A longitudinal comparison of cognitive and behavioural problems in children who are normally developing and at-risk for developmental delay

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A Thesis

in

The Department

of

Psychology

Presented in Partial Fulfilment of the Requirements

for the Degree of Master of Arts (Psychology) at

Concordia University,

Montreal, Quebec, Canada

September 2006

Your file Votre référence
ISBN: 978-0-494-20695-9
Our file Notre référence
ISBN: 978-0-494-20695-9

Abstract

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By school age, a relationship exists between children's cognitive and behavioural problems that can further minimize their probability of academic success. Children from the Concordia Longitudinal Risk Project were examined in the years prior to and following grade 1. A subsection of these children were at risk for developmental delay based on low birth-weight, low early IQ and diagnosed developmental delay. These children were compared to a group of children from the same sample who were normally developing. The current study focused on the relationship between cognitive and behavioural problems before grade 1 entry, after grade 1 entry, and how the relationship between cognitive and behavioural problems changed between these two times. The results indicate that prior to grade 1, there was a relationship between cognitive performance and observed behavioural style in children at risk for developmental delay, but not for normally developing children. After grade 1, school related success and behaviour problems were related in all of the children, but only as reported by the teacher. IQ prior to grade 1 predicted internalizing and total scores on the Child Behaviour Checklist following grade 1. Children with the most extreme behaviour problems at time 1 were found to have later problems in limited areas of school functioning. The findings indicate the value of using several measures of child behaviour, especially in the examination of children at risk for developmental delay.

Acknowledgments

There are many people without whose support this thesis would have been impossible to complete. First, I would like to thank my supervisor, Lisa Serbin, for her valuable guidance at every stage of this process and her commitment to creating nurturing lab environment. Without the presence of Caroline, Dahlia, Lisa, Erin, Jennifer and Paula, this thesis would not have been nearly so fun to prepare, and I thank them all for their patience. As well, I would like to thank my colleagues Amelie and Erin. I would also like to thank my committee members, Dr. Bill Bukowski and Dr. Mark Ellenbogen for their suggestions and comments in preparation of this thesis. I would like to thank Claude Senneville for his endless patience and organizational capacity. I would also like to thank all of the individuals in the high-risk lab who were involved in data collection for this project, and of course all of those who gave their valuable time to participate in the present study.

None of this would be possible without the support of my family. I would like to thank my parents for their support and guidance. Finally, I am grateful for the support of my sister Erica, for making me laugh and inspiring me to work as hard as she does.

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Problematic patterns of behaviour are related to children's success in a classroom environment (Speltz, De Klyenm Calderon, Greenberg & Fisher, 1999). These patterns are linked to poorer overall cognitive performance. By the time children reach early school age, teachers and parents report that children with early developmental delay have more behavioural problems (Baker, McIntyre, Blacher, Crnic, Edelbrock & Low, 2003; Plomin, Price, Eley, Dale & Stevenson, 2002). Studies of community samples of children indicate that their cognitive and behavioural problems are related during their school years (Rapport, Denney, Chung & Hustace, 2001; Riggs, Clair, & Greenberg, 2003). How does the relationship between cognitive and behavioural problems develop, and how does this development differ in children at-risk for developmental delay compared to those who are normally developing? The current study compares how cognitive and behavioural problems relate in children who are normally developing with those who are at-risk for developmental delay.

The relationship between cognitive and behavioural problems was examined in a normally developing group of children and in a group of children at-risk for developmental delay prior to and following entry into first grade. All of these children had families that were selected based on their prior participation in a longitudinal study of early parental behaviour styles. The examination of the timing of cognitive and behavioural problems will increase understanding about how these problems relate to school success in at-risk and normally developing children.

Literature review

To understand the research studying the relationship between cognitive and behavioural problems in early childhood, it is first important to examine what is meant by cognitive and behavioural problems. Then previous research that has examined the relationship between cognitive and behavioural problems in community samples, samples with cognitive delay and samples with behavioural problems will be reviewed. Finally, theoretical explanations of this relationship will be discussed.

Behaviour problems

Behaviour problems in childhood are frequently grouped under the categories of internalizing and externalizing disorders (Qi & Kaiser, 2003). Externalizing disorders include early difficulty with impulse control, non-compliance, aggression and high activity levels (Cambell, Shaw & Gilliom, 2000). Internalizing disorders include symptoms of anxiety, depression, phobias, somatic symptoms and withdrawal (Angold, Costello & Erkanli, 1999). While internalizing and externalizing disorders in young children may seem very different, they can co-occur (Mun et al., 2001; Lavigne et al., 1996). Longitudinal research has indicated greater negative outcomes for children who have combinations of both internalizing and externalizing behaviour (Farmer & Bierman, 2002). Factors that increase prevalence of behaviour problems in preschool children include older age, minority status, male sex, lower socio-economic status (SES), father absence and smaller family size (Lavigne et al., 1996).

Developmental delay

In the present study, the children were selected for the at-risk group based on having factors that increased the likelihood of problems with cognitive functioning later

on in life. The spectrum of cognitive outcome for these children is quite likely very broad, with some children completely growing out of any problem and other children later being diagnosed with intellectual or learning disabilities. The term developmental delay characterizes a large group of children who fail to reach developmental milestones by the age at which most other children are able to do so, and may describe as many as 10% of preschool children (Gringras, 1998). Developmental delay describes a number of different conditions including mild mental retardation, learning disabilities and low achievement (Gresham, MacMillan & Bocian, 1996). While differentiating amongst children with developmental delay is difficult, even by school age, research does indicate that these classifications differentiate children with different sets of abilities (Gresham et al., 1996). It is important to understand the relationship between these classifications and later school performance. Later in childhood, moderate correlations exist between school achievement and intelligence testing (Molfese & Martin, 2002; Lassiter & Bardos, 1995). In examining patterns of performance on subscales of numerous cognitive tasks, Scott & Delago (2003) found that screening was able to identify 79% of the children who would go on to require special education. Other studies have also linked cognitive assessment during preschool to later school functioning (Hughes & McIntosh, 2002; Lenkarski, Singer, Peters & McIntosh, 2001).

Behavioural problems and cognitive deficits

There have been three principle approaches to examining the relationship between cognitive and behavioural problems in children. The first approach involves looking at both problems either simultaneously or longitudinally in a community sample. The second involves looking at behavioural problems in children who have cognitive delays.

The third involves looking at cognitive problems in groups of children that have been diagnosed with behavioural problems.

Community Samples

During preschool, research from community samples of children indicates that child behaviour problems and cognitive abilities are related through significant but low negative correlations. Dietz, Lavigne, Arend & Rosenbaum (1997) found that lower IQ in children ages 2-5 was related to higher ratings on the internalizing, externalizing and total problem scales of the Child Behaviour Checklist (Achenbach, 1991; CBCL). A longitudinal study conducted by Plomin and colleagues (2002) found that between the ages of 2 and 3 the relationship between behavioural problems and both verbal and non-verbal problems increased, but between the ages of 3 and 4 only the verbal functioning problems were related to behaviour problems. The same study also examined the relationship between cognitive and behavioural problems in children that were in the bottom 10^{th} and 5^{th} percentiles for IQ, and found the same low negative correlation between cognitive and behavioural problems in these children as they had found in the entire group (Plomin et al., 2002). Researchers concluded that there was a mild relationship between the cognitive and behavioural problems of children between the ages of 2 and 4. Additional factors also play a role in influencing the relationship between cognitive and behavioural problems in preschool children. For example, preschool children with lower cognitive functioning were more withdrawn due to difficulties in sustaining interaction with their peers (Gulralnick & Groom, 1985). Together, these results indicate that the relationship between cognitive and behavioural problems is

dependant on the age of the child, the nature of the sample used in the study and the aspects of the child's cognitive functioning that are being examined.

The relationship between cognitive and behavioural problems has also been examined in community samples of school-aged children. Child IQ has been related to externalizing in grade 1 (Heller, Baker, Henker & Hinshaw, 1996). Research has identified a connection between early attention and reading problems and later problem behaviour (Fleming, Harachi, Cortes, Abbott & Catalano, 2004; Maguin, Loeber & Le Mahieu, 1993). Research has also shown that children who had poorer working memories showed more internalizing behaviours (Aronen, Vuontela, Steenari, Salmi & Carlson, 2004). Both teacher perceptions of academic success and productivity, and cognitive functioning were respectively related to withdrawal and anxiety/depression in children between the ages of 7 and 15 (Rapport et al., 2001). By adolescence, there is a strong relationship between behaviour problems, such as delinquency, and school success (Hinshaw, 1992). In examining how early behavioural problems predict later school achievement, McLeod & Kaiser (2004), found that internalizing and externalizing predicted high-school completion and university entry. Early externalizing, but not internalizing behaviour, decreased the likelihood of completing high school and continuing on to university, even when other variables such as SES were taken into account (McCleod & Kaiser, 2004). This research provides examples of some of the ways in which cognitive and behavioural problems interact as children age.

