

**THE ONSET OF SELF-CONTROL IN PRESCHOOLERS:
BRIDGING THE GAP BETWEEN CRIMINOLOGICAL AND
DEVELOPMENTAL RESEARCH**

by

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Abstract

This study sought to examine the relationship between overall levels of self-control and preschoolers' performance on various self-regulation tasks. An associated aim was to examine levels of self-control while taking into consideration specific antisocial and aggressive child behaviours as well as psychiatric indicators. To that end, the study examined the individual characteristics (i.e. clinical symptoms such as ADD/ADHD) of preschool-aged (3 – 5) boys and girls who have more difficulties controlling their aggressive behaviours ($n = 207$). Independent samples t-tests, one-way ANOVA's and multiple regressions were conducted. Findings indicated significant differences in self-control with regards to gender, age, and referral source, but not ethnicity. Results also revealed significant relationships between level of self-control and both behavioural and clinical indicators of antisociality. Theoretical implications of the findings are discussed.

Keywords: self-control; aggression; antisocial behaviour; preschool

Dedication

I can honestly say there was a time (actually several times) when I did not truly believe this day would ever come. And suddenly... it arrived! It has definitely been a long and interesting road. But through it all I had amazing supports guiding me through and cheering me on. I am so thankful for that. To my friends. You always stuck by me - even when I was probably not a delight to be around. I cannot imagine any of you not being in my life. To my family. C, my brother, my friend, you have shown me that today really is the day. This is a beautiful life. Dad and Mum, you have truly inspired me by the way you lead your lives. You have shown me that the best is always yet to come. Thank you.

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Executive Summary

In 1990, Gottfredson and Hirschi published a “General Theory of Crime” which would later become one of the most influential and widely-cited explanations of crime and delinquency. Central to their explanatory model is the concept of low self-control (LSC) which represents a stable and fixed propensity to engage in a wide array of deviant behaviours. According to them, LSC is an enduring trait established relatively early in life as a result of an inadequate family environment. Since the publication of the general theory of crime, research on the measurement, developmental course, and the stability of self-control have exploded. That said, there has been a lack of empirical research looking at how self-control develops at the earliest developmental stages. Indeed, most studies have focused on the study of self-control in late childhood and adolescence. The study of the onset of self-control in early childhood is of importance given that it is currently believed that self-control is relatively fixed after early childhood. Hence, the period said to be critical for the development of self-control coincides with the period where children learn behavioural inhibition mechanisms to control their aggressive impulses as well as alternative pro-social responses to situations conducive to a physically aggressive response.

The aim of the current thesis is to build on child development and criminological research on self-control by exploring its onset in a sample of preschoolers. Very few longitudinal studies have examined and followed the same children for long periods of time. Even fewer have examined the relationship between self-control and antisociality in early adolescence. The Vancouver Longitudinal Study on the Psychosocial Development of Children addresses this specific empirical question on boys and girls between the ages of three and five. The unique design of this study allows for the use of both validated questionnaires along with clinical measures to tap into different aspects of self-control. Further, this study is based on three samples of preschoolers that mirror the research that has been conducted in the past. Specifically, past research has examined general, correctional and clinical samples of the population. The sample of preschoolers is comprised of community-based children, at-risk community-based children and clinically-referred children. Finally, as we are examining different samples of children in early childhood, we are interested in investigating whether their levels of self-control differ among other areas such as gender, age, and ethnicity. Given that the current study

uses a multinational sample, which is indicative of the shifting demographic in Canada, LSC and its relationship to ethnicity and aggression is important to explore. Finally, the study explored the use of a measure that has been shown to be both a reliable and valid indicator of self-control in late childhood and adolescence, but has never been used with preschoolers.

Study findings indicated that level of self-control significantly increased with age. Further, significant differences in self-control emerged between boys and girls, with boys presenting with lower levels of self-control than girls. We also found that our clinically-referred children had significantly lower levels of self-control than children coming from our community sample. Interestingly, no significant cultural or ethnic differences across groups were observed. When looking at child behavioural indicators, we found that children with lower levels of self-control scored higher on the Antisocial Process Screening Device (APSD) and physical aggression, suggesting that manifestations of LSC were not limited to just one domain of behavioural problems. Children with lower levels of self-control also presented with higher scores on psychiatric indicators of Attention Deficit Disorder (ADD)/Attention Deficit Hyperactivity Disorder (ADHD) as well as Oppositional Defiant Disorder (ODD).

Of note is our finding of two distinct groups of preschoolers presenting with LSC. The first group tended to be more physically aggressive, was a part of our clinical sample, and was typically Caucasian and male. The second group presented with more antisocial symptoms, was either male or female (no gender differences) and was more likely to be non-Caucasian. As such, the first group may consist of children whose manifestations of LSC could be part of a clinical picture, whereas the second group may be more reactive to their emotional states and may be more likely to act aggressively when angry or frustrated.

The findings of this thesis show the importance of the role of self-control in early childhood development. As it stands, most criminological studies have failed to look at the early childhood period, instead choosing to focus on youth and adolescents. Conversely, the majority of studies conducted in the field of child psychiatry have focused on the period of early childhood. By examining the earliest years of development, a more complete picture of the road to aggression and antisociality is able to be revealed. The observations made in the field of child psychiatry can thus often be extended to apply to the research being conducted in criminology, though there seems to be a lack of

dialogue between disciplines. This study aimed to highlight and address this disparity and begin to work towards linking these fields, as both emphasize the importance of self-control.

Chapter 1: Introduction

Child development research has burgeoned in recent years with the presence of multiple prospective longitudinal studies examining physical aggression in the early years. One area that has flourished in the past two decades is the study of the developmental course of physical aggression and associated risk factors. Currently, there is substantial empirical evidence that most children begin using physical aggression in infancy (e.g., Hay, Castle, & Davies, 2000; Keenan & Wakschlag, 2000; Tremblay, Japel, & Persusse, 1999). It appears that the frequency of physical aggression increases up to three to four years of age (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Tremblay, 2000; 2003; Tremblay et al., 2004) and after that point, that is, around school entry, it decreases until adolescence (Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003; Cairns, Cairns, Neckerman, Ferguson, & Garipey, 1989; Côté et al., 2006; Lacourse et al., 2002; Nagin & Tremblay, 1999). Furthermore, several empirical studies also point to the fact that between birth and four years, the majority of children learn to inhibit physical aggression (Tremblay et al., 1999; Tremblay & Nagin, 2005). It has been hypothesized that during this developmental period, physical aggression is a normative behaviour. Of importance, during early childhood, through trials and errors, children learn ways to inhibit their aggressive responses while learning alternatives to respond to frustration and anger without using physical aggression (e.g., Hay, 2006; Joussemet et al., 2008).

The socialization process of children has been said to be key in the development of internal control mechanisms. Importantly, it is also hypothesized that children who show problems inhibiting their aggressive responses to frustration and anger during this period tend to experience the same difficulties later on in life (Broidy et al., 2003). Specifically, studies looking at developmental trajectories in elementary-aged children have identified a small group, of about 5 percent of children, who show a stable and high-level trajectory of physical aggression (Broidy et al., 2003; Nagin & Tremblay, 1999). While several factors have been associated to a trajectory of chronic physical aggression, one of the key factors has been described as self-control or self-regulation. In fact, the development of self-control and self-regulation is a key developmental task during childhood (Paus, 2005; Tremblay & Nagin, 2005). The field of

criminology has experienced various developments in the past two decades that are reminiscent of those seen in the field of child psychology and the study of physical aggression. Among such developments is the recognition that self-control is a key element associated with the development of crime and delinquency (Pratt & Cullen, 2000). There have been several longitudinal studies examining the development of self-control and its relation to juvenile delinquency (e.g. Browning & Loeber, 1999; Glueck & Glueck, 1950; Farrington, 1994). Further, there has been a growing interest for the period of childhood and how the risk factors during that period influence the developmental course of self-control as well as its relation to crime and delinquency in adolescence (e.g. Brannigan, Gemmell, Pevalin, & Wade, 2002; Beaver & Wright, 2005; Morizot & LeBlanc, 2007; Wright & Beaver, 2005; Beaver, Wright, & DeLisi, 2007, Beaver, DeLisi, Vaughn, Wright, & Boutwell, 2008; Vaughn, DeLisi, Beaver, & Wright, 2009).

Since the publication of the general theory of crime (Gottfredson & Hirschi, 1990), research on the measurement, developmental course, and the stability of self-control have exploded (e.g. Grasmick, Tittle, Bursik, & Arneklev, 1993; Arneklev, Cochran, & Gainey, 1998; Hay, 2006; Raffaelli, Crockett, & Shen, 2005). Scholars have recognized the theoretical and empirical importance of self-control for the study of various forms of antisocial, delinquent, and criminal behaviour (Tremblay & Nagin, 2005). That said, there has been a lack of empirical research looking at how self-control develops at the earliest developmental stages (for an exception, see Vazsonyi & Huang, 2010). Indeed, most studies have focused on the study of self-control in late childhood and adolescence. The study of the onset of self-control in early childhood is of importance given that it is currently believed that self-control is relatively fixed after early childhood (e.g. Gottfredson & Hirschi, 1990). Hence, the period said to be critical for the development of self-control coincides with the period where children learn behavioural inhibition mechanisms to control their aggressive impulses as well as alternative pro-social responses to situations conducive to a physically aggressive response. The current study builds on child development and criminological research on self-control by exploring its onset in a sample of preschoolers. To that end, several indicators and dimensions of self-control were examined to determine its impact of the regulation of aggression and antisocial behaviour. In doing so, the study examines the individual characteristics (i.e. clinical symptoms such as ADD/ADHD) of preschool-aged (3 – 5) boys and girls who have more difficulties controlling their aggressive behaviours. This study is based on the Vancouver Longitudinal Study of the Psychosocial Development of Children which aims to advise policymakers on identifiable risk and protective factors that influence a child's aggression and antisocial development. The study

will look at a clinical profile of preschoolers showing manifestations of low self-control. Further, the study will explore the use of a measure that has been shown to be a reliable and valid indicator of self-control in late childhood and adolescence, but has never been used with preschoolers. First, a review of the scientific literature on self-control and self-control theory of crime and delinquency and their implications for the current study will be discussed.

Chapter 2: Literature Review

Self-Control Theory of Crime and Delinquency

The general theory of crime. In 1990, Gottfredson & Hirschi published a “General Theory of Crime” which would later become one of the most influential and widely-cited explanations of crime and delinquency. Central to their explanatory model is the concept of low self-control (LSC) which represents a stable and fixed propensity to engage in a wide array of deviant behaviours. According to them, LSC is an enduring trait established relatively early in life as a result of an inadequate family environment. Gottfredson & Hirschi (1990) posit that the family environment may shape the child’s ability to develop self-control over their emotions and behaviours. According to their model, LSC is the result of a combination of parenting factors: (a) the inability of parents to monitor their child’s behaviour; (b) the inability of parents to recognize their child’s deviant behaviour, and; (c) the inability of parents to be consistent in punishing the deviant behaviour of their child. Hence, in the absence of positive socialization experiences characterized by adequate supervision or monitoring, and discipline, children are less likely to learn to delay immediate gratifications. Gottfredson & Hirschi (1990) further state that the first eight years of a child’s life are pivotal for the development of self-control. They argue that beyond that point, it becomes more difficult for children to improve their ability to control and regulate their emotional states and behaviours. Stated differently, Gottfredson & Hirschi (1990) argue that the propensity for crime and delinquency become relatively stable in mid-childhood having serious consequences for the subsequent developmental stages.

Gottfredson & Hirschi (1990) have been rather specific about the consequences and the manifestations of LSC. First, children with LSC are more likely to be involved in antisocial and aggressive behaviours at a young age. At a young age, children with LSC are unlikely to show manifestations limited to these types of behaviours. Second, individuals with LSC are more likely to show an early onset of crime and delinquency. Third, individuals with LSC not only are early-onset offenders, but also show a more active pattern of crime and delinquency in terms of the frequency or volume of crimes committed. Fourth, based on their theoretical model,

individuals with LSC are more likely to be involved in criminal behaviours, but also deviant behaviours and accidents, when compared with individuals with higher self-control. Specific manifestations of LSC include a variety of behaviours that largely involve immediate gratifications at the costs of more long-term consequences. Gottfredson and Hirschi (1990, p. 92) state that individuals with LSC are more likely to use tobacco, drink alcohol, skip school, engage in risky sexual behaviours, get in accidents, be absent from work, die at an early age and become criminals. One of the unique features of the general theory of crime, as demonstrated above, is that it is intended to explain not only criminal acts, but also general deviance (often referred to as “analogous acts”). The authors suggest that crime and deviance are intimately linked, and are simply different manifestations of LSC. To that end, it is important to examine the earliest manifestations of this trait to combat later antisocial behaviours. The early onset, high frequency and diversity of deviant manifestations shown by LSC individuals can be explained by the particularities and the underlying dimensions of LSC.

Low self-control. According to the theory, self-control is an unobservable latent construct comprised of six underlying dimensions. Gottfredson and Hirschi (1990) stress the importance of viewing these six dimensions together, and argue that they are not simply different variations of LSC. The first dimension comprising LSC is *impulsivity*, and describes individuals who tend to have difficulty delaying gratification, and have a strong response to their physical and immediate environment. The second dimension, *short-sightedness*, refers to individuals who have a preference for tasks that provide them with easy pleasure, and tend to avoid undertakings that they deem to be complex or difficult. *Risk-taking* is the third dimension of LSC, and encompasses individuals who enjoy taking risks and being adventuresome, as opposed to exercising caution. Preferring *physical* activities (in opposition to mental tasks), is the fourth dimension discussed. Such individuals tend to show a preference for physical activities or being physically active, as they lack the diligence to enjoy cognitive activities such as reading and contemplating ideas. The fifth dimension, *insensitivity*, refers to the fact that individuals with LSC tend to be self-centered and bad-tempered, and are as a result, insensitive to the needs and/or suffering of others. The sixth and final dimension of LSC is *non-verbal*, referring to the fact that such individuals prefer to resolve and respond to disagreements through physical action as opposed to discussing issues verbally (p. 90). Taken together, Gottfredson and Hirschi (1990) suggest that individuals with LSC are impulsive, short-sighted, risk-taking, physical, insensitive and non-verbal.

