leisure Activities for Youth] Program, CPRA, 2009). There is no reason why children with special needs, such as ASD should be excluded and that special funding and legislation for this population should be on par with that for typically-developing children.

Study Limitations

Self-selection biases, representativeness issues and generalizability of results

Respondents to this study were volunteers, and self-selection biases were present. Participants were recruited using a letter that was posted on online ASD related discussion networks. There are limitations associated with this recruitment approach. Respondents are limited to individuals who use the Internet, likely excluding those with lower socioeconomic status or with low literacy rates. Not all parents of children with ASD belong to online discussion networks and it may be that only specific types of parents join these groups. Furthermore, the online discussion forums where the recruitment letter was posted are typically for parents of children with ASD to share information and to pose questions to other parents in a similar situation. It can be argued
that many parents would not be interested in a letter describing a research study, and that only a specific subgroup of parents would choose to view the letter and wish to participate. For example, parents of children who are very low functioning relative to others with ASD might be less likely to have time to participate in a research study, while a parent of a child who is more independent may have been more inclined to participate. This is a likelihood given that parental reports in this study have generally described a higher functioning group of children with ASD.

The study appears to have attracted parents with mostly positive attitudes about the necessity of PA for their children and families. Most parents began the interview with a description of their child that was extremely favorable, optimistic and with a tone that suggested they were proud of the child’s accomplishments. The researcher did not actually meet the children and so descriptions of their skills and characteristics could not be verified.

Most respondents were quite active themselves and appeared to be strong advocates for PA as part of a healthy lifestyle. Although this made for a biased sample, there is certainly a very positive aspect about this common attitude trait among parent participants. These characteristics demonstrate that there are parents of children with ASD who possess strong opinions and motivation with regard to PA.

Accordingly, the representativeness of this sample’s exercise habits and characteristics as compared to that of the general population of children with ASD. The children in this sample had adequate to high levels of exercise which does not correspond to the literature asserting that children with ASD are at a disadvantage when it comes to fitness and rarely attain adequate levels, especially in comparison to typically developing peers. The children in the sample were also generally moderate to high functioning in most areas explored, which does not correspond to our knowledge that children with ASD represent a large variety of abilities and levels of functioning, including some children with severe impairments in the areas explored in this study. A relatively large proportion of persons with autism have cognitive impairments (Diagnostic and Statistical Manual of Mental Disorders 4th edition-Text Revision, 2000).
Despite the selection biases and use of parent report for the diagnosis, children in this sample are like the general population of children with ASD in some ways. The ratio of males to females in ASD is 4:1 (Fombonne, 2005) and the distribution of males (n=18) to females (n=5) in this study is very similar. The sample had many deficits that would not be observed among typically developing children and are common among those with ASD. Parents reported difficulties in social skills, communication, cognitive processes, motor skills and tolerance of sensory experiences. In addition, the majority barriers to optimal PA described by parents were ASD specific and would not be reported among parents of typically-developing children, such as severe hypersensitivity to touch in PA related environments, the inability of instructors to manage ASD specific behaviours, or financial constraints due to regular expenditures toward ASD specific therapies.

To summarize, due to the small and potentially biased (self-selected) sample, the results cannot be generalized to all children with ASD. A larger sample would have allowed for more variability in PA levels and functioning among the children. Still, the study poses some interesting questions with regard to PA in children with ASD who have various levels of functioning that can be further explored through future research. While the results of this study cannot be used to make assumptions about the general population of children with ASD, the descriptions provided of the children’s PA help us to understand what some children with ASD may be capable of with regard to PA.

**Measurement Issues**

The psychometric properties of the general and specific probing questions asked in the interview guide are unknown. The interview guide was not pilot tested prior to its implementation to identify questions and probes that were unclear. However, the interview guide and probing questions were used in a consistent manner with each open-ended question and probing sub question asked in an identical way. Although open-ended questions allowed parents to interpret the question in their own way and to answer whatever they wanted, the probing questions in each section limited parent responses to one of the response options given for each probing question. This assured consistency across interviews and ensured that the same data in each area was collected.
The validity of the interview guide was quite good, given that the 8 areas of functioning included in the interview and probing indicator questions were selected based on a review of the literature and consultation with experts. Although ASD can manifest itself in many ways and can represent a whole gamut of characteristics, the interview guide and indicator questions did address the three central features of the disorder and 5 associated features (DSM-IV, 1994) in order to obtain accurate descriptions of the children’s functioning. However, it is impossible to know whether the characteristics covered in the interview and probing questions were exhaustive. Taking the approach of developing a new guide is certainly a limitation of this study. There is no information on the construct validity of the interview guide in terms of identifying the child’s functional levels.