Behaviour problems in children with cognitive delays

Twenty-six percent of the children between the ages of 5 and 15 who have learning problems also have some kind of behaviour problem (Emmerson, 2003). The

rates of behaviour problems seen in preschool children with cognitive delay vary according to the severity of developmental delay. Children with IQ's between 30 and 70 were examined for behavioural problems between the ages of 2 and 3 (Baker, McIntyre, Blacher, Crnic, Edelbrock & Low, 2003). Seventy percent of the children with low IQ scores scored in the clinical range on the CBCL, while 24% of the children with normal IQ scores scored in the clinical range on the CBCL (Baker et al., 2003). When children aged 3-5 selected based on having been formally diagnosed with developmental delay were compared to normally developing children, these children had more behaviour problems as reported by both parents and teachers (Merrell & Holland, 1997). Another study of children looked at the development of behaviour problems in preschool children who were considered at risk for developmental delay because they were multiple birth babies, had low birth weights, had sensory/motor impairments and had been diagnosed genetic and non-genetic disorders (Feldman, Hancock, Rielly, Minnes & Cairns, 2000). The researchers found that children at early risk for developmental delay scored higher on most of the measures of behaviour problems (Feldman et al., 2000). However, when using the CBCL the children did not perform significantly differently on the total, internalizing or externalizing subscales (Feldman et al., 2000). The researchers concluded that while these at-risk children may be starting to show increased rates of behaviour problems when compared with normally developing children, the differences on the CBCL are not yet significant. The difference in rates of behaviour problems found in the Baker and colleagues' study (2003), Merrell & Holland's (1997) study and Feldman and colleagues' study (2000), may have occurred due to the differing levels of severity used as selection criteria. This is particularly relevant to the current study in

which the selection criterion most closely resembles that of the Feldman and colleagues (2000) study.

Similar studies have been carried out with older children with developmental delay. Children selected based on their attendance to special schools for children with intellectual delay had significantly higher rates of psychiatric symptoms (Linna et al., 1999). Their teachers reported these low IQ children as having significantly more emotional and behavioural disturbances, with parents reporting the children as performing worse on scales of emotional and mixed types of disturbances (Linna et al., 1999). Dekker, Koott, van der Ende & Verhulst (2002) examined children between the ages of 8 and 16 and also found a relationship between intellectual delay and behaviour problems. Children with IQ's between 60-80 and children with IQ's between 30-60 had higher scores on CBCL subscales than normally developing children (Dekker et al., 2002).

The relationship between cognitive and behavioural problems has also been evident for children with other types of cognitive difficulties. Children between the ages of 6 and 7 with a learning disability (LD) were reported by their teachers to display problems with attention, while children with difficulties reading and spelling were found to have more psychosocial problems (Gadeyne, Ghesquiere & Onghena, 2004). Children between 4th and 6th grade that had a LD, low academic achievement or average academic achievement were examined for behavioural problems (La Greca & Stone, 1990). Girls with LD had more anxiety and withdrawal as reported by teachers than either the normally developing girls or the girls with low academic achievement. Boys failed to

show a similar pattern. This again illustrates how different subgroups of children show different patterns in the relationship between cognitive and behavioural problems

Learning problems in children with behaviour problems

Research has also examined children with behaviour problems for their likelihood of having lower school achievement and IQ. Individuals tested because of their involvement in delinquent behaviour have been found to have significantly lower IQ's than other adolescents, and have lower general academic achievement (Schonfeld, Shaffer, O'Connor & Portnoy, 1988; Hinshaw, 1992). This pattern has also been found in younger children. Looking at a preschool sample of boys with oppositional defiant disorder (ODD) it was found that they had lower overall IQ scores, more IQ discrepancies, poorer executive functioning and more verbal learning problems (Speltz et al., 1999). Further, children who had ODD and attention deficit hyperactivity disorder (ADHD) performed poorer on measures of executive functioning. The researchers indicated that the children's cognitive profiles matched cognitive profiles of older boys with ODD and ADHD and supported the idea of common cognitive problems preceding behaviour problems (Speltz et al., 1999). Researchers found that children described by their teachers as being disturbed were more likely to repeat a grade or be referred for academic services (Pryor, Wilkinson, Harris & Trovato, 1989).

Theoretical relationship between behaviour problems and cognitive delay

There are three main theoretical explanations as to why cognitive problems and behavioural problems may be related. Cognitive functioning problems may cause children to develop behaviour problems. Behaviour problems, particularly those associated with externalizing problems may prevent children from acquiring necessary

skills and performing adequately when it comes to cognitive and school achievement tasks. Finally, underlying deficits, possibly linked to neurological factors may cause both behavioural and cognitive problems to occur simultaneously in children.

Several different kinds of research support the first theory that early cognitive problems lead to latter conduct problems. In a longitudinal study of African American boys between the ages of 7 and 17, Schonfeld and colleagues (1988) found their research to support a model in which early cognitive problems led to later delinquent behaviour. Specifically, the researchers suggested that their findings supported the idea that broad, early academic failures led to loss of self-esteem and increased the likelihood of conduct problems rather than a specific failure of a specific cognitive mechanism that led to both problems. This may partially explain studies where children's early reading difficulties predict their later externalizing problems (Fleming et al., 2004; Maguin et al., 1993). Studies that find increasing behaviour problems as children with cognitive delay age also support this theory. Several studies have concluded that prior to school entry the relationship between children's academic achievement and their behaviour problems is mild (Feldman et al., 2003; Dietz et al., 1997: Plomin et al., 2003). Research on older children with varying degrees of developmental delay indicates that these children are at a greater risk to develop behavioural problems than children not at risk for developmental delay (Emmerson, 2003; Dekker et al., 2003, Linna et al., 1999; Schonfeld et al., 1988). Research on community samples of children points to low but significant correlations between cognitive and behavioural variables when children are not yet in school (Plomin et al., 2002).

The second theory suggests that early behavioural problems prevent children from learning, and thus acquiring necessary cognitive skills. Many disorders, particularly those such as ADHD influence attentiveness, thus impeding school achievement and cognitive assessment. This relationship is verified by studies indicating a strong link between academic achievement and ADHD, but not between academic achievement and ODD/CD (Clark, Prior & Kinsella, 2002, Oosterlaan, Scheres, Sergeant, 2005). Aronen and colleagues (2004) found that childhood depression was linked to memory, which would influence a child's ability to learn effectively. Pathways of childhood withdrawal and depression/anxiety show that withdrawal and anxiety/depression both deteriorated children's school functioning, through classroom performance and cognitive functioning respectively (Rapport et al., 2003). Behaviour problems preceded school success problems in a longitudinal study that found that children's externalizing and internalizing behaviours in 6-8 year olds predicted later probability of completing high school, and that in particular, externalizing problems reduced probability of later attending college (McLeod & Kaiser, 2004). At least some research points towards behaviour problems preceding cognitive problems.

The third theory suggests that some underlying factor is responsible both cognitive and behavioural problems. Research that supports the idea of cognitive functioning problems and behaviour problems occurring simultaneously shows that children with very severe behaviour problems also have very high rates of mental retardation (Harada, Satoh, Sakuma, Imai, Tamaru, Takahashi & Amano, 2002). One explanation for the relationship posits a neural basis. Children with increased mild neurological dysfunction clusters were more likely to have poorer school performance

and increased likelihood of attention problems (Baststra, Neeleman & Hadders-Algra, 2003). Executive functioning deficits could also potentially explain some of the relationship between behavioural problems and cognitive problems. Problems with inhibition of behaviour would hinder a child's ability to meet behavioural and educational demands, especially once a child reached their school years. Research indicates a link between ADHD and executive functioning (Clark et al., 2002). Further, the relationship between behavioural problems and cognitive problems in early development exists in children with developmental delay prior to school entry (Baker et al, 2003). If it is the stress of the school environment that forces children who have behaviour problems to act out, then this relationship would not be stable between the ages of 2 and 3.

Ultimately, all of these theories could be related to the co-occurrence of cognitive and behavioural problems depending on the child being examined. That is why it is essential to compare how these problems develop in children that are at-risk for developmental delay and those who are normally developing. What the research does suggest is that more longitudinal studies beginning in early childhood are needed to understand how these problems develop together. This is particularly the case for children moderately at-risk, the largest group of children with early delay.

Other factors contributing to the development of an at-risk population

While up until now the relationship between behavioural problems and problems relating to factors such as school success have been discussed in isolation, research has uncovered many other variables that influence children's cognitive and behavioural problems. Factors such as family income, neighbourhood quality and family functioning have all been linked through research to cognitive and behavioural functioning as

children develop (Liaw & Brooks-Gunn, 1994; Mathijssen, Koot & Verhulst, 1999; Leventhal & Brooks-Gunn, 2000; Macmillan, McMorris & Kruttshnitt, 2004). One example of this is the relationship between low birth weight and later cognitive and behavioural functioning. Several studies indicate that very low birth weight children have lower IQ's, lower school achievement and more behavioural problems (Schneider, Wolke, Schlagmuller & Meyer, 2004; Nadeau, Tessier, Boivin, Lefebvre & Robaey, 2003; Breslau & Chilcoat, 2000). Sameroff & Chandler (1975) reviewed research that examined the relationship between early peri and post-natal complications to later developmental outcomes and found that while factors such as anoxia and prematurity could be retrospectively linked to at-risk child outcomes, the prospective work was much less clear. They proposed that factors such as maternal emotional stress during pregnancy and later environmental factors play an integral role in how behavioural and learning problems develop (Sameroff & Chandler, 1975). Factors such as poverty interact with other aspects of the child-rearing environment to influence childhood outcome (Liaw & Brooks-Gunn, 1994). Biological and environmental factors can confound each other in numerous ways. For example, individuals who face both early risk for developmental delay due to early neuromotor problems and family adversity faced more problems then individuals who had experienced one or the other (Raine, Brennan, Mednick, & Mednick, 1996).