Definitional and operationalization issues. According to Barlow (1991), one of the problems of the “General Theory of Crime” has been the absence of a clear operational definition of self-control as well as the lack of a clear foundation that differentiates between levels of self-control. As a result, several operationalizations of LSC have been proposed in the scientific literature. For example, researchers have measured LSC using behavioural indicators such as drunk driving and non-use of seat belts (e.g., Keane, Maxim, & Teevan, 1993), getting intoxicated and becoming hostile or mean whilst under the influence (e.g., Avakame, 1998). Others have used psychologically-oriented indicators such as psychomotor clumsiness (e.g., Polakowski, 1994). Others instead have relied on attitudinal measures to capture LSC. The most widely accepted operationalization of LSC based on attitudinal indicators to date has been proposed by Grasmick and colleagues (1993). In line with the description of LSC provided by the “General Theory of Crime”, these researchers created the Grasmick Low Self-Control Scale (GLSC-S), which is a 24-item self-report scale devised to capture the essential elements of the six dimensions of self-control (i.e., “I enjoy taking risks just for the fun of it.”). Please refer to Appendix 1 where the full scale is presented.

In their validation study, based on a general sample of Americans, Grasmick and colleagues found support for Gottfredson and Hirschi’s (1990) assertion that the six dimensions of LSC could be combined into a higher latent construct and noted that the dimensions “appear to coalesce into a single personality trait” (Grasmick et al., 1993, p. 17). In reaction to the Grasmick et al. (1993) study, Hirschi and Gottfredson (1993) suggested that results garnered from the GLSC-S may not, in fact, be valid, as LSC, they claimed, may be best captured through the use of behaviourally-oriented indicators rather than attitudinal measures such as the GLSC-S. Further, the very nature of low self-control itself, according to Hirschi and Gottfredson (1993) may affect how respondents answer survey questions (see also Piquero, MacIntosh & Hickman, 2000). However, after conducting a thorough meta-analysis, Pratt and Cullen (2000) found evidence to suggest that regardless of whether self-control is measured attitudinally or behaviourally, does not affect the strength to which the scores on a measure of LSC are related to crime and delinquency.

Use of the Grasmick Low Self-Control Scale. Generally speaking, the GLSC-S has been used with populations such as high school students (e.g., Brownfield & Sorenson 1993; Junger & Tremblay, 1999; LaGrange & Silverman 1999; Vazsonyi, Pickering, Junger, & Hessing, 2001; Wood, Pfefferbaum, & Arneklev, 1993; Grasmick, Tittle, & Bursik,

1993), college/university students (e.g. Cochran, Wood, Sellers, Wilkerson, & Chamlin, 1998; Gibbs & Giever 1995; Nagin & Paternoster 1993; Piquero & Tibbetts, 1996), as well as samples drawn from the general population (e.g. Evans, Cullen, Burton, Dunaway, & Benson, 1997; Grasmick et al. 1993). In recent years however, several studies have utilized the GLSC-S to inform about the development of self-control and its relationship to crime and delinquency. In 2000, Pratt and Cullen carried out a meta-analysis of empirical studies to examine the empirical status of the general theory of crime, most particularly the impact of LSC on crime and delinquency. To do so, they did a literature search of LSC, and included all empirical studies that tested the theory and that considered LSC to be a unitary construct. They ended up with 21 studies, including 49, 727 individual cases among studies. Of the 21 studies examined, 11 used the GLSC-S. When utilizing the GLSC-S, Pratt and Cullen found a mean effect size of .255** (adjusted mean effect size = .263*). Though Pratt and Cullen did note whether the sample of each study was ethnically homogenous (limited to Caucasians only) or ethnically integrated (of which 17 studies were), due to the fact that no study reported separate analyses among ethnicities, no direct assessment of the effect size for self-control among ethnicities was available. Further, no studies included in the analysis tested children, let alone preschool-aged children. That said, 10 studies examined looked at adults versus juveniles level of self-control in either a community or offender population. Of the studies looking at juveniles, five utilized the GLSC-S. Essentially, Pratt and Cullen found that, regardless of age or gender, the relationship between deviance and LSC were virtually the same. Further, the effect of LSC regularly exceeded .20 across the reviewed studies, and LSC was a consistent predictor of crime (mean effect size = .277**; adjusted mean effect size = .238*) and related behaviours (e.g., drug use, smoking, driving fast; mean effect size = .352**; adjusted mean effect size = .354**).

The Pratt & Cullen (2000) study was largely based on empirical studies conducted using American samples of youth and adults. It is unclear therefore, whether the findings of their meta-analysis could be generalized to other cultures and other ethnic groups. Few researchers have addressed this limitation by examining LSC in various countries located mainly in Asia and Europe. For example, a large scale study conducted by Vazsonyi et al. (2001) examined LSC in Hungarian, Dutch, Swiss and American adolescent students (n= 8,417). Of interest for our review, Vazsonyi et al. (2001) used the GLSC-S to measure LSC, therefore, attempting to examine the validity of the measure outside the U.S. Their study showed that scores on the GLSC-S accounted for about 10 to 16 percent of the variance in antisocial behaviour during adolescence. These findings were relatively stable across samples drawn in Hungary, the

Netherlands, and Switzerland, along with the U.S. However, Tittle and Botchkovar (2005) remark that the overwhelming majority of cross-cultural research has been done on Western nations. Further, one study conducted in Japan to look specifically at low self-control and deviance through use of the GLSC-S was conducted by Vazsonyi, Wittekind, Belliston, & Van Loh (2004). They utilized a sample of 335 Japanese university students (aged between 18 and 23; 67 percent female), and through self-report data, found the low self-control measure to be both a valid and reliable measure of low self-control among male and female students. They also found that low self-control was related to various measures of both minor (e.g., school misbehaviour) and more serious forms of deviance (e.g., assault). Deviance was measured through the Normative Deviance Scale (NDS, Vazsonyi et al., 2001) which is a 55-item scale gauging a variety of both deviant activities and norm-violating behaviours. Further, they conducted multiple comparisons of partial unstandardized regression coefficients between the Japanese students with U.S. counterparts (n = 1,285; mean age 20 years; 61 percent female; 88 percent Caucasian), revealing that the low self-control-deviance association was invariant across their measures of deviance, except alcohol use. That is, these researchers found that, contrary to their expectations, LSC was negatively related to alcohol use in this sample. This particular finding was inconsistent with past studies that have found evidence of a positive relationship, albeit in younger samples. However this finding can likely be explained through cultural differences, where in Japan, consuming alcohol before the age of 20 is not necessarily considered risky or imprudent, and is often customary.

Given that the current study uses a multinational sample, which is indicative of the shifting demographic in Canada, LSC and its relationship to ethnicity and aggression is important to explore. Further, no studies have utilized this particular assessment of LSC on a preschool sample, opting instead for predominantly behavioural tools. These studies, that have reviewed the formation of LSC in a young population, with a tool other than the GLSC-S, are discussed below.

Self-Control in Childhood

Behaviourally-oriented studies of LSC. While there has been considerable attention to Gottfredson & Hirschi's (1990) theoretical formulation and Grasmick et al's operationalization of it, LSC has also been subject to empirical scrutiny using behaviourally

oriented measures of LSC. For the purpose of this review, we focus on those having been conducted with samples of children (less than 13 years old). Vazsonyi and Huang (2010) used data from the National Institute of Child Health and Human Development longitudinal study over a six-year period to examine self-control in boys and girls at 4.5, 8.5 and 10.5. Self-control was measured through an adapted version of the Social Skills Rating Scale (SSRS; Gresham & Elliott, 1990). This standardized assessment battery includes various scales examining self-control, and is based on both teacher and parent responses. Their results showed that over their six-year measurement period, the construct of self-control and deviance was stable, ranging from .63 to .83 across the three measurement periods. At the same time, they identified a positive growth in the trajectory of self-control, which was predicted by parenting. The authors suggest that this particular finding demonstrates how positive socialization may help to explain why children vary in their levels of self-control at preschool entry. Further, their results indicated that self-control, when assessed at initial status, was able to explain almost half (44.8 percent) of the variance in deviance. Deviance was assessed through use of The Child Behaviour Checklist (CBCL; Achenbach, 1991), with a focus on lying, cheating, stealing and fighting, based on mother reports.

Raffaelli et al. (2005) and Hay and Forrest (2006) both used data from the National Longitudinal Study of Youth (NLSY) to examine the development and stability of self-control in childhood. This dataset oversampled both disadvantaged groups and minorities. Both sets of researchers assessed self-control through maternal reports on items selected from the Behaviour Problems Index (BPI; Peterson & Zill, 1986), which is a validated inventory that uses behavioural measures of self-control such as "He/she is restless or overly active, cannot sit still". Whereas Raffaelli et al. (2005) assessed the stability of self-control across 3 age-points, Hay and Forrest (2006) looked at the development of self-control between 7 and 15 years of age. Raffaelli et al. (2005) found that girls had higher levels of self-control than boys at all three time points. They also found that individual differences in self-control remained fairly stable between 4 and 13 years. That said, the biggest increase in self-control was most evident between 4-5 and 8-9. Hay and Forrest (2006) had similar findings, revealing that strong absolute and relative stability of self-control emerged as early as 7 for more than 80 percent of their sample. However, they also found that it is still sensitive to socialization effects, as once gained, self-control can fluctuate.

In a Canadian example, Brannigan et al. (2002) used data from the first cycle of the Canadian National Longitudinal Survey of Children and Youth (NLSCY) to examine self-control in boys and girls between 4 and 11. Essentially, the NLSCY targeted children from 0 to 11, but constrained their analysis to the 4 and 11 age-set. For their analysis of aggression, they included 2 and 3 year olds, and collapsed the rest into biannual categories (i.e. 4 and 5, 6 and 7, etc.). Brannigan et al. (2002) measured self-control through use of a *hyperactivity scale*, which used 10 items relating to impulsivity, inattentiveness and hyperactivity. Their findings show that hyperactivity in childhood as well as hostile parenting each seems to increase the risks of the youth engaging in aggressive behaviours and misconduct. Gender was controlled for, with no significant findings emerging. The ethnic breakdown of the sample was not assessed nor provided in this study. The use of a hyperactivity scale makes it difficult, however, to compare with studies having used the Grasmick et al. scale measuring LSC, as the concept of LSC as operationally defined by Grasmick et al. has manifestations other than hyperactivity.

Some researchers have focused their attention on specific ethnic groups to assess the effects of parenting on self-control. Kim and Brody (2005) examined 139 single African American mothers with youth (mean age of 11; 51 percent females). Self-control was measured by the Children's Self-Control Scale (Humphrey, 1982), which is a five-point scale ranging from 0 (never) to 4 (almost always). Mothers answered questions about their child's behaviours (i.e., "Talks out of turn"). As predicted by the researchers, findings showed that as self-control develops, African-American children are less likely to partake in antisocial conduct and inattentive behaviours. Gender was not assessed.

Similarly, Burt, Simons & Simons (2006) had longitudinal data on approximately 750 African American children (10 – 12 years of age at wave 1) and their primary caregivers. However, they measured self-control through self-report responses on 39-item relating to self-control (i.e., "You enjoy taking risks"). These researchers found that low levels of self-control were positively related to delinquent involvement between 10 and 12. Specifically, they found that, when holding their other study variables constant, that a standard deviation increase in low self-control increased the delinquency count by more than 50 percent. Measures on delinquency were measured by child self-reports asking how often they engaged in 26 deviant acts in the prior year (i.e., shoplifting, physical assault, lying, setting fires). These authors found that low self-control was significantly related to all of their study variables at the $p < .01$ level, with the exception of age and sex.

Finkenauer, Engels and Baumeister (2005) used cross-sectional data on Dutch children aged between 10 and 14 years old to examine self-control and behavioural problems. Similarly, DeKemp, Vermulst, Finkenauer, Scholte, Overbeek, Rommes, et al. (2009), using data from a 3-wave longitudinal study, looked at the association between self-control and delinquent behaviour in boys and girls between 11 and 14. Both studies measured self-control by a Dutch translation of a self-report self-control scale developed by Tangney, Baumeister and Boone (2004). This scale consists of 7 items gauging individuals' impulse control, ability to alter emotions and behaviours, as well as refrain from acting on them. Finkenauer et al. (2005) found that low self-control was strongly related to both emotional (i.e., depression, stress, low self-esteem) and behavioural problems (i.e., delinquency and aggression including such things as shoplifting, lying, fighting and destroying others things) for both boys and girls. Conversely, DeKemp et al. (2009) discovered comparable findings, by showing that in a normal sample of early adolescents, having higher levels of self-control was indicative of less antisocial behaviours.

Finally, Feldman and Weinberger (1994) examined middle-class (i.e., with 70 percent of fathers and 64 percent of mothers reporting post-secondary education or training) 6th grade boys attending public schools in San Francisco (93 percent of the boys were 11 or 12 at the initial assessment). "Restraint" was measured at time 1 by five informants (the boys themselves, their peers, their parents and their teachers). Self-control was assessed through the Weinberger Adjustment Inventory (WAI; Weinberger, 1991). 30 items were rated on a 5-point likert scales (i.e., "I do things without giving them enough thought"). The results from this study indicated that parenting practices only predicted delinquency indirectly through its association with the boys' levels of self-restraint, which is similar to later findings (e.g. Finkenauer et al., 2005; Beaver et al., 2007).

Aside from the research outlined above, little attention has been paid to the formation of LSC in *early* childhood. The studies reviewed below, by the researchers Beaver, Wright, Vaughn and DeLisi, are the closest match to the empirical questions that we are raising. While their main focus is on parenting influences and neurological factors that may affect levels of self-control, they have utilized a sample of kindergarteners throughout their studies, which is the youngest age group to have been examined, and several parallels can be drawn between their work and our study.

These researchers used the Social Skills Rating Scale (SSRS; Gresham & Elliot, 1990) to assess child self-control (as was briefly outlined previously as the assessment method used by Vazsonyi & Huang, 2010). They typically employed both mothers and teachers to make ratings to increase reliability. The SSRS is a standardized, multi-rater assessment that contains various subscales related to self-control such as overactivity/hyperactivity, the child's ability to control his or her temper/emotions, ability to regulate conduct and impulsivity. These items were scored as *never*, *sometimes*, *often*, and *very often*. Researchers examining the psychometric properties of the subscales and scale have found high reliability (see Benes, 1995; Gresham, 2001). To create a scale of LSC, the researchers developed a composite measure based on reports from both the mothers and the teachers, both containing two sets of questions for each. The parental reports asked the mother to first rate their child's impulsivity and over-activity, and then rate their child's ability to control his or her behaviours. Their responses were summed together to create the parental self-control scale. Similarly, teachers were asked to assess the child's ability to control/regulate his or her own behaviour (i.e., respecting others property, controlling his or her temper, accept peer ideas in group activities and respond appropriately to peer pressure), as well as to rate the degree to which the student shows externalizing behaviours (i.e., fights, argues, gets angry, is disruptive). These two measures were summed to create the teacher self-control scale. Together, the parent and teacher reports formed the scale used to assess levels of self-control.