Selecting a standardized measure or adapting an existing measure may have improved comparability with other studies and ensured reliability and validity. For instance, the Children’s Assessment of Participation and Enjoyment (CAPE) and Preferences for Activities of Children (PAC) (King et al., 2004) could have been adapted. The CAPE is appropriate for children ages 6 years and older and measures participation or engagement in recreational, physical, social, skill-based, and self-improvement activities. Diversity, intensity, enjoyment of the activities and with whom the activities are done is measured. The PAC typically follows the CAPE and assesses the individual’s preference for activities. The CAPE and PAC can be self-administered by the child or by the parent and take between 45-65 minutes to complete. The relevant physical, recreational and skill-based activity items could have been administered and additional descriptive information obtained through probes. However, not all of the items within these three subscales relate directly to physical activities (e.g., recreational activities include crafts and computer games) which was the focus of the study. Also, activities reported by parents in this study are clustered (e.g., snow sports instead of tobogganing; team sports instead of hockey, basketball, soccer, baseball; non-team sports instead of bowling and golf) so the level of detail would have been lost. The CAPE does include physical activities not mentioned in this study (e.g., playing on equipment such as slides, climbing structures, trampolines). The time required to add the CAPE to the interview would have increased respondent
burden and an additional measure of the functional areas required for describing the sample would still have been needed.

Another standardized outcome measure that may have been useful in this study is the Assessment of Life Habits (LIFE-H) (Fougeyrollas, Noreau, Lepage, 2002). The LIFE-H is appropriate for children age 5-13 years, can be administered by the parent or a clinician within 30-60 minutes, and measures the child’s life habits at home, school and neighborhood environments. The LIFE-H evaluates the child’s functioning in such areas as eating, mobility, communication and social skills. While the LIFE-H covers many areas of childhood functioning, it does not address all of the key areas selected for the interview guide in this study that are especially applicable to children with ASD. Although the LIFE-H does address some areas that are important with regard to describing ASD (social skills, communication), it does not address (list what you thought was important that was not addressed be specific). Finally, although the LIFE-H can be administered in interview format over the phone, there are many areas of the assessment that would need to be skipped or not useful for this study (e.g. questions about the child’s ability to maintain the grounds at their home, stand up for his/her own rights, or ability to use a bank card and ATM).

Another possible limitation of this study is that interviews were conducted over the phone, and the researcher did not meet with participants face to face. However, Ng et al. (2010) investigated the reliability of administering a pediatric assessment to identify children at risk for developmental disorders to parents via telephone versus face-to-face. According to their findings, telephone surveys were reliable. Ng et al.’s (2010) sample consisted of parent participants across Ontario, Canada, much like the majority of participants in this study. Although reliability may not have been affected by the use of phone interviews versus face to face interviews, the limitation around phone interviews in this study meant being unable to use certain types of measures that require face to face administration. Nevertheless, phone interviews were useful for obtaining information from parents who often have limited availability, availability at unpredictable times (i.e. early morning or late evenings) and phone interviews were not limited by geographical distance of the participant.
The process of scoring response options to probing questions and categorizing the children into functional groups would have been simplified with fewer coding steps. When planning to categorize the children into three functional level groups, it may have been easier to have scored each response option on a three point scale where appropriate and not on a five point scale that was later to be reduced to a three point scale. Having probing question response scales that needed to be further reduced raised the potential to have complicated the scoring process and may have increased the risk of calculation error. Limiting response options to a three point scale would have also permitted more precise answers and increased clarity of the child’s functional level in each area, without needing to collapse five point gradation scales into a three point scale later on. Likewise, it may have been best for each functional area to have an equal number of probing/indicator questions to be sure each area was equally addressed by parent responses. Finally, there is a limitation in how the children were classified into low, medium and high groups in a fairly arbitrary manner which questions the meaningfulness of each level grouping. Further to this, a similar limitation related to classification of the children into functional groups is that the study did not take the child’s age into account when classifying the children. A future direction for this study might be to evaluate functioning in the context of the child’s age as there are differences in expectations for a child of 6 years performing personal hygiene versus a child of 13 or 14 years. Similarly, a child of 10 would probably be expected to demonstrate better social functioning or a greater repertoire of social skills than a child of 6.