The current study

The first question of the current study will focus on how cognitive problems, as measured through IQ relate to behaviour problems in children prior to grade 1. Normally developing children will be compared with those that face a number of early risk factors

including low birth weight, premature gestation, developmental delay and low early IQ scores. Children in the at-risk group are expected to be at greater risk for lower IQ and increased behaviour problems, placing them at one end of the spectrum in terms of their cognitive and behavioural functioning. Because the problems in these at-risk children will be more severe, it is expected that the relationship between behaviour problems and early IQ scores will be related in children who are at early risk, but not in children who are normally developing.

The second question examines the relationship between cognitive and behavioural problems after entering grade 1. This will be done using the same sample after they have entered grade 1. By the time the children are in grade 1 or above, all the children, at-risk or not, will be facing the pressures associated with their ability to perform in school. For this reason, at this time it is expected that there will be a relationship between cognitive and behavioural problems for all children.

Finally the third question will examine continuity between behavioural and cognitive problems prior to and following grade 1 entry. Based on the literature that tends to find cognitive problems preceding behavioural problems (Fleming et al., 2004; Maguin et al., 1993; Schonfeld et al., 1988), and given the fact that the at-risk group was selected based on factors related to problems associated with cognitive functioning, low IQ is predicted to precede the development of behaviour problems, but problematic behaviour is not expected to precede problems with school functioning.

Method

Demographics

There were 175 families that agreed to participate during the first period of testing. During the second period of testing, 132 of these families agreed to have their children participate again. A subset of 66 of the children from the total 175 sample were selected for the at-risk group based on meeting criteria that put them at risk for developmental difficulties. Fifty-five were included in the at-risk sub-sample because at the initial period of testing, they were found to have a score below 80 on one or both scales on the Bayley Scales of Infant Development or below 85 on one or both subscales of the Stanford Binet-IV (one standard deviation below the mean in each case). Ten were described as having a low birth weight. Three had a shorter than average gestational period (less than 37 weeks). Finally, two had developmental delay that was not labelled by the time of the initial testing period.

Demographic descriptions comparing the at-risk children to the children who are not at-risk for developmental delay can be seen in Table 1. The at-risk group was significantly younger than the normally developing children ($t = 4.29$, $p < .01$).

Insert Table 1 here

Of the children in the at-risk group, 32 were male and 34 were female. The children ranged in age between 1.09 and 6.12 with a mean of 3.54. On SES variables, 19% were on welfare, meaning they received social assistance from the government, 29% were working poor, meaning they lived below the poverty line in their region based on

their family size, and 52% had incomes above that. In terms of family variables, 71% of the children lived with both biological parents, with 29 % did not live with both biological parents. Of the normally developing children, 48 were male and 61 were female. Fifteen percent were on welfare, 23% were working poor and 62% were in neither of these groups. Again, many of the children did not live with both biological parents with 78% living with both biological parents and 22% not living with both biological parents.

Demographics for the children in both groups at time 2 can be seen in Table 1. At this time both groups had fewer participants. The twelve participants who left the study from the at-risk group were not significantly different from the others on measures of income or years of maternal education or child age. The children that left did have significantly lower IQs ($t = 2.35$, $p < .05$). For the normally developing children who declined to participate at time 2, there were no significant differences on measures of mean family income, maternal years of education or child IQ. There was a significant difference in child age, with children who remained in the study being older on average than those did not participate in the follow-up testing ($t = 2.47$, $p < .01$).

Measures

Demographic Information

For the current study, the Demographic Information Scale was used to gather demographic information about the participants (see Appendix B). The demographic questionnaire was filled out over the phone at the same time as consent was being provided. It established information about family composition, maternal education and mean family income.

Child behaviour at time 1

Behaviour problems

Achenbach's Child Behaviour Checklist-Parent Report Form (CBCL-PRF; Achenbach, 1991) was given to the parents to assess the children's behaviour problems according to their parent's report. The CBCL-PRF is a widely used and very popular scale that examines behaviour problems in children using parent answered questionnaires. Only 132 of the children in the current sample were above the cut-off age of 2 years required to use the CBCL-PRF. The total score was used for the current study.

Observed Behavioural Style

The measure that was used to assess observed behaviour in the current study was taken from the Behavioural Style Observational System (BSOS; Karp, 1999, see Appendix D). This measure uses observational data taken from the children while they interact with primary caregiver during three separate tasks. Based on behavioural style stipulated in Thomas and Chess's 1977 theory of temperament, the measure captures child behaviour in the naturalistic setting of the home. It focuses on measuring children's compliant and attentive behaviour. In terms of reliability, the BSOS has a Cohen's Kappa ranging from .70 to .96. The BSOS also demonstrates good internal and inter-task consistency. When compared with other measures such as the EAS Temperament survey, it showed some similarity, and provided an important additional observational measure of child behaviour (Karp, Serbin, Stack & Schwartzman, 2003).

Child cognitive functioning at time 1

Child IQ was measured with Bayley Scales of Infant Development (Second Edition, Bayley, 1993) if the child was between 12 and 42 months old. This is a very

commonly used measure to assess infant intelligence and has good validity and reliability. If the child was over 42 months old, the child was assessed using the Stanford-Binet Intelligence Scale (SB-IV, Thorndike, Hagan & Sattler, 1986). Due to the fact that the Stanford-Binet Scores were on average 10 points higher than the Bayley's scores for the current sample, z-scores were used for the current analysis so that both measures of IQ could be used simultaneously. This difference may be due to the fact that SB-IV has problems in terms assessing children in the lowest ranges of cognitive functioning (Saylor, Boyce, Peagler & Callahan, 2000). Eighty-nine of the children were assessed using the Bayley Scales of Infant Development and 86 of the children were assessed using the SB-IV.

Home environment at time 1

The infant-toddler and the preschool versions of the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1984) were used to measure the home environment for the children in the current study. The infant-toddler HOME, designed for children between the ages of 0 and 3 has 45 items and the preschool home for children between the ages of 3 and 6 has 55 items. The HOME focuses on a number of criteria including factors such as responsiveness of the mother, avoidance of restriction and punishment, organization, providing appropriate play materials and other subscales which allow an observer to rate the quality of a home environment for raising children. This measure is also commonly used and recent studies have found consistent validity and reliability for the infant and toddler scale (Linver, Martin & Brooks-Gunn, 2004). Research shows that the preschool HOME scale provides predictive validity

relating to child cognitive and behavioural functioning two years in the future (Leventhal, Martin & Brooks-Gunn, 2004).

Child behaviour problems at time 2

During the second period of testing, the Child Behaviour Checklist Parent Report Form and Teacher Report form were used to assess the children's behaviour (CBCL-PR, CBCL-TR, Achenbach, 1991). Both of these versions of the CBCL are widely used measures that assess parent and teacher perceptions of child problem behaviour. They have good levels of reliability and validity. The CBCL is made up of 112 items that are divided into 8 syndromes. There are two broad subscales, of internalizing and externalizing. The internalizing subscale includes withdrawal, somatic complaints and anxious and depressed behaviour, while the externalizing subscale includes delinquent and aggressive behaviour (Erickson, 1998).

School achievement scores at time 2

The children's report card scores from the most recently completed school year were used to assess their school achievement. These scores were broken down numerically. An overall report card score from their combined math and French grades was used (French being the equivalent of language arts as the children in the sample were francophone). As well, a combined score of the children's math performance was obtained. The report cards were broken down into numerical equivalencies, with an A=5, a B =4, a C= 3, a D= 2 and an F=1, a failure.

Cognitive assessment at Time 2

A French translation of the Stanford-Binet IV vocabulary subscale (SB-IV, Thorndike, Hagan & Sattler, 1986) was used to assess the children's vocabulary. This

subtest includes both picture and verbal vocabulary items and is part of the verbal reasoning subscale. On the whole the SB-IV is a reliable and widely used measure. To assess the children's math abilities, the composite math score of the Wechsler Individual Achievement Test II (WIAT-II: Wechsler, 2001) was used. The WIAT-II is a test that can be used to assess the individual in terms of their strengths and weaknesses, and covers all of the areas specified by the individuals with disabilities act. The composite math score is made of a combination of two math-related subscales, a problem solving subscale and an arithmetic subscale. The WIAT II composite math scale and the SB-IV vocabulary scale were used because they were two appropriate and discreet subscales that assessed math and vocabulary and could be translated for use with a francophone population.