Using data from the Early Childhood Longitudinal Study, kindergarten class (ECLS-K), Beaver et al. (2007) measured levels of self-control in a nationally representative sample of about 3,000 American children. Like Vazsonyi and Huang (2010), self-control was measured through an adapted version of the SSRS (Gresham & Elliott, 1990). Specifically, both teachers and parents provided details with regards to the child's externalizing behaviour problems, impulsivity, attentiveness/persistence and their ability to form/sustain friendships. Responses from each of these items were added to create a low self-control scale, with higher scores indicating lower self-control levels. Beaver et al. (2007) found that deficits in neuropsychological functioning (i.e., gross and fine motor skills) were related to levels of self-control across gender, and that measures of neuropsychological functioning were the most predictive measures of low self control in childhood. They also concluded that most measures of parenting had either small or inconsistent effects on levels of self control, which they had previously found in earlier studies (e.g., Wright & Beaver, 2005; Beaver & Wright, 2005).

In a follow-up study, Vaughn, DeLisi, Beaver and Wright (2009) examined manifestations of self-control in preschoolers (51 percent male, 57 percent Caucasian). They found that self-control was entwined with conduct issues (i.e., arguing, fighting), as well as interpersonal deficits (i.e., forming friendships, helping other children) in early childhood, and that this connection was quite stable. Further, they identified a small subset of children, about 9.3 percent of their sample, who were rated as being severely impaired (i.e., possessing various neurocognitive deficits, behavioural issues and learning problems). This subset closely parallels findings that five to ten percent of people in a population are involved in the majority of antisocial behaviours.

Finally, in 2008, using a sample of 310 twin kindergarteners, Beaver, DeLisi, Vaughn, Wright and Boutwell examined the relationship between self-control and language. They state that few criminological studies focus on individual-level characteristics when examining self-control. They focus on language development as diminished skills and verbal abilities have been connected with a range of antisocial and maladaptive outcomes (e.g. Dionne, 2005; Luria, 1966). Further, language problems have been shown to co-occur with clinical diagnoses of ADHD (Cohen, Barwick, Horodezky, & Vallance, 1998; Willcutt, Pennington, & DeFries, 2000) as well as physical aggression (Dionne, Tremblay, Boivin, Laplante, & Perusse, 2003) and delinquency in adolescence (Davis, Sanger, & Morris-Friehe, 1991). These researchers found a fairly strong relationship between language skills and self-control levels both cross-sectionally and longitudinally. In particular, the children who scored lowest on assessments of language during the first wave, were more likely than higher scoring children to have low levels of self-control at the first and later waves, demonstrating the importance of language development in early childhood.

Taking all of these findings together, it thus appears as though it is quite likely that the negative traits shown by adolescent delinquents and adult offenders are already there in kindergarten and that research on self-control theory in childhood is imperative. Specifically, it seems as though LSC in childhood is accompanied by various other difficulties, including neuropsychological deficits (Beaver et al., 2007), language difficulties (Beaver et al., 2008) and both emotional and behavioural problems (Finkenauer et al., 2005) at the present and later in life. Furthermore, LSC has consistently been found to be stable in studies examining the early childhood period. Interestingly though, studies have also suggested that self-control levels can fluctuate depending on socialization (e.g., Vazsonyi & Huang, 2010; Raffaelli et al., 2005; Hay &

Forrest, 2006). Parenting, highly considered to be the main method of socialization according to Gottfredson and Hirschi (1990), was also shown to be either directly, and/or indirectly related to self-control level (e.g., Brannigan et al., 2002; Feldman & Weinberger, 1994) (for an exception see Beaver et al., 2007). Finally, and perhaps not surprisingly, the lower the child's level of self-control, the more likely they were to present with myriad of antisocial and delinquent behaviours (e.g., DeKemp et al., 2009; Vaughn et al., 2009; Burt et al., 2006). Also necessary to note is that all of these studies have been conducted on older children (not the preschool age) and none have used the GLSC-S in their assessments.

Aim of Study

Gottfredson and Hirschi's (1990) self-control theory continues to be one of the most researched theories of crime and delinquency. Numerous empirical tests have spawned from its relatively simple premise that low self-control is the single most important indicator of antisocial behaviour. Since its recognition and operationalization in the early 90s, low self-control has been demonstrated time and again, to be a key indicator in theories of crime and delinquency. It has been found that individuals with low self-control are at-risk of engaging in delinquent, antisocial and violent behaviours (Damasio, 1994; Gottfredson & Hirschi, 1990; Moffitt, 1990).

Individuals low in self-control tend to be impulsive, have trouble delaying immediate gratifications, gravitate towards simple, easy tasks, take risks, are self-centred and prefer engaging in physical activities over mental ones (Arneklev, et al., 1993; Gottfredson & Hirschi, 1990; Grasmick et al., 1993). Essentially, the unifying theme between all these characteristics is the importance of the individual in being able to regulate or control their visceral emotions and sustain their attention. Moreover, self-control requires the individual to be future-oriented and to anticipate the consequences of current actions.

The importance of LSC has been tested in several empirical studies. Measures of self-control have been shown to predict criminal and other misbehaviours among established criminals (e.g., Longshore & Turner, 1998), general samples of individuals (e.g., Grasmick et al., 1993), college students (e.g., Cochran et al., 1998), youth (e.g., Vazsonyi et al., 2001), those of different age categories (e.g., Burton et al., 1999), among males as well as females (e.g., LaGrange & Silverman, 1999), among research subjects in various countries (e.g., Vazsonyi et

al., 2001) and for both cross-sectional (e.g., Evans et al., 1997) and longitudinal samples (e.g., Wright, Caspi, Moffitt, & Silva, 1999).

These studies have relied on operationalizations of LSC as proposed by Grasmick et al. (1993), but this concept has rarely been examined in younger samples. When it has, it has been looked at with differing operationalizations of self-control, thus making the limited findings hard to compare within the criminological research. Further, though the preschool age has rarely been examined by criminologists, clinical research has been looking at infants and young children for quite awhile (Kopp, 1982). Due to a lack of communication between the fields however, it is apparent that different terminology and operationalizations have been used when referring to and measuring self-control. Taken together, though the early years has been researched under a slightly different context by criminologists and clinicians, no previous work has examined the development of self-control as framed by Gottfredson and Hirschi's (1990) self-control theory in preschoolers. As such, the current study examines the onset of self-control, as defined by Grasmick et al. (1993), at the earliest stages, which will add to the criminological research on this issue.

There have been very few longitudinal studies that have examined and followed the same children for a long period of time. And only a handful of those studies have examined the relationship between self-control and antisociality in early adolescence. The Vancouver Longitudinal Study on the Psychosocial Development of Children addresses this specific empirical question on girls and boys between the ages of three and five. The unique design of this study allows for the use of both validated questionnaires along with clinical measures to tap into different aspects of self-control. Further, this study is based on three samples of preschoolers that mirror the research that has been conducted in the past. Specifically, past research has examined general, correctional and clinical samples of the population. Our sample of preschoolers is comprised of community-based children, at-risk community-based children and clinically-referred children. Finally, as we are examining different samples of children in early childhood, we are interested in investigating whether their levels of self-control differ among other areas such as gender, ethnicity, and age. For examples of other findings from this study please refer to Lussier, Corrado, Healey, Tzoumakis, & Deslauriers-Varin, 2011; Lussier & Healey, 2010; Lussier, Tzoumakis, Corrado, Reebye, & Healey, 2011; Tzoumakis, Lussier, & Corrado, 2012.

As discussed earlier, Vaughn et al. (2009) inspected early childhood manifestations of self-control. They ended up identifying five different groups of children, each with unique profiles, depending on level of impairment. Class 1 was labelled *moderate* and was based on teacher ratings, Class 2 was *low* and was based on teacher ratings, Class 3 was *low* and was based on both parent and teacher ratings, Class 4 was *moderate* and was based on parent ratings, and Class 5 was *severely impaired*, based on both parent and teacher ratings. Findings revealed that females were more likely to be rated as *low* based on both teacher (57.5 percent) and parent and teacher ratings (55.8 percent). Conversely, males made up 68.5 percent of the *severely impaired* group. When examining class membership and ethnicity, Caucasian children were more likely to be rated as *low* based on both teacher (65.5 percent) and parent and teacher ratings (58.1 percent). Conversely, Non-Caucasians accounted for 53.4 percent of the *severely impaired* group. However, when examining a polytomous regression predicting class membership, neither gender nor ethnicity was significant in predicting membership in the *severely impaired* group. Ethnicity was significant when looking at membership in the *low* group (parent and teacher ratings, $p < .001$) and the *moderate* group (teacher ratings, $p < .001$; parent ratings, $p < .05$). Taken together, the *severely impaired* group were most likely to be non-Caucasian and male.

Rafaelli et al. (2005) also looked at gender differences in self-regulation (note that their definition of “self-regulation” closely mirrors what criminologists would call “self-control”). Specifically, they define self-regulation as “the internally-directed capacity to regulate affect, attention, and behaviour to respond effectively to both internal and environmental demands” (p. 54). They sampled 646 children (52 percent boys; 36.2 percent Black, 23.4 percent Hispanic, 40.4 percent Caucasian) at ages 4 to 5, 8 to 9 and 12 to 13. They found, based on maternal reports, that girls showed significantly higher levels of self-regulation than boys at each time point. With regards to age-related change, these researchers found that self-regulation increased from early childhood (i.e. 4 to 5 years old) to middle childhood (i.e. 8 to 9 years old), but not from middle childhood to early adolescence (i.e. 12 to 13 years old). These age-related findings make sense, given that many self-regulatory skills continue to develop in early childhood, as many cognitive abilities (i.e. long-term planning, goal-setting) do not fully mature until later adolescence. These researchers did not comment on ethnic differences in levels of self-regulation.

Kochanska, Murray, and Harlan (2000), found that girls scored higher on levels of self-regulation than boys at 2 and 3 years old on several measures of effortful control, gauged by behavioural tasks (i.e. ability to delay gratification, slow motor control, sustain attention). Similarly, Murphy, Eisenberg, Fabes, Shepard, and Guthrie (1999) found that parents rated girls higher than boys on three measures of self-regulation (attention shifting, behavioural regulation, inhibition control). Finally, Stifter and Spinrad (2002) also found that girls tended to be better at self-regulating than boys. As suggested by Raffaelli et al. (2005), this provides a strong basis to further inspect gender differences at the earliest stages of development. Additionally, given the dearth of research looking at this specific age group, as well as ethnic differences, it seems the logical next step.

One of the most robust effects when examining antisocial and deviant behaviour is the link between these outcomes and neuropsychological impairment. According to Moffitt (1993), neuropsychological dysfunctions can manifest themselves as impulsivity, inattentiveness and low self-control, among other indicators. Deficits in self-control have been shown to be strongly associated with antisociality and various forms and externalizing behaviours and clinical indicators (e.g. Beaver et al., 2008; Ishikawa & Raine, 2003; Moffitt, 1993). For example, Clark, Prior and Kinsella (2000) discovered that children presenting with both ADHD and ODD/CD had the lowest level of self-control when compared with peers with neither or only one of these disorders.

Building upon the suggestions of Vaughn et al. (2009), who state that the negative characteristics and traits that manifest in adolescent delinquents and adult offenders are likely already present in kindergarteners, we extend this back to examine preschool-aged children. Importantly, adolescents with externalizing problems typically have an onset that dates back to the preschool years, yet, compared to older age groups, little is known about this specific period of development and its link with later antisocial behaviour. As noted by Keenan and Wakschlag (2000), “the preschool period is a time of rapid behavioural change and upheaval” (p. 43), particularly with regards to language, social, and behavioural skills. Further, they note that the preschool period may indeed be a crucial time when clinically significant behavioural problems are emerging. These early manifestations have the potential to carry forth into adolescence and beyond, thus suggesting that their identification could alter an otherwise pervasive and antisocial trajectory. As such, re-focussing efforts to identify the children most at-risk of not learning to control their impulses seems necessary. To that end, we are concerned with

identifying the specific characteristics (i.e. socio-demographics, clinical indicators, behavioural indicators) that manifest in children with LSC in the preschool years.

Chapter 3: Methodology

Sample

This study is based on the first 207 boys (50.2 percent) and girls (49.8 percent), aged between three and five years ($M= 3.78$, $SD= .74$), participating in the Vancouver Longitudinal Study. This study is, among other things, looking at the psychosocial development of children and the factors that lead to later aggression and violence. The sampling procedure reflects three different recruiting strategies and groups.

The clinical sample. The first cohort of children involves a clinical sample of children ($n= 18$; 8.7 percent), recruited from the Infant Psychiatric Clinic at the BC Children's Hospital, where clinical practitioners informed primary caregivers of our study. Inclusion criteria included: (1) the child was currently being assessed and/or treated for any externalization spectrum disorder; (2) the child was between three and five years old; (3) both the child and the primary caregiver had a reasonable understanding of English, and; (4) the child and the primary caregiver resided in or around the city of Vancouver and the Greater Vancouver Regional District (GVRD).

The community at-risk sample. For comparative purposes, this project also includes an at-risk community sample of children, targeting vulnerable socio-economic neighbourhoods ($n= 150$; 72.5 percent). Recruiting took place across Vancouver and the GVRD, including Surrey, Burnaby, Coquitlam, Port Coquitlam, Port Moody and New Westminster. At-risk regions were deemed as such based on the BC Atlas of Human Development which classifies all the regions in BC across various measures, displaying visual information relating to childhood development (Kershaw, Irwin, Trafford, & Hertzman, 2005). The Atlas uses an Early Developmental Index (EDI) that focuses on five different domains of functioning including: physical health and well-being, emotional maturity, social competence, language and cognitive development, and communication and general knowledge. These domains were scored by Kindergarten teachers in three different waves of testing. To determine

the most at-risk regions in the four areas of interest, each neighbourhood was ranked within each region according to their average scores across the five domains. We selected the bottom 25 percent of regions across Vancouver and the GVRD. Importantly, it was the neighbourhood, not the specific child or family, which was sampled in our study. As such, even though vulnerable neighbourhoods were identified and targeted, this sample still included families that varied in terms of development and functioning.

The community sample. Beginning in February 2009, a comparison group of children who attended daycares outside of the catchment area were recruited in the city of Vancouver, following the same procedure. These randomly selected neighbourhoods comprise our community sample (n= 39; 18.8 percent). In other words, recruiting took place in a random sample of neighborhoods ranked in the top 75 percent percentile of all neighborhoods in the city of Vancouver according to the EDI survey conducted by Kershaw et al. in 2005.