Lacking in this study was a means to measure or quantify PA intensity. Rather, it was considered in terms of duration. It is unknown whether reports of activity engagement represented PA which occurred at a light, moderate or high intensity level. For example, parents reported activities such as walking, but it is impossible to know whether walking occurred at a brisk pace, or whether it occurred in the form of a leisurely stroll around the block. In addition, when reporting their child’s participation in any given group-based PA, it is impossible to know to what degree the child actually participated in the activity, or whether his or her participation consisted of observing the other children or of taking a more passive role within the game or sport [i.e. there is an
obvious difference in PA intensity when playing the goalie position in hockey than when acting as one of the players, or when standing in the outfield in baseball versus running the bases.]

Likewise, this study did not have a method of quantifying physical activities that occur in an incidental manner in day-to-day life, such as walking for transportation, snow shoveling, use of stairs, or use of playground equipment. It is likely that children reported about in this study engaged in several other forms of PA incidental to their lifestyle and routines, but this could not be quantified toward the final PA frequency counts in this study.

According to Rowlands and Eston (2007), heart rate telemetry (for sustained periods of moderate to vigorous activity), pedometry (valid measure of total activity) and accelerometry (measures total activity, and pattern and intensity of activity) are methods of measuring PA intensity in children. A combination of these approaches may be the most accurate prediction of activity level and intensity in children. However, using these methods to monitor PA intensity would not likely have been feasible in this study, given that this would have required all of the children to wear a device consistently throughout the day for an extended period of time to measure their PA patterns and habits. This would have likely been challenging, given that the children had an array of sensory difficulties and behavior issues that may have made compliance with wearing a monitoring device unrealistic.

Previous studies have suggested physical activities that could work well for individuals with ASD (Reid & O’Conner, 2003; Schultheis et al., 2000; Stillman, 2003; Todd & Reid, 2003) and since the commencement of this study, a review of the current literature (Pan, 2010; Crollick, et al., 2006) has yielded few new suggestions. Recommendations made by previous studies were based on known characteristics of individuals with ASD and activity suggestions that might be compatible with those traits were theoretical, and not based on the actual experiences and preferences of those with ASD. The current study has explored the activity habits of 23 children with ASD, and has broadened our understanding of the activities being practiced by this sample of children. Future studies
may delve deeper into understanding why these activities in particular appear popular or work well for some families of children with ASD.

Finally, recommendations for future research include examining specific physical activities or community PA programs closely to determine which are best for children with ASD in general and which are best suited to children with specific types of personal characteristics associated with the disorder considering the barriers listed above. Specific programs should be evaluated to assess whether children with different levels of ASD functioning could participate, and if not, it would be helpful for future studies to outline specific adaptations and changes that can be made.

**Conclusion**

It is essential to address the PA needs of children with ASD as early as possible, since establishing healthy lifestyle habits related to activity set the stage for lifelong PA habits. Lifelong adherence to PA can be accomplished when children have positive experiences with activity from a young age (Cantell et al., 2008). As stated by Stoll et al. (2000), “it would seem logical that individuals who experience playful movement from childhood through adolescence would maintain movement and PA throughout their adulthood” (p. 51). Likewise, encouraging children with ASD to become active or increase activity levels during youth has the potential to impact some of the specific areas of difficulty in ASD (Allison, et al., 1991; Ayvazoglu et al., 2005; Moressey et al., 1992; Powers et al., 1992; Reid & Collier, 2002; Rosenthal-Malek & Mitchell, 1997).