Procedure

All of the children that participated in the present study were the children of individuals who, during the 1970s were selected as part of a longitudinal study aimed at examining outcomes of aggression and withdrawal entitled Concordia Longitudinal Risk Project. The data collected in the current study was part of both the Concordia Longitudinal Risk project, as well as the Child Care Vision Project. The Child Care Vision Project was carried out in four different Canadian provinces to examine the development of behaviour problems in children who are at-risk for developmental delay. It is the Quebec portion of this data set that was used for the current thesis. A subset of the measures used in Child Care Vision Project were used in the current study to examine the children's cognitive and behavioural problems over time.

The first period of testing occurred prior to the children entering grade 1. To be recruited for the current study, individuals who had been past participants in the Concordia Longitudinal Risk Project were contacted over the phone and asked if they would participate in the current phase of testing (see Appendix A). If they consented, they were also asked to fill out a demographics questionnaire over the phone. Testing for the current study was done over a two-day period, and the protocol can be seen in Appendix C. On the first day, the interviewer, an individual with M.A training or above in the field of clinical psychology went to the participant's house and started to administer the Bayley's Scales or SB-IV, according to the age of the child. It was at this time that the main caretaker of the child (primarily the mothers) filled in a number of questionnaires including the CBCL. After this, the mother and child were asked to do a number of videotaped tasks to assess their interactions. On the second day of testing, the interviewer completed all of the measures that had not been completed on the first day, as well as some additional observational measures. At this time the interviewer also completed the interview section of the HOME inventory. If the interviewer felt that the family would benefit from additional services, services were recommended at this time. The children's observed behaviour was then later examined according to the criteria used in the BSOS scale as analyzed from collected videotapes.

The second period of testing occurred between 3 and 5 years later after the children had entered grade 1. The parents were again contacted to solicit their participation in the second part of the study. Those who agreed were again asked to fill in over the phone a demographics questionnaire. During the second period of testing the children were assessed by a trained researcher in their respective schools. As well, the

children's teachers were provided with a package of questionnaires to complete concerning the child. To work with children in the schools, permission was requested from the children's principals. Questionnaires were also sent to the parent's homes asking about the children's behaviour. Finally, at the end of the year, the student's final report cards were collected from the schools via either the school secretary or the school principal.

Results

Preliminary analysis

After initial examination of distribution and skew, several of the variables used in this study were modified. Family incomes at time 1 and 2, and observed behaviour style were squared to account for skew in the data. Z-scores were used for measures of child cognitive functioning at time 1 to account for mean and distribution discrepancies between the Bayley Scales of Infant Assessment (used for children under 42 months of age) and SB-IV (used for children over 42 moths of age). Z-scores of the HOME were used in all analyses. Prior to running regressions, correlation tables indicated that none of the correlations were high enough to cause problems of multicollinearity. All of the statistics were performed using the Statistical Package for the Social Sciences 11 for Mac OS X.

Design

Several different statistical procedures were used to analyze the results of this study. Correlations and t-tests were performed to examine the relationship between variables as well as the direct differences between the at-risk children and the normally developing children. The results were then analyzed using hierarchical multiple

regressions. Finally, chi-squares were used to examine the relationship between low IQ's and high levels of behaviour problems, over time

(1) Compairison of the samples at time 1.

To examine differences between the children at-risk for developmental delay and the normally developing children a series of t-tests were performed (see Table 2). The two groups differed significantly on a number of variables. Children in the at-risk sample had lower overall scores on the HOME ($t(173) = -3.44$, $p < .01$), were younger then the children that were normally developing group ($t(173) = 4.29$, $p < .01$) and had lower IQ scores ($t(173) = -7.42$, $p < .01$). The differences in IQ scores were expected considering the fact that low early IQ was a criterion for selection into the at-risk group. While the two groups did not significantly differ in terms of parent reported behaviour problems, children in the at-risk group had more problematic observed behaviour scores ($t(170) = 3.55$, $p < .01$), indicating poorer compliance and more inattentive behaviour. Based on these differences, regressions were then run to see if the differences in observed behavioural style and IQ were related, and to see if this relationship could be attributed to demographic variables.

Insert Table 2 here

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(2) What is the relationship between cognitive and behavioural variables in children prior to grade 1 in children at-risk for developmental delay compared with normally developing children?

Correlations between the variables used in this regression analysis appear in table 3. Using child IQ as an outcome, the first regression was run to examine factors related to child IQ prior to grade 1(See Table 4). In predicting early IQ, an interaction between observed behaviour and at-risk group status trended towards significance ($\beta = .11$, $p < .10$), which prompted the running of separate but identical regressions within the at-risk and the normally developing groups.

Insert Tables 3 & 4 here

Correlations for the children in the at-risk and normally developing groups can be seen in Table 5 and Table 6. The correlation between observed behavioural style and IQ score for the at-risk children ($r = -.32$, $p < .05$) was significant, but the correlation between observed behavioural style and IQ for the normally developing children ($r = -.04$, $p > .05$) was not significant.

Insert Tables 5 & 6 here

Regressions were then run separately for the at-risk children and the normally developing children. They can be seen in Table 7, with the first regression examining the at-risk children and the second regression examining the normally developing children. Child IQ was used as the outcome measure in both regressions. Maternal age, family income and the child variables of age and sex were entered in the first step. The second

step added the HOME score and the third step included child behaviour as observed by the experimenter and child behaviour as reported by the parents.

Insert Table 7 here

IQ in the at-risk sample was significantly predicted by observed behaviour style ($\beta = -.33$, $p < .01$). When the same regression was performed on the normally developing children, observed behavioural style did not significantly predict IQ as it did in the children at-risk for developmental delay. Age did significantly predict the standardized IQ scores, with older children having lower IQ scores. In neither group did maternal reports of behaviour problems significantly predict variance in child IQ.

(3) Comparison of the samples at time 2.

T-tests were run to examine differences between the children in the at-risk sample and normally developing children at time 2, after grade 1 entry (See Table 8). The difference in family income had narrowed slightly so that at time 2 there was only a trend in terms of difference in family income between the at-risk and normally developing children ($t(136) = 2.69$, $p < .10$). The two groups also failed to differ on any measures of behaviour problems or according to report cards grades or WIAT score. However, the children in the at-risk sample scored significantly lower on the SB-IV vocabulary subscale ($t(135) = -3.46$, $p < .01$).

Insert Table 8 here

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(4) What is the relation between cognitive and academic achievement variables with behavioural problems at time 2 in the at-risk sample compared with the normally developing sample?

Correlations were performed for the entire sample at time 2 (see Table 9). Separate multiple regressions were carried out with report card grades and the WIAT math composite score being used as dependent measures (see Table 10). The first step included demographic variables: the child's age, the child's gender, maternal education and the family income at time 2. The second step added mother reported behaviour problems and teacher reported behaviour problems.

Insert Table 9 & 10 here

The regressions, which can be seen in Table 10, indicate that at time 2, teacher reports of behaviour problems were related to the children's report card grades ($\beta = -.34$, $p < .01$). Teacher reported behaviour problems were also related to a standardized assessment of math abilities, as measured by the WIAT ($\beta = -.27$, $p < .01$). In a final step of the regression, membership in the at-risk group was not found to relate to either school grades or WIAT math score after grade one. Behaviour problems as reported by the mother failed to predict grades or math ability as tested by the WIAT after grade 1.

(5) How does the relationship between cognitive and behavioural problems change between time 1 and time 2?

The final question examined how IQ and behavioural problems at time 1 predicted school performance and behaviour problems at time 2. The correlations

between the variables are in Table 9. First, the relation between time 1 cognitive and behavioural variables and time 2 school performance and cognitive variables was examined by performing two regressions using school grades (regression 1) and WIAT math scores (regression 2) as the outcome measures (see Table 13). The first step included child age, child sex, family income, maternal education and the HOME measured time 1. The second step included observed and parent reported child behaviour problems and IQ at time 1. The third step included mother and teacher behaviour problem scores at time 2 and the fourth step added risk-group status.

Insert Table 11 here

When children's grades were analyzed as the dependent variable, early IQ was a significant predictor (β=. 30, $p <$. 01), as was the entire last step of the equation (R^2 = .30, $p <$. 01). This indicates that early IQ was related to later school success. Neither observed behaviour style nor parent reported behaviour problems at time 1 predicted later grades. Finally, a chi-square test indicated that CBCL scores one standard deviation or more above the mean at time 1 were significantly related to WIAT math scores one standard deviation below the mean at time 2, (χ^2 = 3.85, $p <$. 05), as can be seen in Table 12. This was done to test if the children with the highest CBCL scores for behaviour problems at time 1 showed greater difficulty with academic functioning at time 2, and indicates that this may be true for some variables.

Insert Table 12 here

This may indicate a predictive relationship for those individuals with the highest rates of behaviour problems in early childhood and the most problems with math functioning, but not in the children who were in the normal range. It appears that child IQ shows some continuity as evidenced by early IQ's relationship to children's later report card grades. Early behaviour problems and early observed behaviour style both failed to predict later report card grades. As well, teacher reports of child behaviour were concurrently related to the children's grades. The one exception to this is in the case of early maternal reports predicting later math skills in those children who had behaviour problem scores one standard deviation or more above the mean.