Procedures and Ethics

The present study is focused on the first wave of data. All interviews with participants were conducted between February 2008 and April 2010. An in-person, standardized, semi-structured interview was conducted with both the primary caregiver (usually the biological mother) and the child, simultaneously. The primary caregiver interview contained questions pertaining to pre- and neonatal events, the child's personality and behaviours, family dynamics, and the broader environment in which the child was raised (i.e., their neighbourhood characteristics). The child interview included IQ testing and a series of cognitive and behavioural tasks, related to self-regulation abilities, which is discussed in more detail below. On average, the entire interview process took approximately two and a half hours to complete. Both parent and child interviews were administered by trained graduate research assistants. The design of this study was approved through the ethical guidelines set forth by Simon Fraser University, the University of British Columbia and the BC Children's and Women's Hospital. Participation in the study was voluntary and the participants were informed that they could withdraw at any time. Participants were required to sign a consent form that acknowledged that they understood the collection of data was confidential and for research purposes only. After the completion of the interview, participants were compensated forty dollars for their participation in the study.

Instruments, Measures and Coding

Self-control. Self-control was measured by a revised version of the GLSC-S (1993). In the original version of the GLSC-S, the questions are worded so that older children and adolescents are asked to answer a series of attitudinal questions. The questions were not appropriately worded for a sample of preschoolers nor were the scoring for this age-group. Therefore, the items included in the GLSC-S were reworded so that the primary caregiver was asked questions about attitudes of her/his child. For example, the item “I often act on the spur of the moment without stopping to think” was reworded as follows: “he/she often acts on the spur of the moment without stopping to think”. Primary caregivers were requested to answer 24 questions regarding their children’s attitudes towards various issues, all relating to Gottfredson and Hirschi’s (1990) original six dimensions of self-control. Answers ranged from 1 (strongly disagree) to 4 (strongly agree). A higher score indicated that the child possessed a lower level of self-control, according to their primary caregiver’s responses. The scale reliability reported in the original developmental study of the GLSC-S by Grasmick et al. was .81. The 24-item scale reliability for the present sample was high (Alpha= .89) and in line with the one reported in past research.

Socio-demographics. Eight variables were selected as control variables, with the first four pertaining to the child’s socio-demographics: age, gender, sample and ethnicity. Age was coded as a continuous variable, ranging from three to five. Age was controlled for given that, even if the age band of this sample is quite restricted (3 – 5 years old), this period is pivotal for the development of self-control and we should expect significant differences between three, four and five years old in terms of their scores on the GLSC-S. This age effect is expected because children are still learning self-control skills and statistically controlling for this age-effect is necessary to account for the normal curve of development. Further, the child’s gender was also controlled for in statistical models: (0) male and; (1) female. It was controlled for given that there are known gender differences in this age group. Moreover, Gottfredson and Hirshi (1990) report that boys, compared to girls, typically have lower levels of self-control. Sample was coded as: (0) clinical; (1) community at-risk and; (2) community control. Comparing the three samples gave a unique opportunity to determine whether scores of the GLSC-S helped to identify a sample of children clinically-referred for an externalizing disorder. It also allowed determining whether children sampled from an at-risk neighbourhood were significantly different from lower-

risk neighbourhoods. It is expected that children in the clinical sample would show the highest scores on the GLSC-S among the three groups. It is also expected that children from the at-risk neighbourhood would show the second lowest level of self-control among the three groups given their exposure to a higher number of risk factors as opposed to children sampled from the community. Finally, we explored the possibility that there were cultural differences in low self-control in preschoolers given that parenting is crucial in the development of self-control and that there are significant cultural differences in parental practices, which could impact the development of self-control. For the purpose of this study, the child's ethnic origin ethnicity was coded as: (0) Caucasian; (1) Asian; (2) South Asian/East Indian; or (3) other or mixed ethnicity. Descriptive information about the sample is presented in Table 1. Table 1 indicates that this sample was fairly evenly split between male (n= 104) and female (n= 103) children. These children were predominantly Caucasian (n= 127), followed by a mixed origin (n= 34), Asian (n= 30) and South East Asian/East Indian background (n= 16). There were 84 three year olds, 85 four year olds and 38 five year olds. Most of these children came from our at-risk community sample (n= 150), followed by our community control sample (n= 39) and clinical sample (n= 18).

Table 1. Descriptive Information about the Sample (N= 207)

Indicators	x (sd)	Range	%
Child's age	3.78 (.74)	3 – 5	3 years old: 40.6 4 years old: 41.1 5 years old: 18.4
Child's gender			Male: 50.2 Female: 49.8
Child's ethnic origin			Caucasian: 60.4 Asian: 15.0 South East Asian/East Indian: 8.2 Mixed/Other: 16.4
Sample			Clinical referral: 8.7% At-risk community: 72.5% Community control: 18.8%

Intelligence. The final four control variables were related to domains of intelligence through use of the Reynolds Intellectual Assessment Scale (RIAS; Reynolds & Kamphaus, 2003). Children were assessed on their verbal intelligence, nonverbal intelligence and memory. A composite IQ score was also recorded, which was the combination of their verbal and nonverbal intelligence scores. Intelligence is important to self-control in that it is linked to executive functioning. For example, working memory is necessary for successful executive control as an individual needs to be able to focus on one specific task while ignoring extraneous stimuli. In our study, the children scored the highest on the nonverbal IQ domain ($x= 115.99$), followed by the composite domain (which was a combination of verbal and nonverbal assessments) ($x= 112.22$), verbal IQ domain ($x= 107.08$) and memory IQ domain ($x= 106.31$).

Sustained attention. Sustained attention is believed to be related to self-regulation as it has been linked to greater focus and attentiveness. This is particularly true when children need to focus on a particular task for a certain amount of time, thus blocking out distracting stimuli. The task used to assess this domain was entitled “what’s missing on this face” (Reebye, 1996). Information about the instrument is presented in appendix 1. The average number of positive responses children gave for this task was 4.36, whereas they provided, on average, 1.18 negative responses. The ratio between positive to negative responses was 3.70.

Motor control. Motor control or motor inhibition has been studied in the past in order to examine children’s capacity to control their fine and gross motor behaviours, including walking and drawing (Maccoby, Dowley, Hagen, & Degerman, 1965; Kochanska, 1993). Kochanska (1993) noted that intercorrelations between these two tasks would suggest that they are both measuring an inhibitory quality. Further, the current evidence proposes that fine and gross motor behaviours are related to the regions in the brain that manage behavioural inhibition or, self-control (Beaver et al., 2007). To examine motor control for this study, children were requested to engage in three distinct tasks: “walk-a-line”, a circle tracing exercise, and another tracing task entitled “take Johnny to the apple tree” (Reebye, 1996). Due to the multitude of motor control tasks, a scale was created with all 12 of the motor control variables. This scale had a Cronbach’s alpha of .85. Information about the instrument is presented in appendix 1. Scores for these tasks are as follows: for the “walk-a-line” assessment, children took, on average, 6.81 seconds to complete the baseline trial, 2.83 seconds to complete the fast trial, and 8.42 seconds to complete the slow trial. When looking at the “take Johnny to the apple tree” task, the children took, on average, 19.44 seconds to complete it, made just under one

error ($n = .88$) and typically had one of the indicators present on our 5-indicator scale ($n = .96$). Finally, when examining the circles tracing task, the children tended to take about 25.78 seconds to complete the baseline assessment, making about 1.38 errors. They took about 28.82 seconds to complete the slow trial, making about 1.58 errors, and about 11.13 seconds on the fast trial, making about 2.33 errors.

Impulse control. Impulsivity is believed to be a central component of self-control. As such, two behavioural activities were used to assess this trait in the children. The first task, “temptation task” (Kochanska, Murray, & Coy, 1997; Kochanska et al., 2000), gauged the child’s ability to delay gratification. The second task chosen to reflect this trait was a “tapping task”, originally devised by Luria (1966) to assess inhibitory difficulties in patients with frontal cortex damage, which was later used by Diamond & Taylor (1996) to examine the development of inhibitory control in young children, as the frontal cortex has been shown to change importantly during early childhood. A scale was created to simplify the interpretation of multiple impulse control variables. The impulse control scale consisted of four of the five impulse control tasks and had a Cronbach’s alpha of .71. Information about the instrument is presented in appendix 1. Looking more closely at the domain, children had a mean score of about 13.96 (out of 16) on the temptation task (with higher scores indicating a higher level of control). The tapping task showed that 58 percent of these children completed the practice trials correctly, took about 41.14 seconds to complete the task, scored 5.20 (out of 10) on the assessment (indicating about a 50 percent correct-response rate) and had about one indicator present on our 4-indicator assessment scale (.95).

Table 2. Indicator Descriptives (N= 207)

DEPENDENT VARIABLE	n	%	x (sd)	Range
Self-control score (GLSC-S)	207		60.49 (9.53)	26 – 93
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CHILD INDICATORS	n	%	x (sd)	Range
Antisociality score (APSD)	207		10.75 (4.65)	2 – 24
Physical aggression score – in past yr	207		3.05 (2.34)	0 – 9
Attention Deficit Hyperactivity Disorder score	207		9.03 (7.07)	0 – 32
Oppositional Defiant Disorder score	207		6.86 (4.91)	0 – 26
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IQ				
Verbal IQ index score	207		107.08 (20.55)	71 – 158
Nonverbal IQ index score	207		115.99 (20.77)	68 – 160
Composite IQ index score	207		112.22 (20.97)	69 – 160
Memory IQ index score	207		106.31 (22.07)	66 – 159

SUSTAINED ATTENTION

What's missing on the face – Number of positive responses	207	4.36 (1.74)	0 – 8
What's missing on the face – Number of negative responses	207	1.18 (1.16)	0 – 6
What's missing on the face – Ratio positive to negative responses	207	3.70	

MOTOR CONTROL

Motor control scale (12 items)	207	123.96 (57.70)	29.6 – 314.38
Walk the Line – Baseline trial time (in seconds)	207	6.81 (5.13)	1.83 – 43.05
Walk the Line – Fast trial time (in seconds)	207	2.83 (1.85)	0.94 – 17.83
Walk the Line – Slow trial time (in seconds)	207	8.42 (7.07)	1.13 – 59.84
Johnny apple tree – Time to complete (in seconds)	207	19.44 (10.82)	2.13 – 94.61
Johnny apple tree – Number of errors	207	0.88 (0.74)	0 – 3
Johnny apple tree – 5-Indicator scale	207	0.96 (1.16)	0 – 4
Circles – Baseline trial time (in seconds)	207	25.78 (23.26)	1.26 – 202.59
Circles – Baseline trial number of errors	207	1.38 (2.31)	0 – 8
Circles – Slow trial time (in seconds)	207	28.82 (24.62)	1.12 – 144.78

Circles – Slow trial number of errors	207		1.58 (2.40)	0 – 8
Circles – Fast trial time (in seconds)	207		11.13 (11.03)	1.41 – 83.21
Circles – Fast trial number of errors	207		2.33 (2.86)	0 – 8

IMPULSE CONTROL

Impulse control scale (4 items)	207		22.83 (6.47)	6 – 31
Tapping – Practice trials successfully completed				
No	87	42.0		
Yes	120	58.0		
Tapping – Time to complete (in seconds)	207		41.14 (12.03)	1.23 – 100.83
Tapping – Total score	207		5.20 (3.81)	0 – 10
Tapping – 4-Indicator scale	207		0.95 (1.19)	0 – 4
Temptation – Total score	207		13.96 (3.50)	0 – 16

COGNITIVE CONTROL

Simon Says – Total score	186		23.05 (6.27)	0 – 40
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Antisocial behaviours. Antisocial behaviours were gauged through use of the APSD (Antisocial Process Screening Device; Frick & Hare, 2001). The APSD asks primary caregivers to respond to various questions relating to their child's antisocial development, and examines three clusters of behaviour: callous/unemotional traits, narcissism and impulsivity. Primary caregivers responded using a three-point scale: (0) not at all true; (1) sometimes true; and (2) definitely true. A total score was created for each participant by summing the answers to the 20 questions. The APSD had an alpha of .74. The overall average score on the APSD scale among all three samples was 10.75 (ranging from 2 to 24). Looking more closely at the individual groups however, we can see that the community control sample scored the lowest on this scale (n= 9.05), followed by the community at-risk sample (n= 10.84), with the clinical sample, unsurprisingly, scoring the highest (n= 13.83), suggesting that they had the most antisocial indicators among samples.

Physical aggression. Childhood physical aggression was measured through use of part of the Multi-Dimensional Aggression Index (MDAI), which asks primary caregivers to respond to whether or not their child has exhibited various acts of physical and non-physical aggression. As a result, three items were chosen to create a scale of physical aggression: (a) kicked, bitten, or hit anyone; (b) shoved or pushed anyone; and (c) thrown things at other people. Primary caregivers were asked the frequency of these behaviours, exhibited by their child, in the past year using a four-point scale: (0) never; (1) a few times; (2) several times; and (3) very often. The total physical aggression scale had a Cronbach's alpha of .75. On average, most children were being physically aggressive relatively infrequently (n = 3.05; range of 0 to 9), although the frequency did vary from one behaviour to another being highest for pushing/shoving (n= 1.17; range 0 to 3) and kicking/biting/hitting (n= 1.15; range 0 to 3) and lowest for throwing things (n= .72; range 0 to 3).

ADHD & ODD. Child psychiatric indicators were assessed through use of the Conners Rating Scales – Revised: Long version (CRS-R: L; Conners, 1997). This 80-item questionnaire asks primary caregivers to respond to questions relating to their child's problem behaviour. It specifically examines ten clusters of behaviour: oppositional, cognitive problems/inattention, hyperactivity, anxious-shy, perfectionism, social problems, psychosomatic, Conners' global index, *DSM-IV* symptom subscales and an ADHD index. Primary caregivers responded using a four-point scale ranging from (0) not at all true; to (3) very much true. For the purpose of this study, two of the domains of problem behaviours were examined: oppositional

and ADHD index. Questions relating to each of these two domains were summed and a total score created for each. When examining the ADHD index, children were scoring, on average 9.03 (range 0 to 32) and 6.86 (range 0 to 26) on the oppositional index, suggesting that the children in our sample were showing similar rates of ADHD and ODD.