The findings of this study have been positive with respect to the PA habits of children with ASD as it is evident that there are children with ASD who are engaging in a variety of physical activities and belong to families who serve as role models with regard to PA habits. Activity selection for children with ASD appears to be individually-based and dependent on each child’s unique characteristics, needs, preferences and goals. One common theme repeats throughout: ASD represents a spectrum of abilities, needs and preferences and therefore necessitates a spectrum of possibility with regard to PA. The ideal form of PA for a child with ASD is that which works best for that child, and as is
the nature of anything that can be expressed on a spectrum, cannot be generalized to the whole. It is the role of parents, allied health professionals, PA providers and others to facilitate a variety of PA experiences so that each child with ASD may discover that with which he or she identifies most.
Reference


Dear Parent or Guardian,

I am writing to invite you to participate in a study examining exercise and children with Autism Spectrum Disorders [ASD]. This study will try to identify and describe exercise activities that are commonly chosen by children with autism and their parents, which activities are enjoyed the most or are favorites of children with ASD and their parents. I would also like to ask about areas of functioning other than those that are exercise related because at the end of my study, I would like to be able to classify the children reported about in the study into different groups, based on their functioning.

In order to participate in this study, you must have a child between the ages of 6 and 14 with any type of diagnosis which can be classified as an Autism Spectrum Disorder.

If you agree to participate, this study would involve a one time phone interview where I will ask you some open ended questions about your child’s exercise habits, social experiences, communication and other skills. This interview is expected to take from 45 minutes to 1 hour and would be conducted over the phone at a date and time convenient for you. Your participation in this study is voluntary and should you change your mind at any time, early withdrawal from the study is always possible with no adverse consequences.

The results of this study can help inform future studies on exercise and ASD and may also help parents of children with ASD to choose the best exercise activities for their child at a later date.

If you have a child between the ages of 6 and 14 with a diagnosis on the Autism Spectrum and are interested to participate in this study, please reply to me via email at atara.engel@utoronto.ca with your name and phone number. This will allow me to call you so that we can discuss more information about the study, as well as your rights as a study participant and answer any questions you may have. If you do choose to participate in this study, I will send you an official consent form for you to sign and return to me. If you have any questions about participating in this study, please do not hesitate to contact me at the email address listed above.

Thank you for considering your participation in this valuable research opportunity.

Sincerely,
Atara Engel
MSc Candidate
Department of Rehabilitation Sciences
University of Toronto
Yahoo Groups (used to recruit participants)

ADD Gazette
Autism Behavioural Science Program
Autism Society Ontario-Waterloo
Autism-Aspergers
Autism-BC
Autism-Mercury
Autism Challengers
Autism Ontario
Autism Therapy Ontario
CanadianMomsCoffeeHouse
ChildrensApraxiaNet
DTT-Net
Enzymes and Autism
Facing Autism
GFCF Kids
OntarioAUTISMVoice
Peace-Liard Autism Support Group
Somewhere on the Autism Spectrum
United Parents
Verbal Behaviour
Dear Parent or Guardian,

My name is Atara Engel and I am a Graduate student at the University of Toronto. I am carrying out a descriptive study as part of the requirements for my Master’s thesis, titled Exercise Participation in Children with Autism Spectrum Disorders: An Exploratory Study. This study is being supervised by Katherine Berg, PhD, PT. The purpose of this study is to describe the types of exercise children with Autism Spectrum disorders [ASD] participate in, what types of exercises are favored most by children with ASD and their parents and what barriers and challenges there are for children with ASD in becoming physically active. I would also like to ask about areas of functioning other than those that are exercise related because at the end of my study, I would like to be able to classify the children reported about in the study into different groups, based on their functioning.

I would like to invite you to participate in this study. In order to participate in this study, you must have a child between the ages of 6 and 14 with any type of diagnosis which can be classified as an Autism Spectrum Disorder.

This study would involve a one time phone interview where I will ask you some open ended questions about your child’s exercise habits, social experiences, communication and other skills. This interview is expected to take from 45 minutes to 1 hour and would take place at a date and time convenient for you. Your participation in this study is voluntary and if you change your mind at any time, early withdrawal from the study is always possible without negative consequences. You also have the right not to participate at all without any negative consequences.

There are no direct benefits to you by participating in this study, but the information you provide could help with future studies on health and exercise for other children with ASD. The results of this study may also help parents of children with ASD to choose the best exercise activities for their child at a later date.