Next, time 1 IQ was examined as predictor for time 2 behaviour problems. Six different regressions were run, with total, externalizing and internalizing scales of the teacher reported CBCL and mother reported CBCL being used as outcome measures. Regressions 1, 2 and 3 examine total, internalizing and externalizing scores respectively. The results of these regressions can be seen in tables 13 and 14. The first step of the regression included the level of education of the child's mother, the household income and the child's sex. The second step added the child's IQ at time 1 and the child's as measured by both the BSOS and the CBCL-PRF at time 1. The final step included the child's score on their report card, their SB-IV vocabulary score and their score on the WIAT math test.

Insert Table 13 & 14 here

In these regressions time 2 maternal perceptions of behaviour problems were not related to IQ at time 1 however, time 2 maternal perceptions of behaviour problems (total) were related to observed behavioural style at time 1 (β= .17, p <.05). This indicates some continuity in terms of the relationship between early observed behavioural style and later maternal perceptions of behaviour problems.

In contrast, early IQ was a significant predictor for several teacher reports of behaviour problems. When child IQ at time 1 was added in the second step it was a significant predictor for child behaviour problems at time 2 (β =-.28, p<. 01). The final step was also significant (R^2=. 28, p<. 01), but the predictive power of IQ at time 1 disappeared in favour of total report card score (β=-.32, p<. 01) and WIAT math score (β=. 22, p < .05). A similar pattern was observed when time 1 IQ was used as a predictor for the teacher reported internalizing subscale of the CBCL. Early IQ predicted a significant amount of variance in internalizing in the second step (β =-.21, p<. 05). In the final step, report card (β=-.20, p<. 05), vocabulary subscale on the SB-IV (β=-.24, p<. 05) and the WIAT (β=-.21, P<. 05) all significantly predicted variance in grades. Both total behaviour problems and internalizing behaviour problems as reported by the teacher indicate that early IQ is related to later behaviour problems until current measures of cognitive and academic performance are accounted for.

Externalizing problems as reported by the teacher at time 2 were not related to time 1 IQ, but were related to measures of behaviour style. The final step predicting externalizing behaviour problems was significant (R^2=. 17, p <. 01). In the final step, measures of observed behaviour style at time 1 (β=. 22, p<. 05) predicted teacher

reported externalizing. This indicates that early behavioural style was related to later teacher perceptions of the children's behaviour problems.

Summary

In early childhood, there is a difference in the relationship between the way in which cognitive and behavioural problems are related in at-risk and the normally developing children. More problematic observed behaviour style (such as greater inattentive and less compliant behaviour) is related to lower IQ in the children at-risk for developmental delay, but not in children who are normally developing. In neither sample were mother reports of behaviour problems related to child IQ scores. Three years later, after school entry, behaviour problems as reported by the teacher, but not as reported by the mother, were related to both the children's grades and the children's WIAT math composite scores in all of the children. When cognitive and behavioural variables were examined longitudinally, early behaviour problems did not predict school grades or WIAT math composite scores in either group of children. However, those children who had the most extreme behaviour problems in early childhood are more likely to have low WIAT math composite scores after school entry. This finding may indicate that children who were having the greatest behaviour problems prior to elementary school may show increased problems with some cognitive variables after grade 1. Low early IQ predicted teacher perceptions of behaviour problems both in terms of the total and internalizing subscales of the CBCL in all children, until factors such as current report card scores were included in the equation. Low early IQ may predict later behavioural problems either directly or through the relationship between IQ and later school functioning.

Discussion

(1) What is the relationship between cognitive and behavioural problems in children in the at-risk sample compared with normally developing children prior to grade 1?

Children's time 1 observed non-compliant and inattentive behaviour, but not their behaviour problems as reported by the CBCL-PRF, were related to IQ scores in children at-risk for early developmental delay. Observed behaviour style was not related to IQ in normally developing children. When all the children were analysed together, cognitive performance and observed behaviour was related prior to grade 1. This supports previous work that indicates that there is a mild relationship between the two variables in a community sample of children between the ages of 2 and 4 (Plomin et al., 2002). The relationship between IQ scores and observed behaviour style in the at-risk children may indicate that non-compliant and inattentive behaviour has already begun to undermine their ability to complete the tasks assessed by the SB-IV and Bayley's Scales. Children who are not at risk for developmental delay have lower rates of inattentive and non-compliant behaviour. While this non-compliant and inattentive behaviour was evident to external observers, it was not yet visible to the children's parents, whose reports of the children's behaviour problems failed to relate to the children's tested IQ scores. These findings support calls for greater use of early screening, especially in children who are at risk for developmental delay. Not only did the at-risk children in the present study show more inattentive and non-compliant behaviour, but their parents may not be aware of these increased rates of problem behaviour.

Previous research has found differing relationships between cognitive and behavioural problems in young children. When Baker and colleagues (2003) examined children with IQs between 30 and 70, they found that children in the delayed group had

higher internalizing, externalizing and total scores on the CBCL. The current study did not find a difference using the CBCL-PRF between the normally developing and at-risk children. The children in the Baker and colleagues (2003) study had tested IQ scores below 70, while only a portion of the children in the current sample who were classified as at-risk met this criteria. Differences in their child's behaviour may be apparent sooner to parents of children with diagnosed delay. Feldman and colleagues (2000) used criteria similar to that used in the current study to define which children were at-risk for developmental delay. Those researchers found that while the children at-risk for developmental delay scored higher on the various subscales of the CBCL, they did not differ significantly from normally developing children using this measure. Research with children with diagnoses of developmental delay has found that while these children have more behavioural problems, these problems are restricted to particular subscales of the CBCL (Nashchen, Garcin & Minnes, 2005). Behaviour problems may remain undiagnosed if only measures of externalizing and internalizing are used.

Speltz and colleagues (1999) found that preschool boys with ODD had lower IQs than other boys. Based on these findings, they discussed the importance of compliant child behaviour during cognitive testing. They suggest that the relationship between cognitive and behavioural problems may occur because children with behaviour problems may be less able or less willing to complete tasks assigned by experimenters during cognitive assessment. This would lower their tested IQ scores. The children in the current study who are at greater risk for developmental delay's less compliant behaviour places them at a disadvantage when completing cognitive measures.

(2) What is the relationship between cognitive and academic achievement variables with behavioural variables at time 2 in the at-risk sample compared with the rest of the sample?

The relationship between teacher reports of behaviour problems and report card grades in the entire sample supports previous research that has shown a relationship between cognitive and behavioural variables during the school years. Previous research has found behaviour problems and school achievement to be related in a community sample (Heller et al., 1996). Previous studies have shown higher rates of psychiatric problems in children who attended schools for children with cognitive problems than in regular schools (Linna et al., 1999). Similarly, children with low IQs show significantly more behaviour problems than normally developing children (Dekker et al., 2002). Reading scores in grade 3 were linked with behavioural problems in grade 6 (Flemming et al., 2004). In the present study, at-risk group status was not found to be related to later increased behavioural problems. This may have occurred because many of the children outgrew the delays that they showed earlier in childhood.

(3) How does the relationship between cognitive and behavioural problems change between time 1 and time 2?

Early IQ was related to later measures of school achievement and early observational measures of inattentive and non-compliant behaviour styles were related to later measures of externalizing behaviour in the classroom. Most importantly, early IQ predicted subsequent teacher reports of total problems and internalizing problems. Neither early observed behaviour style nor mother reported behaviour problems at time 1 predicted later report card grades or other measures of cognitive performance variables.

Child IQ prior to grade 1 significantly predicted grades in the entire sample, before current measures of school achievement were entered, indicating some continuity between early IQ and later academic achievement. Previous research has found that early intelligence testing predicted later school functioning (Rapport et al., 2001; Agostin & Bain, 1997). The present results also indicate continuity between early observed behaviour style and later externalizing problems. Several studies have linked early behaviour problems to difficult early temperaments early in infancy (Andersson & Sommerfelt, 1999; Stormont, 2002).

It was internalizing and total sections of the CBCL that were predicted by early IQ. Previous research has focused on the relationship between early IQ, aggression and attention problems (Riggs et al., 2003; Hinshaw, 1992). Early IQ in the present study did not predict externalizing behaviour problems. Previous research has indicated that there is a relationship between internalizing problems, academic achievement and cognitive variables but these variables have been examined from the perspective of how internalizing problems influence school performance. The association between internalizing and academic achievement is often examined through the different components associated with childhood internalizing (Rapport et al., 2001). Withdrawal, either alone or paired with aggression, can impede classroom functioning and children with higher levels of features relating to internalizing problems may have greater difficulty with cognitive tasks (Farmer & Bierman, 2002; Rapport et al., 2001; Aronen et al., 2004). Rapport (2001) and colleagues looked at how anxiety, depression and withdrawal operated to impede academic functioning. They found that withdrawal and anxiety/depression influenced different areas of classroom performance. One was not

found to be significantly worse than the other, but children who had difficulties with all areas had the most difficulty with school tasks. Like Rapport and colleagues, the current study found a relationship between internalizing and school achievement. However the current results indicated that early IQ predicted these later behaviour problems. There is some research that indicates that children with LD may be prone to depression and withdrawal (Sundheim & Voeller, 2004). Other research has indicated that girls but not boys with LD show more anxiety and withdrawal (La Greca & Stone, 1990). Future research may wish to expand on this finding by examining how the relationship between measures of school performance and later internalizing are mediated or moderated by early intelligence.