Analytical Strategy

Statistical Analyses. The aim of this study was to examine the relationship between overall levels of self-control and preschooler's performance on various self-regulation tasks. An associated aim was to examine levels of self-control while taking into consideration specific antisocial and aggressive child behaviours as well as psychiatric indicators. Therefore this process involved several steps. We first had to examine where differences between groups emerged. As such, we ran an independent samples t-test on gender to look for any existing differences between male and female children on all of our self-regulation variables, child behaviours, and psychiatric indicators. For our variables with more than two groups (e.g. age, ethnicity and referral group), we conducted a one-way ANOVA. For our ANOVA's, depending on whether the Levene's Test for Equality of Variances was less than .05, we would either interpret the Games-Howell or Tukey HSD post-hoc test. We used the Games-Howell when variances were unequal, and the Tukey when variances were assumed to be equal, as it has shown greater power than other tests in most circumstances. Next, a series of multiple regressions were done with: control variables, self-regulation variables, child behaviours and child psychiatric indicators. Second, the variables that came out significant after the initial regressions were put into various regression models to determine the most important predictors of low self-control in preschoolers.

Missing Data. Prior to the analyses, all missing values had to be identified and accounted for. As all the missing values were less than 5 percent (ranging from 1.0 percent - 4.3 percent), the method of mean substitution was used for continuous variables and mode substitution for categorical variables. The only variable that was missing more than 5 percent of values was the cognitive control task (Simon says task) which was missing 10 percent of values, due to its late addition into the research protocol. As such, this variable was analyzed with its original sample size of 186. Variables also had to be screened so that they would meet the assumption of normality. Outliers were present in all of the timed self-regulation tasks, which

accounts for about half of the overall tasks. These outliers were detected through z-score transformations of all of the scores for each task. Any score that was more than three standard deviations above the mean was altered, though the rank was preserved. As such, deviant scores were transformed into the next highest score. No outliers were deleted due to the relatively small sample size to begin with.

Descriptive Information. Before conducting a multiple regression, multivariate outliers were detected by examining the mahalanobis distance. Based on a cut-off of three standard deviations (after scores were standardized), two outliers were detected. Other assumptions of this technique were explored, to ensure that the data were appropriate for entry and analysis. To make certain that multicollinearity was not a problem, the variance inflation factor (VIF) and tolerance values were examined. All VIF values were substantially less than ten, which, as suggested by Stevens (2002), indicate that multicollinearity was not a problem. Tolerance scores were examined next, with all values being considerably more than .01, which, according to Meyers, Gamst, & Guarino (2006), further indicate that multicollinearity was not an issue. Finally, normal probability plots were investigated to confirm that errors were normally distributed. As the variables met the assumptions of this statistical technique, further analyses were performed. Skew and kurtosis were also evident for some variables (i.e., >1.00). As such, variables where skew and kurtosis were problematic were identified and transformed through log transformations. After transformations, these variables were in the appropriate range.

Chapter 4: Results

Descriptives of the Sample

In this section all the indicators included in the study were examined according to sociodemographic indicators to get a better picture of the sample used for this study. Hence, a series of analyses were conducted to inspect group differences in terms of age, gender, ethnic origin of the child as well as group differences in terms of sample the children belong to (clinical, at-risk, and community).

Children's Age. A one-way ANOVA was conducted to test for differences among three age groups of children with regards to performance on IQ and various self-regulation tasks. There were several significant effects which will be discussed in turn. Overall however, three of the four IQ tasks showed significant differences, nine of the twelve motor control tasks, four of the five impulse control, one of the two sustained attention tasks and the single cognitive control indicator were significant. At the $p < .05$ level, children differed with regards to nonverbal, composite and memory IQ. Post hoc comparisons using the Tukey HSD for nonverbal and composite IQ and the Games-Howell for memory IQ indicated that the mean score for three-year olds nonverbal scores ($M = 111.21$, $SD = 21.00$) significantly differed from four-year olds nonverbal scores ($M = 119.59$, $SD = 19.89$). This was also the case for composite IQ scores, with three-year olds ($M = 107.50$, $SD = 22.48$) scoring significantly lower than four-year olds ($M = 115.67$, $SD = 19.32$). Finally, significant difference were found between performance on memory IQ, with three-year olds ($M = 102.11$, $SD = 24.11$) scoring significantly lower than four-year olds ($M = 110.68$, $SD = 21.18$). Taken together, these results indicate that there are significant differences between three and four-year old children with regards to their performance on nonverbal, composite and memory IQ tasks.

Table 3. Task Indicators Bivariate Results

Indicators	Age	Gender	Ethnicity	Sample
SELF-CONTROL	F(2, 204)= 2.791, p<.10 3y.o. > 5y.o.*	M > F, t(207)= 2.572*	F= .841, p= .473	F= 2.338, p= .099
IQ				
Verbal IQ index score	F= 2.139, p= .120	M > F, t(207)= .636	F= 2.136, p< .10	F= 1.090, p= .338
Nonverbal IQ index score	F(2, 204)= 3.875, p< .05 3y.o. < 4y.o.*	M < F, t(207)= .364	F= .673, p= .570	F= .422, p= .656
Composite IQ index score	F(2, 204)= 3.686, p< .05 3y.o. < 4y.o.*	M = F, t(207)= .002	F= 1.797, p= .149	F= .350, p= .705
Memory IQ index score	F(2, 204)= 3.264, p< .05 3y.o. < 4y.o.*	M < F, t(207)= 1.784*	F= .548, p= .650	F(2, 204)= 3.689, p< .05 CC > CAR*
SUSTAINED ATTENTION				
What's missing on the face – Number of positive responses	F(2, 204)= 35.798, p< .001 3y.o. < 4y.o.***, 5y.o.*** 4y.o. < 5y.o.***	M > F, t(207)= .545	F= .579, p= .630	F= .876, p= .418
What's missing on the face – Number of negative responses	F=.454, p= .636	M < F, t(207)= 1.639	F= 1.379, p= .250	F= 2.217, p= .112

Circles – Baseline trial time (in seconds)	F(2, 204)= 13.363, p< .001 3y.o. < 4y.o.***, 5y.o.***	M < F, t(207)= 2.145*	F= 1.405, p= .242	F= .905, p= .406
Circles – Baseline trial number of errors	F(2, 204)= 15.131, p< .001 3y.o. > 4y.o.***, 5y.o.***	M < F, t(207)= .071	F(3, 203)= 3.887, p=.01 C > A***	F= 1.383, p= .253
Circles – Slow trial time (in seconds)	F(2, 204)= 23.285, p< .001 3y.o. < 4y.o.***, 5y.o.*** 4y.o. < 5y.o.*	M < F, t(207)= .299	F= 1.300, p= .275	F= .481, p= .619
Circles – Slow trial number of errors	F(2, 204)= 29.863, p< .001 3y.o. > 4y.o.***, 5y.o.*** 4y.o. > 5y.o.**	M > F, t(207)= 1.437	F(3, 203)= 4.514, p< .01 C > A**, S**	F= .935, p= .394
Circles – Fast trial time (in seconds)	F(2, 204)= 4.922, p< .01 3y.o. < 4y.o.*, 5y.o.*	M < F, t(207)= 1.356	F= 1.511, p= .213	F= .046, p= .955
Circles – Fast trial number of errors	F(2, 204)= 30.887, p< .001 3y.o. > 4y.o.***, 5y.o.*** 4y.o. > 5y.o.*	M > F, t(207)= 1.281	F(3, 203)= 4.067, p< .01 C > A**, S**	F= 1.112, p= .331
IMPULSE CONTROL				
Impulse control scale	F(2, 204)=29.212, p< .001 3y.o. < 4y.o.***, 5y.o.***	M < F, t(205) = .414	F= .963, p= .411	F= .627, p= .535

Tapping – Time to complete (in seconds)	F(2, 204)= 3.634, p< .05 3y.o. > 4y.o.*	M > F, t(207)= .819	F= .424, p= .736	F= .580, p= .561
Tapping – Total score	F(2, 204)= 39.277, p< .001 3y.o. < 4y.o.***, 5y.o.*** 4y.o. < 5y.o.*	M < F, t(207)= .328	F= .665, p= .575	F= .213, p= .808
Tapping – Practice trials successfully completed (yes=1/no=0)	F(2, 204)= 32.100, p< .001 3y.o. < 4y.o.***, 5y.o.*** 4y.o. < 5y.o.*	M > F, t(207)= .480	F= .130, p= .942	F= .741, p= .478
Tapping – 4-Indicator scale	F(2, 204)= 8.575, p< .001 3y.o. > 4y.o.*, 5y.o.*** 4y.o. > 5y.o.*	M > F, t(207)= 1.646	F= 1.594, p= .192	F(2, 204)= 4.507, p< .05 CC < CAR*, CI*
Temptation – Total Score	F= 2.183, p= .115	M > F, t(207)= .083	F= .859, p= .463	F= 1.327, p= .268

COGNITIVE CONTROL

Simon Says – Total score	F(2, 183)= 20.656, p<.001 3y.o. < 4y.o.**, 5y.o.*** 4y.o. < 5y.o.**	M = F, t(186)= .108	F= 1.211, p= .307	F= .115, p= .891
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p < .10+
p < .05*
p < .01**
p < .001***

LEGEND

3y.o. = 3 years old
4y.o. = 4 years old
5y.o. = 5 years old
M = male
F = female

C = Caucasian
A = Asian
S = South East Asian
M = Mixed ethnicity
CI = clinical sample
CAR = community at-risk sample
CC = community control sample

The first domain the children were assessed on was sustained attention, consisting of two tasks. Significant differences were identified between all three age groups at the $p < .001$ level by the Games-Howell post-hoc test for the number of positive responses given on the “what’s missing on the face task”. Three-year olds provided, on average, 3.37 (SD= 1.74) positive responses, four-year olds provided 4.74 (SD= 1.39) and five-year olds provided 5.68 (SD= 1.12) positive responses. When examining the motor control domain, significant differences were found on the majority of the tasks. Differences were found between three, four, and five-year old children with regards to the time they spent on the slow trial of the walk-a-line task. Games-Howell post-hoc comparisons of the three age groups indicated that the three-year olds took the least amount of time (M= 5.89, SD= 3.75), followed by the four-year olds (M= 8.80, SD= 5.75) and five-year olds (M= 11.67, SD= 7.12). Specifically, at the $p < .001$ level, three-year olds took less time than both the four and five-year olds. At the $p < .10$ level, four-year olds spent less time than five-year olds.

Children’s performance on Johnny apple tree task was examined next. Using the Tukey HSD post-hoc test, significant differences were found at the $p < .001$ level between three (M= 1.27, SD= .77), four (M= .66, SD= .59) and five-year old children (M= .50, SD= .56) with regards to the amount of errors they made during the task. Specifically, these differences were found between the three and four-year olds and the three and five-year olds. Next, using the Games-Howell post-hoc test, significant differences were found at the $p < .001$ level between three (M= 1.43, SD= 1.38), four (M= .67, SD= .84) and five-year olds (M= .58, SD= .86) with regards to their performance on various indicators gauged during testing. These differences were found between three and four-year olds and three and five-year olds, with the three-year olds consistently exhibiting more difficulties with the indicators that were assessed.

The next task that was examined was the circles tracing task. Significant differences emerged for each of the circle tasks. Significant differences were found between three, four, and five-year olds when examining the time it took to complete the task on the baseline trial. Tukey HSD post-hoc comparisons of the three age groups indicated that at the $p < .01$ level, three (M= 17.81, SD= 13.69) and four-year olds (M= 27.48, SD= 19.13) differed and at the $p < .001$ level, three and five-year olds (M= 33.75, SD= 18.71) differed. Using the Games-Howell post-hoc, significant differences were also found between the numbers of errors children were making on the baseline trial. At the $p < .001$ level, differences were found between three (M= 2.36, SD= 2.65) and four-year olds (M= .86, SD= 1.88) and three and five-year olds (M= .37, SD= 1.44).

Together, these results demonstrate that the younger the child, the least amount of time they take with the task, and the more errors they tend to make.

Next, time it took the children to complete the task during the slow trial was assessed, with significant differences emerging between the three groups. Results from the Games-Howell post-hoc indicated that at the $p < .001$ level, three ($M = 18.17$, $SD = 14.76$) and four-year olds ($M = 30.86$, $SD = 21.17$) and three and five-year olds ($M = 43.64$, $SD = 25.25$). At the $p < .05$ level, four and five-year olds differed with regards to time spent completing the task. When examining the number of errors the children made during the slow trial, significant differences emerged between the three groups. The Games-Howell post-hoc indicated that at the $p < .001$ level, three ($M = 2.93$, $SD = 2.85$) and four-year olds ($M = .86$, $SD = 1.66$) differed, as well as three and five-year olds ($M = .21$, $SD = .58$). At the $p < .01$ level, four and five-year olds differed significantly with regards to number of errors they were making. Similar to the results garnered during the baseline trial of this task, the younger the child, the less time they spent with the task, as well as the more errors they made during.

Finally, differences were found through the Tukey HSD post-hoc at the $p < .05$ level between three ($M = 8.43$, $SD = 7.81$) and four-year olds ($M = 11.85$, $SD = 10.08$) and three and five-year olds ($M = 13.38$, $SD = 9.47$) with regards to the amount of time it took to complete the task during the fast trial. When examining the amount of errors the children made during the fast trial, the Games-Howell post-hoc identified significant differences at the $p < .001$ level between three ($M = 3.94$, $SD = 2.93$) and four-year olds ($M = 1.55$, $SD = 2.41$) and three and five-year olds ($M = .53$, $SD = 1.64$). Significant differences were also found at the $p < .05$ level between four and five-year olds. Again, these results indicate that the younger the child, the more errors they made and the less time they took with the task.

In order to simplify the amount of variables within the self-regulation domains, scales were created. The motor control scale consists of all twelve of the motor control indicators, with a higher score on this scale suggesting a higher level of motor control. As would be expected given the previous findings, there were significant differences among the age groups. At the $p < .001$ level, the Games-Howell post-hoc identified differences between three ($M = 95.53$, $SD = 43.22$) and four-year olds ($M = 135.97$, $SD = 58.48$) and three and five-year olds ($M = 159.94$, $SD = 57.70$). At the $p < .10$ level, differences were seen between four and five-year olds, again, with the older children exhibiting higher levels of motor control.