There are no anticipated risks or potential harm to you or your child by agreeing to participate in this study. Your participation is voluntary and you will not be asked to answer any interview questions that make you uncomfortable. Rest assured that if anything changes during the course of this research that may affect your decision to continue, you will be notified.
All personal information will be kept strictly confidential. At the time of the interview, a code number will be used to replace your name and your child’s name. The names will no longer be used from this point onward. Only two people, Atara Engel and Dr. Katherine Berg, will have access to the interview responses. One file containing the actual names of participants and their contact information will be kept in a locked file cabinet. This file containing personal contact information will be permanently destroyed once the research is finished. Consent forms containing personal information and signatures will also be stored in a locked filing cabinet in the office of Dr. Katherine Berg. Interview responses will also be kept in locked cabinets for the requisite period of time. Confidentiality will be guaranteed to the extent permitted by law. No information will be used in publications or reports that would permit identification of individuals. Information will be aggregated to describe the overall sample or stratified sample based on activity levels.

You waive no legal rights by participating in this study. If you have questions about your rights as a research participant, please contact Jill Parsons, Health Sciences Ethics Review Officer, Ethics Review Office, University of Toronto, at telephone 416-946-5806 or by email: jc.parsons@utoronto.ca.

If you are interested in participating in this study, please fill out the form below and return it to me by mail or fax, using the information listed below. As a participant, you will have the right to ask for a copy of the final report and findings of this study. You can request a copy of the study from the researcher by emailing atara.engel@utoronto.ca. If you have any questions or concerns about this research study, please feel free to contact Atara Engel at atara.engel@utoronto.ca or Dr. Katherine Berg at katherine.berg@utoronto.ca or 416-978-0173.

Please print out a copy of this informed consent letter to keep for your own records. Thank you for considering your participation in this valuable research opportunity.

Sincerely,

Atara Engel
MSc Candidate,
Department of Rehabilitation Sciences
University of Toronto
Consent Form: ASD and Exercise Participation

I, _______________________ (full name of parent or legal guardian), hereby consent to participate in the study entitled Exercise Participation in Children with Autism Spectrum Disorders: An Exploratory Study. I have read the informed consent letter sent to me by the researcher, Atara Engel, and understand its contents. I understand that my participation in this study is voluntary and that I may withdraw at any time.

Full name of parent/legal guardian (please print): _______  ___  __________

Given Name
Initial  Family Name
Signature: ____________________ Date: _______  _______  _______

Day  Month  Year

Phone number: (______) _______ - _________

Please return one copy of this signed consent form to:

Mail:
Atara Engel
c/o Dr. Katherine Berg
160-500 University Ave. 8th Floor
Toronto, ON
M5G 1V7

Fax: (416) 946-8561

Email: Consent forms may also be signed, scanned and returned by email to atara.engel@utoronto.ca
Exercise and ASD Interview

Thank you for agreeing to participate in this interview. As you well know, children with Autism Spectrum Disorders have a variety of functional and skill levels. In addition to questions about your child’s exercise habits, I will be asking a number of additional questions about your child’s functioning. I will ask these additional questions so that when I complete all of the interviews for this study, I will be able to give a general description of the different types of participants who were interviewed and what their functional levels were like. When I write up the results of this study, I won’t be describing anything specific that would identify your child in particular. Of course, if there is anything about your child that you feel is too personal and don’t wish to share with me, that will be just fine. You can choose not to answer any question that makes you uncomfortable.

The purpose of the questions I will ask you is to generate some discussion about some issues that are often known to pose challenges for children who have ASD, for example; social skills, communication and behaviour. The exercise-related questions will help me learn about your child’s exercise habits. All of the questions I will ask you are open-ended and you are free to share as much or as little information as you wish. I might skip over some of the questions in this interview if you have already talked about those topics in an answer to a previous question. Likewise, I might ask you to tell me more about certain topic if I didn’t learn enough from your response. If I ask you to give more information and you don’t want to share any more about a certain topic than you have, that is just fine.

In all, there are 22 questions in the interview and it should take about 45 minutes to 1 hour for me to ask them all and for you to give your answers. If you want to stop the interview at any time, please tell me and we will stop. You are free to ask me any questions you like at any time before, during or after the interview.
APPENDIX E

*Interview guides completed during parent interviews included one question per page, with ample space to write down parent responses to open ended questions

Participant No. ________

Date: _____/_____/_____
    Day  Month  Year

A. Background information

1. Sex  M___ F____

2. Birthdate: ____/ _____/ _______
    Day  Month  Year

Dx: ________
3. If you were to describe your child to someone who’s never met him/her, what would you say? How would you describe your child’s personality/character?