Gender predicted for total score and internalizing score as reported by the CBCL-PRF at time 2 in the current study, with boys having higher internalizing and externalizing scores. There have been many studies that have looked at gender and childhood internalizing. In general, these studies seem to report that girls have higher levels of internalizing as well as higher levels of factors related to internalizing such as depression when compared with boys (van der Ende & Verhulst, 2005; Keiley, Lofthouse, Bates, Dodge & Pettit, 2003; Angold, Erkanli, Silberg, Eaves & Costello, 2002). Higher maternal reports of internalizing in boys compared to girls may indicate greater acceptance of internalizing behaviours of girls by these particular mothers. The total score on the CBCL was higher in boys than in girls. This is not surprising given that previous research has indicated a greater risk for comorbidity for behaviour problems in boys and girls (Keiley et al., 2003; van der Ende & Verhulst, 2005).

The children in this study who had higher behaviour problem scores at time 1 did not seem to have a greater likelihood of having problems later in school except for those children with the highest rates of behaviour problems. Some research indicates that children with diagnosed behaviour problems such as ADHD and ODD may in fact have elevated rates of verbal problems and lower IQ's (Speltz, 1999) and children with disruptive behaviour problems also had difficulties in school (Barkley, Shelton, Crosswait, Moorehouse, Fletcher, Barrett, Jenkings & Metevia, 2002). It could be that this relationship is only found in children who have very severe behaviour problems early in life, but does not occur in children within the normal ranges on problem behaviour. In the current sample, only 16 of the children were in the borderline range for diagnosable behaviour problems, with 5 of those being in the clinical range in terms of their parent's ratings of their behaviour. For those children who are not in the clinical range, early elevated rates of behaviour problems may not be an accurate predictor of learning difficulties in the primary grades.

Researcher and teacher evaluations of the child's behaviour were frequently related to the children's scores on measures of intelligence and academic achievement while parent's evaluations were not. Previous studies have indicated that parental scores of child behaviour problems are frequently lower than teacher scores of child behaviour problems, and speculate that this may occur because teachers and experimenters see the children in a more demanding environment, where problems with behaviour would be more apparent (de la Barra, Toledo & Rodriguez, 2005). Teachers and experimenters also have a greater number of children that can be compared to the child in question. Previous research shows teacher and parent inter-rater reliability is highest for externalizing

behaviours and lowest for internalizing behaviours, with higher rates of behaviour problems leading to greater concordance (Keough & Berheimer, 1998). Agreement between mothers and teachers looking at children with developmental delay is also stronger for externalizing than for internalizing, with mothers reporting higher behaviour problems scores then teachers (Keough & Berheimer, 1998).

Limitations

As is the problem with many longitudinal studies, the current study has a number of limitations that must be discussed. A total of 35 participants left the study between time 1 and time 2. The only significant difference between those who remained in the study and those who left was that the mothers of children in the at-risk group had fewer years of education. The difference in age and child IQ trended towards significance, with children who left the study having younger ages and lower IQ scores. As well, because this study was conducted as part of a larger study, the age at which the children were tested ranged widely both prior to and following grade 1. Future research may seek to follow children over a more specific time period.

The children selected for being at-risk for developmental delay were younger than those who were normally developing. This may have occurred in part because of the measure chosen, the SB-IV, to assess cognitive performance in the children at time 1. The SB-IV has shown some difficulty in accurately assessing preschool children at the lower end of cognitive functioning (Saylor et al., 2000). Other researchers have raised concerns about the use of the SB-IV for specific populations of individuals with developmental delay such as Down's syndrome, referencing the fact that children's classification often varies widely between assessments (Couzens et al., 2004). In this

way, the use of the SB-IV in initial assessment for children in the at-risk group may have led to an under-diagnosis of children at-risk for developmental delay. Future research examining children at-risk for developmental delay may seek to use a more sensitive measure of this variable.

The relationship between age and the children's observed behaviour could also be influenced by other factors. The relationship between observed behaviour and child age was expected given the fact that as children transition from preschool to school they become more compliant. The negative relationship between child IQ and child age at time 1 was surprising. This relationship is not attributable to the age related problems with the SB-IV because otherwise the correlation would be seen in the opposite direction. This may be due to the fact that the older children have spent longer in a lower-stimulation environment than the younger children. The home environment was a significant predictor of child IQ at time 1. After school entry, HOME scores were not available for all of the children in the sample. Future studies looking at this longitudinal relationship between child with behavioural and cognitive problems may wish to use the HOME or some other measure of the child's environment as another factor that may potentially mediate the development of cognitive and behavioural problems over time. Given the relationship between the HOME at time 1 and the child's academic achievement at time 2, a larger sample size would allow for structural equation modelling which would allow the researchers to test how home environment moderated the relationship between cognitive functioning and behavioural problems prior and following school entry. Future studies that examine the longitudinal relationship between cognitive and behavioural problems in children may wish to include measurements of the home

environment at every period of testing, so as to better understand how home environment influences the way in which these problems develop.

Future directions

While family poverty was not considered as a variable relating to early developmental risk, the families of the children at-risk for developmental delay did on average have a lower income prior to school entry. Low-birth weight infants living in poverty showed fewer signs of resilience than other premature infants (Bradley, Whiteside, Mundfrom, Casey, Kellher & Pope, 1994). A review of studies looking at the effect of poverty on child development concluded that low SES, particularly persistently low SES, has a profound impact on the development of children's IQ, school achievement and socio-emotional functioning (McLoyd, 1998). As discussed by Chandler and Sameroff (1975), factors that influence premature early birth weight may be similar to factors that influence early IQ. Future research may wish to focus more on the role of SES in determining the developmental trajectories for children at-risk for developmental delay and behaviour problems.

This study identified children during the transition into formal schooling. It is during this period that the demands on children increase significantly, and thus there is more of an opportunity for potential behaviour problems to become evident. It is not, however, the only period in which children face these kinds of transitions. This study will continue to follow both at-risk and normally developing children longitudinally as they progress through Secondary School. It will be interesting to examine how the relationship between cognitive and behavioural problems develop as the children progress through their education.

Conclusions

The present study found a relationship between cognitive and behavioural variables for children at early risk for developmental delay prior to school entry, and in all of the children in the sample following school entry. For the children in this sample, cognitive deficits precede behavioural problems. In children at-risk for developmental delay, the relationship between these problems may appear at an even earlier time. This relationship may occur because of the way in which behavioural problems, both internalizing and externalizing, relate to the ways in which children are able to learn, or it may occur because behavioural problems impede a child's ability to be successfully tested. Also, this study reveals the importance of using measures of observed behaviour style, as observed behaviour style, but not parent reported behaviour, was significantly related to lower IQ. At time 2, cognitive and behavioural problems were related in all children, not just those at-risk for developmental delay. Finally, early low IQ scores predicted later internalizing and total problem scores. The children with the highest reported behaviour problems at time 1 had higher rates of math problems at time 2, but this was the only significant relationship between time 1 behaviour problems and time 2 academic variables. These findings indicate that the relationship between cognitive and behavioural problems occurs at different times for different children, and emphasizes the importance of early assessment, particularly in children at-risk for developmental delay.

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Table 1: Demographic variables for both groups prior to and following grade 1

	Entire group (T1)		At-risk group (T1)		Low-risk group (T1)	
	N = 175		N=66		N=109	
	Mean	SD	Mean	SD	Mean	SD
Age of Child (T1)	3.54	1.56	2.93	1.28	3.92	1.60
Maternal education	11.47	2.37	11.41	2.11	11.98	2.50
Mean family income (T1)	40, 346	24,363	35,788	24,108	43,106	24,211
	Entire Group (T2)		At-risk group (T2)		Low Risk group (T2)	
	N=138		N=54		N=84	
	Mean	SD	Mean	SD	Mean	SD
Age of Child (T2)	7.67	.93	7.62	.80	7.70	.99
Mean family income (T2)	44,473	24,875	39,171	20,756	47,530	26,871

Table 2: T-tests comparing the at-risk and normally developing groups at time 1

	N	Mean	SD	Df	T-score
Family Income					
At Risk	66	35,788	24,108	173	-1.94(t)
Low Risk	109	43,106	24,211		
Maternal education					
At-risk	66	11.41	2.12	173	-1.55
Low Risk	109	11.98	2.50		
Age of child					
At-risk	66	2.93	1.28	173	-4.29**
Low Risk	109	3.92	1.60		
HOME (z score)					
At-risk	66	-.28	.89	173	-3.44**
Low Risk	109	.21	.93		
Child IQ (z score)					
At-risk	66	-.63	1.02	173	-7.42**
Low Risk	109	.38	.77		
CBCL total					
At-risk	44	54.80	8.83	130	1.76
Low Risk	88	52.00	8.43		
Observed Behaviour					
At-risk	64	1.02	.54	170	3.55**
Low Risk	108	.77	.39		