The next self-regulation domain where significant differences emerged between age groups was with regards to impulse control. Specifically, the tapping task yielded significant results with regards to the time it took the children to complete the task, significant differences between three ($M=43.10$, $SD= 11.85$) and four-year olds ($M= 39.01$, $SD= 9.35$) at the $p < .05$ level were found through the Games-Howell post-hoc test. When looking at the total score of the children on this task, differences were found at the $p < .001$ level between three ($M= 2.82$, $SD= 2.91$) and four-year olds ($M= 6.52$, $SD= 3.47$) and three and five-year olds ($M= 7.53$, $SD= 3.47$) through the Tukey HSD post-hoc. The differences found between four-year olds and five-year olds were also significant at the $p < .10$ level. Next, differences between age groups regarding whether they were able to successfully complete practice trials of this task were found. At the $p < .001$ level, the Games-Howell post-hoc identified differences between three ($M= .30$, $SD= .46$) and four-year olds ($M= .72$, $SD= .45$) and three and five-year olds ($M= .89$, $SD= .31$). At the $p < .05$ level, differences were found between four and five-year olds. Finally, when examining a scale created to gauge various indicators during testing of this task, significant differences emerged between the age group. Using the Games-Howell post-hoc, differences were found at the $p < .05$ level between three ($M= 1.31$, $SD= 1.31$) and four-year olds ($M= .84$, $SD= 1.13$) and four and five-year olds ($M= .42$, $SD= .72$). At the $p < .001$ level, significant differences were found between three and five-year olds. Taken together, younger children tended to take more time to complete this task, score lower, be less likely to correctly complete the practice trials, and have more difficulties with the indicators gauged during testing.

As with the motor control domain, a scale was created with four of the five impulse control tasks. At the $p < .001$ level differences between age groups were examined through the Tukey HSD post-hoc. A higher score on this scale indicated a higher level of impulse control. Results were in the expected direction, with three-year olds ($M= 19.24$, $SD= 6.01$) scoring less on the overall scale than four ($M= 24.69$, $SD= 5.94$) and five-year olds ($M= 26.61$, $SD= 4.50$).

The final domain examined was the cognitive control domain, which consisted of the Simon Says task. Significant differences were found between the age groups through the Games-Howell post-hoc. Specifically, at the $p < .01$ level, differences were observed between three ($M= 20.83$, $SD= 3.35$) and four-year olds ($M= 23.29$, $SD= 6.31$) and four and five-year olds ($M=28.28$, $SD= 7.39$). At the $p < .001$ level, differences were observed between three and five-year olds. These results show that the younger the child, the weaker their level of cognitive control, as indicated by this task.

Gender. An independent samples t-test was conducted to compare male and female preschooler's performance on various IQ and self-regulation tasks. Males and females differed at the $p < .10$ level with regards to their memory, with females ($M = 109.04$, $SD = 22.85$) slightly outperforming males ($M = 103.60$, $SD = 21.03$). When assessing gender differences in the four domains of self-regulation (motor control, impulse control, sustained attention, cognitive control), differences emerged within the motor control domain. Specifically there was a significant difference at the $p < .10$ level in the scores for males ($M = 1.10$, $SD = 1.29$) and females ($M = .83$, $SD = .99$) with regards to their performance on indicators gauged during the Johnny apple tree task. A 5-item scale was created to reflect if the child had: proper pencil grip; if they were reluctant to engage in the task; if they impulsively started the task; and if they were able to talk during the task. Three other indicators were also assessed, though due to the lack of variance in the scores, they were combined to create a single indicator, with a child earning a score of one if one of the indicators was present, and zero if none were present. These three indicators were: ready to attempt the task; if they were frustrated with the task; and if they were able to complete the task. There were also significant differences ($p < .05$) with regards to the time it took males ($M = 22.05$, $SD = 15.59$) and females ($M = 27.39$, $SD = 19.93$) to complete the circles tracing task (baseline trial). Further differences emerged on the walk-the-line task (fast trial), with males taking significantly less time ($M = 2.57$, $SD = 1.11$) than females ($M = 2.85$, $SD = 1.29$) at the $p < .10$ level. Taken together, these results suggest that male preschoolers had a more difficult time with the indicators assessed during testing on the Johnny apple tree task than females. Further, male preschoolers tended to take less time on various motor control tasks than female preschoolers. No significant gender differences emerged with regards to performance on any impulse control, sustained attention or cognitive control tasks.

Ethnicity. A one-way ANOVA was conducted to test for differences among ethnicity of children with regards to performance on IQ and self-regulation tasks. There were no observable differences regarding performance on IQ testing or any impulse control, sustained attention or cognitive control tasks. Significant differences were only found between ethnic groups with regards to tasks relating to motor control.

When examining scores on the Johnny apple tree scale (as discussed above), the Games-Howell post-hoc identified differences between Caucasian children ($M = 1.10$, $SD = 1.27$) and South East Asian/East Indian children ($M = .29$, $SD = .59$) at the $p < .001$ level. Differences were also apparent at the $p < .05$ level with regards to Asian children ($M = .81$, $SD = .65$) and

South East Asian/East Indian children. Finally, at the $p < .10$ level, differences emerged between South East Asian/East Indian children and Mixed ethnicity children ($M = .94$, $SD = 1.18$). Overall, these findings indicate that Caucasian children had the most problems with the indicators gauged during testing of this task, whereas South East Asian/East Indian children had the least difficulties.

Other significant differences were found between ethnicity and the child's performance on the circles tracing task, specifically when examining the number of errors made on the various trials. When looking at the baseline trial number of errors, the Games-Howell post-hoc identified significant differences between Caucasian ($M = 1.78$, $SD = 2.62$) and Asian children ($M = .35$, $SD = .84$) at the $p < .001$ level. Next, the number of errors children were making on the slow trial of this task was assessed. The Games-Howell post-hoc found significant differences at the $p < .01$ level between Caucasian ($M = 2.02$, $SD = 2.66$) and Asian children ($M = .58$, $SD = 1.50$) and Caucasian and South East Asian/East Indian children ($M = .59$, $SD = 1.06$). Finally, significant differences were found between ethnic groups on the number of errors made during the fast trial of the task. At the $p < .01$ level, the Games-Howell post-hoc identified differences between Caucasian ($M = 2.79$, $SD = 2.93$) and Asian children ($M = 1.29$, $SD = 2.07$) and Caucasian and South East Asian/East Indian children ($M = .88$, $SD = 1.83$). These results indicate that Caucasian children consistently made more errors than other ethnic groups during a motor control task assessing ability to successfully trace around a circle.

Sample. To examine differences between types of referrals and performance on IQ and self-regulation tasks, a one-way ANOVA was performed between the three groups (clinical, community at-risk, community control). Nothing significant was observed between how the groups performed on the IQ tasks, sustained attention and cognitive control tasks. Differences did emerge between two motor control tasks and one impulse control indicator. As significant differences were found between the homogeneity of variances of groups, the Games-Howell post-hoc was used. Specifically, the clinical sample took significantly less time than the community at-risk and community control sample on the walk-a-line task (baseline and fast time trials). These differences were most apparent during the baseline trial, when children were not told to go fast or slow, simply to walk normally along the line. The children in the clinical sample ($M = 4.28$, $SD = 1.72$) went faster than children in the community at-risk ($M = 6.48$, $SD = 4.23$) and community control sample ($M = 8.52$, $SD = 5.49$) at the $p < .001$ level. Differences also emerged between the community samples, with the at-risk children going faster than the control children

($p < .10$). When examining the fast trial for walk-a-line, the clinical children ($M = 2.27$, $SD = .67$) went significantly faster than the community control children ($M = 3.43$, $SD = 1.76$) at the $p < .01$ level, and the community at-risk children ($M = 2.57$, $SD = .99$) went significantly faster than the community control children ($p < .05$). Finally, one impulse control indicator, the 4-item tapping indicator scale, came out significantly at the $p < .05$ level. Both clinical children ($M = 1.44$, $SD = 1.10$) and community at-risk children ($M = 1.01$, $SD = 1.25$) scored higher on this scale (indicating more impulsivity) than the community control children ($M = .51$, $SD = .86$).

Correlates of Low Self-control

The relationships between self-control and self-regulation variables were examined next. To begin, we split the self-regulation variables and the associated tasks into separate groups (e.g., all the motor control tasks together, all the impulse control tasks together, and both of the sustained attention tasks together). Then we examined the correlations between each individual task and the child's level of self-control to identify particular tasks that were most indicative of level of self-control. Based on this information, the tasks showing to be most strongly related to (and thus indicative of) low self-control, were combined into a multi-item scale for parsimony (given that the motor control and impulse control domain had the most variables associated with them, they were the two domains that we were able to create scales for).

The first domain to be considered was sustained attention. Of the two variables measured, one was significant at the $p < .01$ level. This was the 'what's missing on the face' indicator, number of positive responses given. It was shown that children who were lower in self-control tended to give fewer positive responses during the task than their higher in self-control counterparts. Next, the motor control domain was examined. Of the 12 indicators used to assess this domain, eight were deemed significant either at the .05 or .01 level. None of the walk a line trials (baseline, fast or slow) came out significantly, and nor did the time it took the child to complete the Johnny apple tree task. At the .05 level, circles (baseline trial time, baseline trial number of errors, slow trial time and fast trial number of errors) came out significant. At the .01 level, Johnny apple tree (number of errors, 5-indicator scale) and circles (slow trial number of errors and fast trial time) were significant. To simplify the amount of variables assessed, a motor control scale was created, consisting of the 12 indicators. Unsurprisingly, this scale was significant ($p < .01$), with low self-control children demonstrating

comparatively weaker motor control skills. Taken together, all results were in the expected directions, with children who were showing lower levels of self-control taking the least amount of time during the tasks and making the most errors.

The final self-regulation domain examined with regards to self-control was impulse control. Four of the five variables looked at were significant. At the .05 level, the temptation task score was significant, meaning children lower in self-control tended to be less able to delay the gratification of eating a candy before they were allowed. At the .01 level, all of the tapping task variables (except the time it took them to complete this task) were significant. Low self-control children thus tended to be less able to successfully complete the practice trials of this task, score lower overall and score higher on a 4-indicator scale used to assess impulsivity during the task. As with the motor control domain, a scale was created for this domain as well. This scale consisted of four of the five indicators and proved to be significant ($p < .01$) with children lower in self-control also having lower impulse control skills.

Table 4. Significant Relationships between Self-control and Self-regulation Domains

MOTOR CONTROL		IMPULSE CONTROL	
Motor control scale (12 items)	-.182**	Impulse control scale (4 items)	-.273**
Walk the line – Baseline trial time	-.033	Tapping task – Practice trials successfully completed	-.213**
Walk the line – Fast trial time	-.032	Tapping task – Time to complete	.048
Walk the line – Slow trial time	-.069	Tapping task – Total score	-.206**
Johnny apple tree – Time to complete	-.077	Tapping task – 4-Indicator scale	.282**
Johnny apple tree – Number of errors	.215**	Temptation task – Total score	-.153*
Johnny apple tree – 5-Indicator scale	.191**		
Circles – Baseline trial time	-.163*	SUSTAINED ATTENTION	
Circles – Baseline trial number of errors	.170*	What's missing on the face – Number of positive responses	-.190**
Circles – Slow trial time	-.171*	What's missing on the face – Number of negative responses	.114
Circles – Slow trial number of errors	.257**		
Circles – Fast trial time	-.220**		
Circles – Fast trial number of errors	.168*		

Significant relationships between self-control, control variables, child behaviour variables and child psychiatric indicators.

Next, levels of self-control were examined with regards to control variables, child behaviour variables and child psychiatric indicators. First, self-control was related to age, gender and sample type at the $p < .05$ level. Children having the lowest levels of self-control tended to be young (with three-year olds showing the lowest levels of self-control when compared with their five-year old counterparts), male and clinically-referred. No differences were observed regarding levels of self-control and ethnicity. Children lower in self-control also scored lower on all four IQ domains, but only at a significantly lower level with regards to memory ($p < .05$). Low self-control was also very strongly related to both antisociality ($p < .01$) and physical aggression ($p < .01$). Finally, those children lower in self-control also scored quite higher on our psychiatric indicators of ADHD and ODD ($p < .01$). Taken together, these findings reveal that young, male, clinically-referred children tend to be the lowest in self-control. To take the profile of low self-control further, these children tend to demonstrate more antisocial traits, be more physically aggressive, and score higher on assessments of ADHD and ODD.

Other significant relationships. The Pearson product-moment correlations for all the variables to be entered into the first multiple regression model can be found in Table 5. Aside from self-control, this includes the following variables: age of child, gender of child, ethnicity of child, sample type, verbal IQ, nonverbal IQ, composite IQ, memory IQ, sustained attention (two variables), motor control scale, impulse control scale, APSD score, physical aggression, ADHD score and ODD score. Significant associations found between these variables will be highlighted.

Age was positively related to nonverbal and composite IQ ($p < .05$), one sustained attention variable (what's missing on the face –positive responses) and both the motor control and impulse control scale ($p < .01$). These findings illustrate that the younger children in our sample have weaker, or perhaps less developed, nonverbal and composite IQ scores, compared with the older children. The younger children also provided less positive answers for the sustained attention task and scored less than the older children on the motor and impulse control scales, suggesting that these skills improve with age. Gender was significantly related to physical aggression ($p < .05$) and ADHD scores ($p < .01$), with males exhibiting higher levels of both. Ethnicity was shown to be related to several indicators at the .05 level. Non-Caucasian

children tended to perform less well on both the verbal and composite IQ tasks, though this may be explained through the fact that English was not the only language that many non-Caucasian's knew. Non-Caucasians also tended to have more antisocial traits. However, compared with Caucasian children, non-Caucasians had better motor control and were less physically aggressive. Finally, the clinical sample provided fewer negative responses on the sustained attention task than the community sample (though this may be due to lower verbal abilities demonstrated by the clinical sample). The clinical sample of children also scored significantly higher on our measure of antisocial traits, frequency of physical aggression, ODD scores ($p < .01$) and ADHD scores ($p < .05$).

Other noteworthy associations were found between domains of the child's IQ. Children exhibiting the highest verbal skills also tended to exhibit the highest nonverbal, composite, and memory skills ($p < .01$). In fact, all of these four IQ domains were highly correlated with each other at the $p < .01$ level. Further, all four domains of IQ were significant at the .01 level with regards to a sustained attention task (what's missing on the face – positive responses) and impulse control. This means that performing well on any of the four IQ domains is positively related to sustained attention as well as having strong impulse control skills. At the .05 level, verbal IQ, composite IQ and memory were all related to APSD score, with children performing well on these tasks showing fewer antisocial traits. The only link IQ showed with an increase in motor control was through memory at the .05 level. The motor control scale was also significantly related to the impulse control scale ($p < .01$) with children who had high motor control skills tending to also have high impulse control skills. This indicates that motor controls and impulse controls are closely linked to each other.

Next, children who showed the most antisocial characteristics also were the most physically aggressive ($p < .01$) and low in impulse control ($p < .05$). It is unsurprising that children scoring lower on the impulse control scale would score higher on the APSD in particular, as both scales are tapping an element of impulsivity, though the impulse control scale captures this element in a behavioural way through the child directly, whereas the APSD captures this element through the primary caregivers responses. Final correlations were observed at the $p < .01$ level between a sustained attention task (what's missing on the face – positive responses) and both motor and impulse control. In essence, all three measured domains of self-regulation were highly associated with each other, meaning children generally performed similarly across domains.