4. Please tell me about what kinds of exercise your child participates in, such as sports or other physical activity programs. How many hours per week does the child participate in each of these activities? Does the child participate in a physical education or other exercise program at school? For how many hours per week?

5. What reasons did you/your child have for choosing these activities in particular? Are there any physical activities that your child has tried and stopped? If so, why?

6. Does your child participate in any other structured activities that are not exercise related? If so, please list.

7. Please describe how your family would spend their time on a typical weekend: What types of activities do family members participate in during their free time in weekends? Does the family participate together or as individuals?

8. Do other members of the family participate in sports or exercise? If so, what type? How active would you rate each family member?

Mother:

Father:

Sibling(s):
9. Are there any factors you can name that make it difficult for your child to participate in various exercise activities, meaning, are there any barriers to his/her full participation?
10. Do you have any concerns about your child’s academic performance at school? What type of feedback have you gotten from your child’s teachers about his/her progress? Does the child have an I.E.P., Learning Assistant, receive supplemental assistance outside the classroom or belong to a Special Ed. Program?

11. In general, how would you describe your child’s social interactions?

<table>
<thead>
<tr>
<th>Probing Indicator Question</th>
<th>Initially coded response options</th>
<th>Reduced to a 3 point scale for analysis or preserved as a 2 point scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can the child name at least one friend?</td>
<td>-Yes, usually</td>
<td>-Yes, usually</td>
</tr>
<tr>
<td></td>
<td>-Yes, but inconsistently</td>
<td>-Yes, but inconsistently</td>
</tr>
<tr>
<td></td>
<td>-Never</td>
<td>-Never</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Yes [usually or inconsistently]</td>
</tr>
<tr>
<td>Does the child have multiple networks of friends?</td>
<td>-Yes, usually</td>
<td>-Yes [usually or inconsistently]</td>
</tr>
<tr>
<td></td>
<td>-Yes, but inconsistently</td>
<td>-Yes, but inconsistently</td>
</tr>
<tr>
<td></td>
<td>-Never</td>
<td>-Never</td>
</tr>
<tr>
<td>Does the child have a close confidant?</td>
<td>-Yes, usually</td>
<td>-Yes, usually</td>
</tr>
<tr>
<td></td>
<td>-Yes, but inconsistently</td>
<td>-Yes, but inconsistently</td>
</tr>
<tr>
<td></td>
<td>-Never</td>
<td>-Never</td>
</tr>
<tr>
<td>Does the child attend parties or sleepovers of non-relatives?</td>
<td>-Yes, usually</td>
<td>-Yes, usually</td>
</tr>
<tr>
<td></td>
<td>-Yes, but inconsistently</td>
<td>-Yes, but inconsistently</td>
</tr>
<tr>
<td></td>
<td>-Never</td>
<td>-Never</td>
</tr>
<tr>
<td>Does the child get along well with teachers and peers consistently?</td>
<td>-Yes, usually</td>
<td>-Yes, usually</td>
</tr>
<tr>
<td></td>
<td>-Yes, but inconsistently</td>
<td>-Yes, but inconsistently</td>
</tr>
<tr>
<td></td>
<td>-Never</td>
<td>-Never</td>
</tr>
<tr>
<td>Is the child generally at ease interacting with others?</td>
<td>-Yes, usually</td>
<td>-Yes, usually</td>
</tr>
<tr>
<td></td>
<td>-Yes, but inconsistently</td>
<td>-Yes, but inconsistently</td>
</tr>
<tr>
<td></td>
<td>-Never</td>
<td>-Never</td>
</tr>
</tbody>
</table>
12. On a typical day, what is your child’s mood like?

<table>
<thead>
<tr>
<th>Probing Indicator Question</th>
<th>Initially coded response options</th>
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</tr>
</thead>
</table>
| Does the child demonstrate sad or worried facial expressions | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child demonstrate crying or tearfulness? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child make negative statements? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child demonstrate irritability? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child demonstrate labile affect? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child exhibit anxious concerns or fears? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child demonstrate persistent anger at self or others? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
13. How would you describe your child’s behaviour?