(t) = $p < .10$, * = $p < .05$, ** = $p < .01$

Table 3: Correlation Table for the entire sample at time 1

	1.	2.	3.	4.	5.	6.	7.
1. Family income	1.00 175	.47** 175	.03 175	.39** 175	-.07 132	-.02 172	.20** 175
2. Maternal education		1.00 175	-.03 175	.44** 175	-.14 132	.03 172	.26** 175
3. Child's age			1.00 175	.05 175	.03 132	-.32** 172	-.05 175
4. HOME total				1.00 175	-.17* 132	-.15(t) 172	.46** 175
5. CBCL total					1.00 132	.11 131	-.19* 132
6.Observed Behaviour						1.00 172	-.28* 172
7. Child IQ							1.00 175

* = $p < .05$, ** = $p < .01$

Table 4: Regression for child IQ at time 1 for the entire sample (N= 175)

Variables	Beta	ΔR^2	ΔF
Family income	.18(t)		
Maternal education	.20*		
Child age	.04		
Child sex	.20*		
		.14	4.94**
Family income	.04		
Maternal education	.06		
Child age	-.01		
Child sex	.19*		
Home score	.44**		
		.13	22.90**
Family income	.05		
Maternal education	.06		
Child age	-.06		
Child sex	.17*		
Home score	.38**		
Observed Behaviour	-.24**		
CBCL total score	-.06		
		.06	5.40**
Family income	-.01		
Maternal education	.08		
Child age	-.18**		
Child sex	.16*		
Home score	.32**		
Observed Behaviour	-.20**		
CBCL total score	-.03		
Group membership	.40**		
		.13	30.42**
Family income	-.01		
Maternal education	.08		
Child age	-.18*		
Child sex	.15*		
Home score	.32**		
Observed Behaviour	-.18*		
CBCL total score	-.03		
Group membership	.42**		
Interaction group and Observed Behaviour	.11(t)		
		.2	2.70(t)
	R^2=.70		
	R=.47		
	F=12.12**		

Table 5: Correlations at time 1 for the at-risk group

	1.	2.	3.	4.	5.	6.	7.
1. Family income	1.00						
	66						
2. Maternal	.31**	1.00					
education	66	66					
3. Child's age)	-.05	-.11	1.00				
	66	66	66				
4. HOME total	.37**	.30*	.05	1.00			
	66	66	66	70			
5. CBCL total	-.22	.01	.03	-.03	1.00		
	44	44	44	44	44		
6. Observed	-.05	.03	-.30*	-.11	.13	1.00	
Behaviour	64	64	64	64	43	70	
7. Kid IQ	.18	.29*	-.14	.43**	-.07	-.32*	1.00
	66	66	66	66	44	64	70

(t) = p <.10, * = p < .05, ** = p < .01

Table 6: Correlations at time 2 for the not at-risk group

	1.	2.	3.	4.	5.	6.	7.
1. Family income)	1.00						
	109						
2. Maternal	.53**	1.00					
education	109	109					
3. Child's age	.03	-.06	1.00				
	109	109	109				
4. HOME total	.37**	.48**	-.07	1.00			
	109	109	109	105			
5. CBCL total	.03	-.19	.11	-.19	1.00		
	88	88	88	88	85		
6. Observed	.06	.08	-.25**	-.07	.04	1.00	
Behaviour	108	108	108	108	88	108	
7. Child IQ	.13	.20*	-.32**	.38**	-.19	-.04	1.00
	109	109	109	109	88	108	109

(t) = p <.10, * = p < .05, ** = p < .01

Table 7: Regressions for IQ in the At-risk and remainder of the sample at time 1

	Among children at-risk for developmental delay N = 66			Among children not at-risk for developmental delay N=109		
	Beta	ΔR^2	ΔF	Beta	ΔR^2	ΔF
Family income	.11			.05		
Maternal education	.22			.16		
Child age	-.10			-.29**		
Child sex	.18			.14		
		.14	2.39		.16	4.91**
Family income	-.01			-.01		
Maternal education	.14			.02		
Child age	-.14			-.28**		
Child sex	.19			.11		
Home score	.40**			.34**		
		.13	10.50**		.09	11.82**
Family income	-.03			.01		
Maternal education	.15			.02		
Child age	-.24*			-.30**		
Child sex	.16			.09		
Home score	.37**			.32**		
CBCL-PRF	.00			-.08		
Observed Behaviour	-.33*			-.08		
		.10	4.49*		.01	.84
	R=.60			R=.51		
	R^2=.36			R=.20		
	F=4.72**			F=4.96**		

(t) = p <.10, * = p < .05, ** = p < .01

Table 8: T-tests between the at-risk and not at-risk parts of the sample at time 2

	N	Mean	Standard Deviation	Degrees of freedom	T-score
Family Income					
At-risk	54	39,717	20,756	136	2.96
Low Risk	84	47,530	26,871		
Child age					
At-risk	41	7.62	.88	112	.47
Low Risk	73	7.70	.99		
CBCL-TRF					
At-risk	47	56.55	11.11	115	1.30
Low Risk	70	54.14	8.85		
CBCL-PRF					
At-risk	53	55.18	11.86	135	.56
Low Risk	84	54.03	11.60		
Vocabulary					
At-risk	55	94.19	16.21	135	-3.46**
Low Risk	83	104.57	17.72		
Report card					
At-risk	53	-.01	1.03	135	-.03
Low Risk	84	.00	.98		
WIAT math					
At-risk	52	96.92	17.82	134	-.73
Low Risk	84	98.87	13.06		

(t) = p <.10, * = p < .05, ** = p < .01

Table 9: Correlations for the entire sample at time 2

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Income	1.00	.37**	-.01	.42**	-.10	.01	.25**	.05	.12	-.06	.03
	138	138	113	138	138	108	138	137	137	117	137
2. Maternal		1.00	-.03	.42**	.01	-.15	.29**	.21*	.09	-.20*	-.17
education		140	114	140	139	108	140	137	137	117	137
3.Child age			1.00	-.13	.07	-.02	.00	-.24**	.19*	-.13	.06
			114	114	114	108	114	137	137	117	137
4.HOME T1				1.00	-.23**	-.18(t)	.54**	.26**	.23**	-.26**	-.16(t)
				140	139		140	137	137	117	137
5. BSOS (T1)					1.00	.14	-.27**	.01	-.15	.13	.18*
					139	108	139	137	137	117	137
6.CBCL-PRF						1.00	-.18(t)	-.13	-.15	.04	.50**
(T1)						108	108	108	107	90	107
7. IQ T1							1.00	.35**	.27**	-.33*	-.19*
							140	137	137	117	137
8.Report card								1.00	.24**	-.43**	-.18*
								137	137	117	137
9.Vocabulary									1.00	-.13	-.04
									137	117	137
10.CBCL-TRF										1.00	.26**
										137	117
11. CBCL-PRF											1.00
											117

(t) = p <.10, * = p < .05, ** = p < .01)

Table 10: Regressions for reports card grades and WIAT math composite score at time 2 for the entire sample.

	Report Card Grades (N =138)			WIAT math composite score (N=137)		
	Beta	ΔR^2	ΔF	Beta	ΔR^2	ΔF
Maternal education	.20*			.21*		
Income at time 2	-.02			-.01		
Child age	.23**			.04		
Child gender	-.01			.08		
		.10	3.55**		.05	1.76
Maternal education	.12*			.17(t)		
Income at time 2	-.01			.00		
Child age	-.20*			.07		
Child gender	-.06			.05		
Maternal CBCL total	-.08			.01		
Teacher CBCL total	-.35**			-.27**		
		.13	11.02**		.07	5.09**
Maternal education	.12			.17(t)		
Income at time 2	-.01			.00		
Child age	-.21*			.07		
Child gender	-.06			.05		
Maternal CBCL total	-.08			.01		
Teacher CBCL total	-.34**			-.27**		
Group membership	.04			.00		
		.00	.16		.00	.00
	R=.48			R=.35		
	R^2=.23			R^2=.12		
	F=5.47**			F=2.51*		

(t) = p <.10, * = p < .05, ** = p < .01

Table 11: Regression for report card grades and WIAT math score at time 2 for the entire sample using time 1 and time 2 variables