Finally, children scoring higher on our measure of ADHD tended to provide more negative responses during a sustained attention task ($p < .05$), had lower motor control ($p < .05$) and lower impulse control ($p < .01$). A higher score on our measure of ODD did not show to be significantly related to domains of self-regulation. The most significant and strong relationships with these two psychiatric indicators were found between each other, and the two child behaviour indicators of APSD and physical aggression ($p < .01$).

Table 5. Intercorrelations for Self-control, Control Variables, Self-regulation, Child Behaviours, and Psychiatric Indicators

VARIABLES	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. Self-control score	----																
2. Age	-.152*	----															
3. Gender (0 = male)	-.169*	-.084	----														
4. Ethnicity (0 = Caucasian)	.012	.111	.062	----													
5. Sample (0 = clinical)	-.139*	-.024	.133	-.031	----												
6. Verbal IQ	-.094	.128	-.042	-.171*	.030	----											
7. Nonverbal IQ	-.062	.158*	.027	-.095	-.063	.529**	----										
8. Composite IQ	-.083	.158*	.002	-.158*	-.012	.882**	.859**	----									
9. Memory IQ	-.173*	.100	.126	.031	.006	.478**	.281**	.435**	----								

10. Sustained attention – what's missing (+)	-.190**	.506**	-.039	-.039	-.016	.397**	.384**	.441**	.267**	----							
11. Sustained attention – what's missing (-)	.113	-.050	.116	-.095	.140*	.032	-.029	.008	-.005	-.118	----						
12. Motor control scale	-.183**	.430**	.091	.154*	.102	.159	.042	.116	.155*	.294**	-.135	----					
13. Impulse control scale	-.268**	.453**	.022	-.013	.074	.339**	.198**	.316**	.203**	.441**	-.038	.443**	----				
14. APSD score	.636**	.018	-.092	.142*	-.203**	-.165*	-.081	-.143*	-.169*	-.120	.034	-.089	-.158*	----			
15. Physical aggression – past year	.490**	.085	-.177*	-.154*	-.205**	.048	.052	.059	-.056	.103	.018	-.103	-.122	.438**	----		
16. ADHD score	.655**	-.050	.168**	-.035	-.155*	.012	.017	.017	-.125	-.125	.174*	-.154*	-.221**	.588**	.496**	----	
17. ODD score	.630**	.015	-.130	-.127	-.213**	.017	.030	.031	-.132	-.062	.117	-.108	-.128	.641**	.609**	.746**	----

Multivariate Results: Predicting Low Self-control

Multiple regression. Multiple linear regression was used to develop various models to predict low self-control in preschoolers from various combinations of indicators including: age, gender, ethnicity, sample type, verbal IQ, nonverbal IQ, composite IQ, memory, sustained attention variables, motor control scale, impulse control scale, APSD, physical aggression, ADHD scores and ODD scores. Essentially two models were examined, based on the results of a series of preliminary models. The final two models consisted of: age, gender, memory, and the impulse control scale; and age, gender, memory, impulse control scale, APSD, physical aggression, ADHD scores and ODD scores. All these predictor variables were regressed on the criterion variable of low self-control. Both models will be discussed in turn.

The first step was to conduct a series of preliminary multiple regression models using the stepwise and enter method to determine which variables to include in the final set of models. The stepwise method of selection was utilized due to the multitude of control variables that were available for analysis. The first model included the eight control variables of age, gender, sample type, ethnicity, verbal IQ, nonverbal IQ, composite IQ and memory. Significant predictors included age ($\beta = -.152$, $p < .05$), gender ($\beta = -.165$, $p < .05$), and memory ($\beta = -.137$, $p < .05$). The model was significant ($F 3, 201 = 5.40$, $p = .001$) and was able to account for 6 percent of the total explained variance in low self-control.

The next three models were created using the enter method. The first model included two sustained attention variables, the motor control scale and the impulse control scale. The impulse control scale came out significant ($\beta = -.208$, $p < .05$) and the model was significant ($F 4, 200 = 4.92$, $p = .001$) with an adjusted R square of .07. The second model conducted used both the APSD ($\beta = .521$, $p < .001$) and physical aggression scores ($\beta = .261$, $p < .001$). Both of these proved to be significant predictors with regards to the prediction of low self-control. This model was significant ($F 2, 202 = 85.79$, $p < .001$) with a large increase in the adjusted R square at .45. The third model

included the two psychiatric indicators, ADHD and ODD scores. When regressed on low self-control, both of these variables were significant (ADHD scores; $\beta = .418$, $p < .001$; and ODD scores; $\beta = .319$, $p < .001$) and the model was significant ($F(2, 202) = 91.19$, $p < .001$) with an adjusted R square of .47.

The next step was to combine all the significant predictors into two final models: the first including only significant control and self-regulation variables, and the second including significant control and self-regulation variables along with child behaviour and psychiatric indicator variables. Model one was therefore conducted using the enter method, and included age, gender, memory and the impulse control scale to predict low self-control. This model was significant ($F(4, 200) = 6.25$, $p < .001$) and was able to account for 9% of the total explained variance in low self-control. Significant variables included gender ($\beta = -.156$, $p < .05$) and the impulse control scale ($\beta = -.218$, $p < .01$). Model two used the variables from the first model and added child behaviour (APSD, physical aggression) and psychiatric indicators (ADD, ODD). With the addition of these four variables, neither gender nor the impulse control scale was significant, but age became significant again ($\beta = -.133$, $p < .05$). That said, the most obvious contributors to this equation were the APSD score ($\beta = .321$, $p < .001$) and the ADHD score ($\beta = .281$, $p < .001$). Physical aggression was also significant ($\beta = .129$, $p < .05$). With the inclusion of these three variables, the adjusted R square moved from .09 to .56 and the model remained significant ($F(8, 196) = 33.43$, $p < .001$).

A final model was then created to predict low self-control. All significant variables from the previous models were used in the prediction. The variables that came out significant from the final model are presented in Table 7. The final model thus includes the significant variables of age ($\beta = -.161$, $p = .001$), gender ($\beta = -.107$, $p < .05$), APSD score ($\beta = .439$, $p < .001$), physical aggression score ($\beta = .207$, $p < .001$) and ADHD score ($\beta = .226$, $p < .001$). The previous significant predictors of memory, impulse control scale, and ODD score were no longer significant, when taking into account the other variables. The final model thus had an adjusted R square of .528 and was significant $F(5, 199) = 46.57$ ($p < .001$).

Table 6. Multiple Regression Models Predicting Low Self-control (N= 205)

All Indicators	Significant Predictors	Model Summary
<p>1. Control variables (stepwise method)</p> <p>Age</p> <p>Gender</p> <p>Ethnicity</p> <p>Sample</p> <p>Verbal IQ</p> <p>Nonverbal IQ</p> <p>Composite IQ</p> <p>Memory</p>	<p>Age ($\beta = -.152, p < .05$)</p> <p>Gender ($\beta = -.165, p < .05$)</p> <p>Memory ($\beta = -.137, p < .05$)</p>	<p>Adjusted R square = .061</p> <p>F(3, 201) = 5.40 (p=.001)</p>
<p>2. Self-regulation variables</p> <p>Sustained attention – what’s missing on the face (+)</p> <p>Sustained attention – what’s missing on the face (-)</p> <p>Motor control scale (k=12)</p> <p>Impulse control scale (k=4)</p>	<p>Impulse control scale</p> <p>($\beta = -.208, p < .05$)</p>	<p>Adjusted R square = .071</p> <p>F(4, 200) = 4.92 (p=.001)</p>

<p>3. Child behaviour variables</p> <p>APSD score</p> <p>Physical aggression score</p>	<p>APSD score</p> <p>($\beta = .521, p < .001$)</p> <p>Physical aggression score</p> <p>($\beta = .261, p < .001$)</p>	<p>Adjusted R square = .454</p> <p>F(2, 202) = 85.79</p> <p>($p < .001$)</p>
<p>4. Child psychiatric indicators</p> <p>ADHD score</p> <p>ODD score</p>	<p>ADHD score</p> <p>($\beta = .418, p < .001$)</p> <p>ODD score</p> <p>($\beta = .319, p < .001$)</p>	<p>Adjusted R square = .469</p> <p>F(2, 202) = 91.19</p> <p>($p < .001$)</p>

Table 7. Final Multiple Regression Model of Significant Predictors of Low Self-control

Significant Predictors	Model Summary
Age ($\beta = -.161, p = .001$)	Adjusted R square = .528
Gender ($\beta = -.107, p < .05$)	F(5, 199) = 46.57 ($p < .001$)
APSD score ($\beta = .439, p < .001$)	
Physical aggression score ($\beta = .207, p < .001$)	
ADHD score ($\beta = .226, p < .001$)	

Chapter 5: Discussion

Gottfredson and Hirschi's (1990) *A General Theory of Crime* generated considerable interest and associated empirical research since its inception. One of the core components to come out is the concept of low self-control, and its relationship to crime. A feature of the general theory of crime is that it is intended to explain not only criminal acts, but also general deviance (referred to as "analogous acts"). While studies examining factors associated with low self-control in adulthood have been heavily researched in the past decade, no work has empirically examined this question at the earliest stage of development, leaving it a neglected area of study. To that end, we examined the onset of self-control in an ethnically diverse, Canadian sample of both clinical and community-based boys and girls. This was done in order to shed light on the distinct characteristics that differentiate children who have difficulty controlling aggressive tendencies with those who successfully regulate their behaviour. Given that this period of early childhood is marked by significant developmental changes, it was unclear if we would find any meaningful associations between self-control and aggression/antisociality.

Low Self-Control and Socio-Demographic Characteristics

Findings from our study indicate that levels of self-control significantly increase with age. The findings are of interest given the limited age range of children included in the study as participants were all between 3 and 5 years old. Hence, in spite of such a short age band, developmental changes were captured by the analyses conducted. More specifically, the three year old children in the sample showed the lower levels of self-control over their emotions and behaviours when compared to the four and five year olds. This is consistent with past research that states that self-control does not fully mature until later childhood or adolescence (Bronson, 2000; Demetriou, 2000). Hence,

while the study findings are in line with prior studies, we cannot preclude that something more specific might be at play here. It could also be that the three years old were actually different in some specific ways than the four and five years old which might explain their lower scores on the self-control scale. Indeed, aside from exhibiting lower levels of self-control, the younger children also had weaker nonverbal and composite IQ scores. Important to note is that the IQ test utilized, the Reynolds Intellectual Assessment Scale (RIAS; Reynolds & Kamphaus, 2003), takes into account the developmental stage of the child at the time of assessment. Though these measures of IQ were not shown to be linked to LSC, we did find that a weaker memory score did have an association ($p < .05$). Further, Blair, Zelazo & Greenberg (2005) state that working memory (along with planning, inhibition of prepotent responding, and shifting and sustaining attention) falls under the broad context of 'effortful control' which involves executive functioning that is integral to self-regulation (as cited in Zhou et al., 2007). This could be related to structural changes in the brain due to normal maturation. In fact, we found that younger children had a weaker ability to hold or sustain their attention, which is also associated with memory ability. Specifically, in a task where children had to focus their attention for one straight minute and come up with features found on a human face, older children were able to successfully name more features ($p < .01$). We therefore cannot eliminate the possibility that the three year olds were actually different in cognitive skills than the four and five year olds, as indicated by their lower scores on these measures, which could explain their lower levels of self-control.

The study findings also indicate significant differences in self-control between boys and girls. The analyses conducted demonstrate that boys have significantly lower levels of self-control than girls at the same age. This finding is in line with past research that suggests gender differences in self-control in children. For example, Kochanska et al. (2000) found that girls scored higher than boys at 22 and 33 months of age on multiple measures of effortful control, indexed by behavioural tasks (i.e., ability to delay gratification, slow motor activity, direct attention). Similarly, Stifter and Spinrad (2002) reported that girls tended to be better self-regulators than boys, as did Murphy et al. (1999) who found that parents rated girls higher than boys on three measures of self-regulation (attention shifting, behavioural regulation, inhibition control). Finally, Raffaelli

et al. (2005) found that girls had higher levels of self-control than boys at three time points in childhood (i.e., ages 4 – 5, ages 8 – 9, and ages 12 – 13). Our findings are thus in line with past research, and help to add to this growing body of literature.

Another important aspect that was analyzed is the ethnic origin and possible presence of cultural differences in levels of self-control in preschoolers. This aspect was particularly relevant to this study considering the large proportion of non-Caucasians who took part in the study, mainly Asians and South East Asians. These two ethnic groups have been rarely examined with respect to the development of self-control in children. Interestingly, the analyses did not reveal any significant differences in self-control across the ethnic groups examined. In other words, Caucasians had similar levels of self-control to Asian and South East Asian children at the same age. These results somewhat contrast to those observed in prior studies. For example, Vaughn et al. (2009) found severely impaired kindergarteners (i.e., possessing various neurocognitive deficits, behavioural issues and learning problems) were more likely to be non-Caucasian, though they did not provide a specific breakdown of how different ethnic groups scored. That said, the ECLS-K has data on African-Americans (approximately 15 percent of the sample), Hispanics (approximately 15 percent), Asian/Pacific Islanders (approximately 8 percent), Native Americans (approximately 2 percent) and “other” or “unknown” (approximately 2 percent). However, Vaughn et al. (2009) did not differentiate between non-Caucasians, so they could not make conclusions about specific ethnic groups. They did offer that most severely impaired male, non-Caucasian children were likely to face more physical punishment, less affection and involvement from parents and live in a more stressed family environment though, when compared with their Caucasian counterparts. As such, studies like these who did observe more obvious ethnic differences in self-control may be inconsistent across studies as they could be reflecting different levels of socio economic status reflecting different environmental settings rather than stable differences.

We did find some ethnic differences with regards to verbal and composite IQ scores, with Caucasian children displaying higher scores on these measures, though the associations were low (.17 for verbal and .16 for composite). A possible reason for this

finding however may be explained through the fact that non-Caucasians often speak other languages, which they may speak in the home, thus having more difficulties expressing themselves verbally at English-speaking preschools.

Overall, we did not find many differences between our ethnic groups of Caucasian, Asian, South Asian and Mixed ethnicity. The only specific differences we found between ethnic groups were on some measures of motor control. That said, the only consistent finding was that Caucasian children tended to make more errors on a tracing task than Asian and South East Asian children on the baseline, fast and slow assessment. The other finding was that South East Asian children had the least difficulty with the behavioural indicators made during the testing of the Johnny Apple Tree task (including readiness to attempt task, reluctance to listen to instructions, impulsive start, ability to talk whilst drawing and frustrations during the task), whereas the Caucasian children had the most difficulties ($p < .001$).