<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| Does the child exhibit physical aggression? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child engage in self-injurious behaviour? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child exhibit outburst of anger? | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Does the child exhibit difficulty following classroom conventions? | -Yes, usually  
-Yes, but inconsistently  
-Never | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |
| Is the child easily distracted? | -Yes  
-No | -Yes  
-No |
14. How does your child communicate with you? Does your child generally express his/her needs in a way you can understand them and does your child typically understand your attempts to communicate?

<table>
<thead>
<tr>
<th>Probing Indicator Question</th>
<th>*Initially coded response options</th>
<th>Reduced to a 3 point scale for analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the child able to make himself/herself understood?</td>
<td>- Understood</td>
<td>- Understood</td>
</tr>
<tr>
<td></td>
<td>- Usually understood</td>
<td>- Usually/Often understood</td>
</tr>
<tr>
<td></td>
<td>- Often understood</td>
<td>- Sometimes understood</td>
</tr>
<tr>
<td></td>
<td>- Sometimes understood</td>
<td>- Rarely/Never understood</td>
</tr>
<tr>
<td>Does the child understand others?</td>
<td>- Understands</td>
<td>- Understands</td>
</tr>
<tr>
<td></td>
<td>- Usually understands</td>
<td>- Usually/Often understands</td>
</tr>
<tr>
<td></td>
<td>- Often understands</td>
<td>- Sometimes understands</td>
</tr>
<tr>
<td></td>
<td>- Sometimes understands</td>
<td>- Rarely/Never understands</td>
</tr>
</tbody>
</table>

*None of the participants were reported to Rarely/Never make themselves understood or to Rarely/Never understand others, although this was one of the initial response options*
15. How much help does your child generally need with daily activities like dressing, toileting, personal hygiene or bathing? Can your child perform these activities independently and make minor decisions independently?

<table>
<thead>
<tr>
<th>Probing Indicator Question</th>
<th>*Initially coded response options</th>
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</tr>
</thead>
</table>
| How does the child perform with regard to personal hygiene [i.e. brushing teeth, washing face, combing hair]? | -Independently  
-Independently, with set-up help  
-With supervision  
-With limited assistance  
-With extensive assistance  
-With maximal assistance  
-Total dependence | -Independent  
-Needs set-up help, supervision or limited assistance  
-Needs extensive or maximal assistance |
| How does the child perform with regard to bathing? | -Independently  
-Independently, with set-up help  
-With supervision  
-With limited assistance  
-With extensive assistance  
-With maximal assistance  
-Total dependence | -Independent  
-Needs set-up help, supervision or limited assistance  
-Needs extensive or maximal assistance |
| How does the child perform with regard to dressing? | -Independently  
-Independently, with set-up help  
-With supervision  
-With limited assistance  
-With extensive assistance  
-With maximal assistance  
-Total dependence | -Independent  
-Needs set-up help, supervision or limited assistance  
-Needs extensive or maximal assistance |
| How does the child perform with regard to toileting? | -Independently  
-Independently, with set-up help  
-With supervision  
-With limited assistance  
-With extensive assistance  
-With maximal assistance  
-Total dependence | -Independent  
-Needs set-up help, supervision or limited assistance  
-Needs extensive or maximal assistance |
| Is your child able to perform multi-step tasks [i.e. picking up all toys and placing them in appropriate bin, putting the bin away]? | -Yes  
-No | -Yes  
-No |
| Does the child use toys in a spontaneous and imaginative way? | -Consistently engages in imaginative play  
-Inconsistently demonstrates some imaginative elements  
-Can follow a series of imaginative scenarios with assistance [i.e. facilitated play]  
-Can imitate basic play skills  
-Never/Views play objects in concrete manner | -Consistently engages in imaginative play  
-Inconsistently demonstrates imaginative elements/Can follow with assistance/Can imitate  
-Never |
| How does the child perform with regard to making minor daily decisions independently [i.e. what to wear, what snack to eat]? | -Independently  
-Modified independence [difficulty in new situations]  
-Minimally impaired [decisions sometimes poor or unsafe] | -Independent  
-Modified independence/Minimally impaired  
-Severely/moderately impaired |
- Moderately impaired [decisions consistently poor or unsafe]
- Severely impaired [never or rarely makes decisions]

*None of the participants were reported to demonstrate ‘Total Dependence’ in any of the Life Skill areas, although this was one of the initial response options.*
16. Does your child have any difficulties around sleep?

<table>
<thead>
<tr>
<th>Probing Indicator Question</th>
<th>Initially coded response options</th>
<th>*Reduced to a 3 point scale for analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Does the child have difficulty falling asleep or remaining asleep?</td>
<td>-Exhibited daily in the last 3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Exhibited on 1-2 of the last 3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Present, but not exhibited in the last 3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Not present</td>
<td></td>
</tr>
<tr>
<td>Does the child experience nightmares or sleepwalking?</td>
<td>-Exhibited daily in the last 3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Exhibited on 1-2 of the last 3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Present, but not exhibited in the last 3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Not present</td>
<td></td>
</tr>
</tbody>
</table>

*This variable was not used for analysis

17. What can you tell me about your child’s tolerance of sensory experiences?

<table>
<thead>
<tr>
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<th>Initially coded response options</th>
<th>Reduced to a 3 point scale for analysis or preserved as a 2 point scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the child exhibit particular likes or dislikes for specific types of food, or food with specific textures?</td>
<td>-Yes</td>
<td>-Yes</td>
</tr>
<tr>
<td></td>
<td>-No</td>
<td>-No</td>
</tr>
<tr>
<td>Does the child appear over-excited or hyperactive?</td>
<td>-Exhibited daily in the last 3 days</td>
<td>-Yes, usually [daily, on 1-2 of last 3 days]</td>
</tr>
<tr>
<td></td>
<td>-Exhibited on 1-2 of the last 3 days</td>
<td>-Yes, but inconsistently[present but not in the last 3 days]</td>
</tr>
<tr>
<td></td>
<td>-Present, but not exhibited in the last 3 days</td>
<td>-Never</td>
</tr>
<tr>
<td></td>
<td>-Not present</td>
<td></td>
</tr>
<tr>
<td>Does the child strongly dislike being touched by others or dislike certain textures or sensations?</td>
<td>-Yes</td>
<td>-Yes</td>
</tr>
<tr>
<td></td>
<td>-No</td>
<td>-No</td>
</tr>
</tbody>
</table>

18. What is your child’s height and weight?

Height: ______

Weight: ______
19. What can you tell me about how your child moves? Do you have any concerns about your child’s physical abilities?

<table>
<thead>
<tr>
<th>Probing Indicator Question</th>
<th>Initially coded response options</th>
<th>Reduced to a 3 point scale for analysis</th>
</tr>
</thead>
</table>
| Does the child have any difficulty with manipulating common household objects? | -Independently  
-Independently, with set-up help  
-With supervision  
-With limited assistance  
-With extensive assistance  
-Total dependence | -Independent  
-Needs set-up help, supervision or limited assistance  
-Needs extensive or maximal assistance |
| Does the child experience any clumsiness or balance issues?     | -Exhibited daily in the last 3 days  
-Exhibited on 1-2 of the last 3 days  
-Present, but not exhibited in the last 3 days  
-Not present | -Yes, usually [daily, on 1-2 of last 3 days]  
-Yes, but inconsistently[present but not in the last 3 days]  
-Never |

20. Did your child participate in any therapies or interventions in the past? If so, what types?

21. Is your child currently getting help with any of his/her difficulties in the form of therapies, school programs or other interventions?

22. Are there any general comments you’d like to make that we didn’t discuss already?
The following are examples of each barrier category, using the language of the ICF:

**Restrictions**  
Product and technology for culture, recreation and sport

Design, construction and building products and technology of buildings for public use

Personal care providers and personal assistants

People in positions of authority

Other professionals

Associations and organizational services, systems and policies

**Participation Barriers**  
Transportation

Assets

**Sensory Functions**  
Sensations associated with the eye and adjoining structures

Sensations associated with hearing and vestibular function

Proprioceptive function

Sensory functions related to temperature and other stimuli

**Attitudes**  
Individual attitudes of acquaintances, peers, colleagues, neighbors and community members

Individual attitudes of people in positions of authority

Societal attitudes

**Other**  
Orientation functions

Intellectual functions

Global psychosocial functions

Psychomotor functions

Perceptual functions

Mental functioning of sequencing and Complex movements

Control of voluntary movement functions

Gait pattern functions
Focusing attention

Making decisions

Handling stress and other psychological demands