Behavioural Indicators

Our findings indicate that children with lower levels of self-control had higher scores on both the APSD and physical aggression scale. This means that manifestations of LSC were not limited to only one domain of behavioural problems. In accordance with this finding, Feldman and Weinberger (1994) found that preadolescent boys' levels of self-control predicted their engagement in delinquent behaviour (i.e., drug and alcohol use, theft) four years later. This finding is further supported by Vazsonyi et al. (2001) who used the GLSC-S in Hungary, the Netherlands, Switzerland and the United States. Their findings were able to account for ten to sixteen percent of variance in adolescent antisocial behaviour. Tittle and Botchkovar (2005) had similar findings in a Russian sample. To further extend the findings culturally, DeKemp et al. (2009) found that LSC was related to physical aggression and delinquency in a normal sample of Dutch adolescents, aged eleven to fourteen. Finally and most closely related to our findings, Vaughn et al. (2009) found that kindergarteners, who had neurocognitive deficits and behavioural issues, showed the most acting out behaviours, such as arguing and fighting.

Aside from the significant link between LSC and APSD and physical aggression score, we found that the children most likely to be physically aggressive were Caucasian boys. As such, the non-Caucasians in our sample were less physically aggressive. This may be explained by different conflict resolution strategies, as ethnic differences on levels of physical aggression have been widely reported (e.g., Côté et al., 2006; NICHD, 2004). That said, the findings have not been consistent across studies (for example, socio-cultural differences in parenting across ethnic and racial groups have been well documented; see Quintana et al., 2006). To extend this finding, non-Caucasians may be less likely to expose their child, early on, to other children by relying on the extended family rather than daycare, thus reducing peer-age interactions and opportunities for physical aggression at the earliest stages.

We also found that the more physically aggressive children were similar, but also different, to those with higher scores on the APSD. The more physically aggressive children are the ones with more antisocial behaviours, so they are similar in terms of their level of self-control. They are also more likely to be in the clinical sample. However, in terms of differences, the antisocial children are more likely to be non-Caucasian, either male or female (therefore no gender differences emerged) and to score lower on a verbal and composite measure of IQ. The profile of the physically aggressive child is different; these children are more likely to be Caucasian and male, with no significant differences in IQ. This may suggest that there are two distinct groups of preschoolers presenting with LSC. The first group may consist of children whose LSC manifestations could be part of a clinical picture, which includes decreased cognitive abilities. The second group may be more reactive to aggressive and emotional states and may be more likely to escalate to physical aggression when angry or frustrated. These two pathways can be likened to the findings of Dodge and Coie (1987), and further developed by Keenan and Shaw (2003) who discussed two pathways to aggression, the first being a proactive one, and the second a reactive one. The proactive pathway consists of antisocial behaviour displayed in order to achieve a specific antisocial goal (such as lying in order to deceive), whereas the reactive pathways consists of antisocial behaviour exhibited as a response to an event.

Psychiatric Indicators

Children with the lowest levels of self-control had higher scores on our measure of both ADHD and ODD. ADHD and ODD were measured using the Conners Parent Rating Scale, which is a tool designed to measure psychiatric symptoms in children. Associations found between high ratings on the Conners, with lower scores on the GLSC-S (our indicator of LSC) is interesting because the GLSC-S was not designed for preschoolers and was also not designed to measure psychiatric symptoms. However, we still found significant associations between the Conners and the GLSC-S, which suggests that the scores on the GLSC-S tap into clinically relevant symptoms of LSC, in children as young as three. Also, ADHD and ODD were strongly correlated; that is, children with more symptoms of ADHD also had more symptoms of ODD (.75). Part of the commonality between these two clinical dimensions may be poor self-control, as measured by the GLSC-S (.60+). What they may have in common is that these children are poorer at controlling their behaviours (i.e. difficulty paying attention or respecting rules to the point where they may become defiant).

The manifestations of LSC are associated with several risk factors linked with the early onset of juvenile delinquency (as ADHD and ODD are predictive markers of juvenile delinquency). As noted by Vaughn et al. (2009, p. 17, as cited in Fishbein, 2000) the reason that LSC is linked and intertwined with so many behaviours is that “focused concentration, planning, goal pursuits, and adaptive inhibition of problematic and ultimately unsuccessful behaviours are key elements of effective self-governance”.

Our findings revealed that clinically-referred children had significantly lower levels of self-control than our community sample. These results are not surprising given that children referred to the clinic are done so due to exhibiting various externalizing problems. These problems would include LSC, which manifests in their externalizing behaviours. Further, LSC is strongly related ($p < .01$) to ODD, ADHD, physical aggression and antisociality. However, this association was quite small (.139), meaning that although clinical children are significantly lower on levels of self-control, it is not by that much. This finding could suggest that the GLSC-S cannot fully measure the clinical differences between samples, especially at this age. On the other hand, it could also

mean that we have a significant group of community children who have similar levels of self-control on the GLSC-S as the clinical children. If so, then there are children with LSC who are not necessarily being referred for assessment or treatment that they may benefit from.

Implications

Most studies in criminology have neglected to focus on the early childhood period, opting instead to research youth and adolescents. Conversely, most studies in child psychiatry have focused on the period of early childhood. Importantly, the observations that criminologists make in adolescents, can often be observed in younger age periods, and the observations that child psychiatrists make in early childhood may be able to extend to explain crime and delinquency down the road. Unfortunately, there is a lack of communication between disciplines. A goal of this study was to highlight this disparity and begin to link the work in the field of child psychiatry to criminology. For example, whereas child psychiatry focuses on the development of physical aggression, criminology focuses on the development of crime and delinquency. However, both types of research emphasize the importance of the role of self-control. It is thus important that criminology makes steps to become more grounded in clinical work at the earliest developmental stage.

Limitations

The current study has several limitations. The data on the child's behaviours and psychiatric indicators were obtained from self-report interviews with the primary caregiver. Consequently, some behaviours or attitudes exhibited by the child could have been overlooked, minimized or unobserved by the primary caregiver. Though the use of a single informant is not the most advantageous, it is fairly typical for studies that utilize a preschool-aged sample. Other studies have suggested that the primary caregiver is a reliable source (e.g., Kerr, Lunkenheimer, & Olson, 2007). The sample of children was also relatively small and contained only Canadian children in the province of British

Columbia. Our findings therefore may not be able to generalize to other, non-Canadian populations. Further, though a short recall period was utilized in order to minimize poor memory recall, the current study was based on retrospective longitudinal data. The findings of this study should therefore be seen as exploratory and results should be interpreted in accordance.

Chapter 6: Conclusion

Typically, the field of criminology has limited the scope of its investigation to the adolescent period. However, by looking at the earliest years of development, a more complete picture of the road to aggression and antisociality is able to come to light. As such, different factors are able to be assessed at different developmental stages. When looking for the true age of onset for various maladaptive behaviours, our findings suggest that they appear to be present among preschool-aged children. Future research should examine the developmental unfolding of self-control and the different ways it could manifest between gender and ethnic groups at different points in time. As suggested by Vaughn et al. (2009), future research should pay more attention to how self-control develops during childhood to look at ways that childhood psychopathology can turn into adolescent delinquency and violence. They note the importance of this line of inquiry, given that, as noted, the majority of research has focused on the adolescent years. This study has thus taken a first step into trying to understand the multifaceted way in which self-control manifests and can be related to various maladaptive outcomes at the earliest stages.

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Appendices

Appendix A.

Instrument Guide

Domain	Instrument Name	Procedures	Coding
Cognitive Control	Simon Says_(Kochanska, Murray, & Coy, 1997)	The child was to perform the movement that was verbally requested and demonstrated by the interviewer, but only if the command had been preceded by the phrase "Simon says"; otherwise, the child was to remain immobile. Practice trials (3) to ensure child understands. 20 real trials commence, no feedback given during testing. Reliability for 10 cases (kappa) has been shown to be .93 (Kochanska, Murray, & Coy, 1997).	For "Simon Says" commands: 2 = child correctly completes the command (DONE); 1 = child starts the specified movement and then stops him/herself before completing the command (PART); 0 = child fails to complete the command (NONE). For commands without "Simon Says": 2 = child does not do anything (NONE); 1 = child starts movement and then stops him/herself from completing the command (PART); 0 = child completes the command or some other movement (DONE). The scores were then summed.
Motor Control	Walk-a-Line-Slowly (Maccoby, Dowley, Hagen & Degerman, 1965)	This task is a modified version of Maccoby, Dowley, Hagen, & Degerman (1965) task, and later adapted by Olson, Bates, & Bayles (1990) and Kochanska et al. (2000). The child was asked to walk carefully along a 6-foot long line at various speeds, including: normal, fast, and slow. The test-retest reliability of the scores under the "slowly" instructions has been shown to be .81 (Maccoby, Dowley, Hagen, & Degerman, 1965).	Each trial was timed, and the number of tries it took the child to complete the task was recorded.
	Circle Drawing Activity (Kochanska et al., 1997; Kochanska et al., 2000*)	This task is a modified version of Kochanska et al.'s (1997; 2000) circle activity where children had to trace a template of a circle at various speeds, including: normal, fast, and slow. Further, children were explicitly told to try and stay on the line as best they could to avoid errors.	Each trial was timed, the number of tries it took the child to complete the task was recorded, and errors were counted. Errors scores were bounded on a scale of 0 – 8, with 0 signifying that the child completed the task errorless, and 8 being the maximum number of errors a child could receive.

	Take Johnny to the Apple Tree (Reebye, 1996)	A drawing of a tree and a stick figure, and a path between them is shown to the child. The child is asked to draw a line between the two outer edges of the path to "take Johnny to the apple tree". They were further instructed to stay within the path as best they could. Additionally, a question was asked to the child while he/she is doing the task to assess his/her ability to talk while engaged in the task. QUESTION: "Is Johnny walking or running down this path".	The children were timed during this task, and errors were coded as follows: (0) no mistakes; (1) minor mistakes or departures from the path; (2) major mistakes or departures from the path and; (3) the child did not understand or could not complete the task. observations are made and coded as follows: (a) child's handedness; (b) ability to hold the pencil: yes/no; (c) readiness to attempt the task: yes/no; (d) reluctance to listen to instructions: yes/no; (e) impulsive start: yes/no; (f) completion of task: yes/no; (g) child's ability to talk whilst drawing: yes/no; (h) child's frustrations during the task: yes/no.
Impulse Control	Snack Delay (Kochanska et al., 2000)	A clear cup was placed over a candy, and the child was instructed that they may only eat the candy when the interviewer rang a bell. There were four trials of varying length (10, 30, 15, and 20 seconds), and halfway through each trial, the interviewer raised their hand over the bell as if they were going to ring it. The bell was only rung however at the completion of the time, not at the halfway point.	Children were scored as follows, based on their ability to delay: (1) ate the candy before the bell was rung; (2) touched the cup or bell before the interviewer raised their hand; (3) touched the cup or bell after the interviewer raised their hand and; (4) waited until the bell was rung before eating the candy. Reliability has been shown to be 1.00 for the touching codes (Kochanska et al., 2000) and test-retest reliability obtained for a similar task on an independent sample of 12 children attending a local preschool (M age = 37 months) and tested twice over a 4-week interval was as follows: impulsive responses, $r = .81$, $p < .002$; good delays, $r = .81$, $p < .002$; correct responses, $r = .64$, $p < .025$ (Campbell, Szumowski, Ewing, Gluck & Breaux, 1982).
	Tapping Test (Diamond & Taylor, 1996 – devised by Luria, 1966)	This task is a modified version of Diamond & Taylor's (1996) task which involves the child tapping (a wooden spoon) once when the interviewer tapped twice, and	The child earned a score of: (0) incorrect, or; (1) correct. This task was timed and various other indicators were scored dichotomously including: whether the child needed

		tapping twice when the interviewer tapped once. The children were provided verbal instructions as well as practice trials. Once practice trials had been completed (successfully or not), ten real trials are commenced	redirection more than once; whether the child used the tapper for purposes other than the task; whether the child hit or tried to hit the furniture or floor with the tapper; and whether the child hit or tried to hit the interviewer with the tapper.
Sustained Attention	What's Missing on this Face? (Reebye, 1996)	The child was directed to a blank "face" on paper that consisted of only a circle for the face and a smaller circle inside, for the eye. The interviewer instructed the child that they had one minute to verbalize everything that was missing on the face. The interviewer proceeded to draw everything that the child listed, whether it was correct or incorrect. After the first negative response from the child (i.e. body, foot), the interviewer redirected the child back to the face, though only one redirect was given.	Everything found on the face is considered positive. Positive and negative items were tallied.

Appendix B.

Grasmick Low Self-Control Scale (GLSC-S; Grasmick et al., 1993)

Dimensions

Risk-Seeking

- 3. I feel little need to test myself every now and then by doing something a little risky.
- 4. Sometimes I will take a risk just for the fun of it.
- 6. I find no excitement in doing things for which I might get in trouble.
- 11. Excitement and adventure are more important to me than security.

Simple Tasks

- 5. I frequently try to seek out projects that I know will be difficult
- 7. I like really hard tasks that stretch my abilities to the limits.
- 15. When things get complicated, I tend to quit or withdraw
- 19. The things in life that are easiest to do bring me the most pleasure.

Physical Activities

- 8. If I had a choice, I would almost always rather do something mental than something physical.
- 10. I almost always feel better with I am on the move than when I am sitting and thinking.
- 16. I like to read or contemplate ideas more than I like to get out and do things.
- 18. I seem to have more energy and greater need for activity than most other people my age.

Temper

- 21. I don't lose my temper very easily.
- 22. Often, when I'm angry at people I feel more like hurting them than talking to them about why I am angry.
- 23. When I'm really angry, other people better stay away from me.
- 24. When I have a serious disagreement with someone, I can usually talk calmly about it without getting upset.

Impulsivity

- 1. I often act on the spur of the moment without stopping to think.
- 9. I often do whatever brings me pleasure here and now, even at the cost of some distant goal.
- 13. I am more concerned with what happens to me in the long run rather than the short run.
- 20. I devote much thought and effort to preparing for the future.

Self-Centered

- 2. If things I do upset people, it's their problem not mine.
- 12. I try to look out for others first, even if it means making things difficult for myself.

14. I will try to get the things I want even when I know it's causing problems for other people.

17. I'm very sympathetic to other people when they are having problems.

Coding

1 = Strongly Agree

2 = Agree

3 = Disagree

4 = Strongly Disagree