	Report card grade (N=138)			WIAT Math score (N=137)		
	Beta	ΔR^2	ΔF	β	R^2	F
Maternal education	.12			.17(t)		
Family income	-.11			-.05		
Child's age	-.26**			.03		
Child's gender	-.04			.06		
HOME total score	.28**			.15		
		.15	4.79**		.07	1.91(t)
Maternal education	.09			.15		
Family income	-.10			-.05		
Child's age	-.25**			.05		
Child's gender	-.08			.05		
HOME total score	.12			.13		
Child IQ (T1)	.31**			.08		
CBCL-PRF (T1)	-.05			-.03		
Observed behaviour style (T1)	-.03			.08		
		.07	3.66*		.39	.76
Maternal education	.05			.12		
Family income	-.07			-.02		
Child's age	-.21*			.09		
Child's gender	-.10			.05		
HOME total score	.09			.10		
Child IQ (T1)	.25*			.02		
CBCL-PRF (T1))	-.05			-.06		
Observed behaviour style (T1)	.06			.10		
CBCL-TRF (T2)	-.29*			-.27**		
CBCL-PRF (T2)	-.04			.03		
		.07	6.70**		.06	4.38*
Maternal education	.05			.13		
Family income	-.07			-.02		
Child's age	-.16(t)			.10		
Child's gender	-.10			.05		
HOME total score	.10			.10		
Child IQ (T1)	.30**			.04		
CBCL-PRF (T1)	-.05			-.06		
Observed behaviour (T1)	.06			.10		
CBCL-TRF (T2)	-.29**			-.27**		
CBCL-PRF (T2)	-.03			.03		
Group membership	-.12			-.04		
		.01	1.65		.00	.13

	R=.55	R=.37
	R^2=.30	R^2=.14
	F=4.989**	F=1.81(t)

(t) = p <.10, * = p < .05, ** = p < .01

Table 12: Behaviour problem scores at time 1 and WIAT math scores at time 2 (χ^2 (4, 107) =3.85, p <.05)

	Behaviour problem scores greater than one sd above the mean	Behaviour problem scores not greater than one sd above the mean	
WIAT one sd or more below the mean	4 (3.7%)	7 (6.5%)	11 (10.2%)
WIAT not one sd or more below the mean	13 (12.1 %)	83 (77.6%)	96 (89.7%)
	17 (15.9%)	90 (84.2%)	107 (100%)

Table 13: Regressions for CBCL-PRF at time 2 (N=138)

	Total Score			Internalizing			Externalizing		
	Beta	ΔR^2	ΔF	Beta	ΔR^2	ΔF	Beta	ΔR^2	ΔF
Maternal education	-.20*			-.13			-.18*		
Family Income	.11			.12			.13		
Child sex	-.22**			-.19*			-.18*		
		.08	4.08**		.06	2.72*		.07	3.21*
Maternal education	-.14*			-.08			-.12		
Family Income	.11			.11			.13		
Child sex	-.16*			-.15(t)			-.12		
IQ (T1)	-.04			-.02			-.11		
CBCL-PRF (T1)	.39**			.32**			.39**		
Observed Behaviour (T1)	.12			.06			.11		
		.19	11.03**		.11	5.85**		.18	10.59**
Maternal education	-.12			-.08			-.10		
Family Income	.10			.10			.13		
Child sex	-.16*			-.15(t)			-.12		
IQ (T1)	-.01			.00			-.02		
CBCL-PRF (T1)	.39**			.32**			.38		
Observed Behaviour (T1)	.14(t)			.07			.12		
Report Card	-.11			-.08			-.07		
Vocabulary	.04			.04			.00		
WIAT Math	-.01			.02			-.06		
		.01	.68		.01	.30		.01	.48
Maternal education	-.12			-.08			-.11		
Family Income	.10			.11			.12		
Child sex	-.15(t)			-.15(t)			-.12		
IQ (T1)	-.04			.03			-.07		
CBCL-PRF (T1)	.39**			.32			.38		
Observed Behaviour (T1)	.14(t)			.07			.13		
Report Card	-.10			-.09			-.04		
Vocabulary	.03			.05			-.02		
WIAT Math	-.01			.02			-.06		
Group membership	.05			-.06			.10		
		.00	.351		.00	.44		.01	1.31

	R=.53 R^2=.28 F=4.99**	R=.18 R^2=.11 F=2.74**	R=.532 R^2=.27 F=4.81**

Table 14: Regressions for CBCL-TRF at time 2 (N=118)

	Total Score			Internalizing			Externalizing		
	Beta	ΔR^2	ΔF	Beta	ΔR^2	ΔF	Beta	ΔR^2	ΔF
Maternal education	-.21*			-.13			-.10		
Family Income	.04			.02			-.02		
Child sex	-.11			-.04			-.14		
		.08	4.08**		.02	.66		.03	1.35*
Maternal education	-.15*			-.07			-.09		
Family Income	.08			.03			.03		
Child sex	-.07			-.02			-.11		
IQ (T1)	-.28**			-.23*			-.15		
CBCL-PRF (T1)	.06			-.10			-.07		
Observed Behaviour (T1)	.07			.11			.19(t)		
		.19	11.03**		.05	1.86		.07	2.75*
Maternal education	-.06			-.02			-.05		
Family Income	.05			.00			.00		
Child sex	-.06			-.05			-.08		
IQ (T1)	-.17(t)			-.08(t)			-.13		
CBCL-PRF (T1)	-.09			-.14			-.08		
Observed Behaviour (T1)	.09			-.13			.22*		
Report Card	-.32**			-.20*			-.18(t)		
Vocabulary	.05			-.24*			.19*		
WIAT Math	-.22*			-.21*			-.15		
		.01	.68		.16	7.53**		.07	3.06*
Maternal education	-.12			.02			-.05		
Family Income	.10			.00			.01		
Child sex	-.15(t)			-.05			-.08		
IQ (T1)	-.04			-.09			-.14		
CBCL-PRF (T1)	.14			-.14			.08		
Observed Behaviour (T1)	.14(t)			-.13			.22*		
Report Card	-.19(t)			-.20*			-.18(t)		
Vocabulary	.04			-.24*			-.19(t)		
WIAT Math	-.14*			-.21*			-.15		
Group membership	.05			.00			.0		
		.00	.351		.00	.00		.00	.04

	R=.53 R^2=.28 F=4.99**	R=.48 R^2=.16 F=3.13**	R=.41 R^2=.17 F=2.22*

Appendix A

"L'INDIVIDU DANS SON MILIEU: Les parents et leurs enfants"

Directeurs du projet: - Lisa A. Serbin, Ph.D.
- Dale M. Stack, Ph.D.
- Alex E. Schwartzman, Ph.D.

FORMULAIRE DE CONSENTEMENT

Je,_____, m'engage volontairement avec mon enfant, _____, à participer à l'étude "L'individu dans son milieu: Les parents et leur enfant" de l'Université Concordia. Les buts du projet m'ont été expliqués. L'étude comprend une série de questionnaires, une évaluation du fonctionnement intellectuel de mon enfant, ainsi que trois périodes de jeux lors desquelles nous serons observés et filmés. L'étude comporte deux sessions d'une durée maximale de 3 heures chacune et une rémunération totale de $50.00 me sera allouée aussitôt que les questionnaires seront remis. En signe de courtoisie, les résultats sommaires de l'évaluation de mon enfant me seront communiqués par téléphone. De plus, les chercheurs seront prêts à effectuer une ou deux visites additionnelles, au besoin, pour terminer l'évaluation, discuter de résultats problématiques, ou m'offrir un service de référence.

Je comprends que toutes les informations que nous fournissons, qu'elles soient écrites ou filmées, sont strictement confidentielles et qu'elles ne serviront qu'à des fins de recherche. Dans toutes les circonstances, je suis assuré(e) que l'anonymat sera conservé. Cependant, selon la loi sur la protection de la jeunesse, toute information indiquant de l'abus physique ou sexuel devra être divulguée à l'Office de la Protection de la Jeunesse.

Je comprends aussi que je suis libre de cesser notre participation à n'importe quel moment. Comme le projet "L'individu dans son milieu" est à long terme, je comprends que je pourrais être appelé(e) dans l'avenir pour participer à d'autres étapes de ce projet. Je me réserve le droit de décider, à ce moment, de donner suite ou non à la demande de participation.

Signature:_____

Nom:_____ Date:_____

Assistant(e) de recherche:_____

Appendix B

PARENT-CHILD/HEALTH CANADA:

Full Protocol

May 15, 1996

DAY 1 PROTOCOL:

1- Examiner: - takes care of introductions,
- builds rapport with child,
- explains general Day 1 procedures to Ss,
- makes sure mother has read and signed consent form,
- administers HOME interview items as part of the warm-up conversation,
- explains saliva sampling and obtains a sample from both of them **immediately before standard testing** (record the time that all samples are taken on the appropriate form).

Interviewer: - chooses the most appropriate room for interaction series,
- sets up camera and materials for Series 1 in the standard order (see toy lay -out sheet),
- removes all other unnecessary materials,
- unplugs that room's telephone if present,
- and attempts to remain as invisible to the child as possible until Series 2. **(±20 min.)**.

2- Examiner: - begins administering Bayley II or SB4.

Interviewer: - **a)** if mother does not need to stay with child (for SB4): Interviewer begins administering the demographic, obstetric, temperament and health questionnaires to her;
- **or b)** if mother needs to stay with her child, the Interviewer can supervise siblings, do HOME observation items, score/enter data, or read a good book!!!

(30-60 min. or whatever the child can handle)

BREAK - **The 2nd saliva sample is taken from both mother and child immediately (±10 min.) following standard testing. Examiner asks mother to come, if she's with Interviewer.**

- Make sure you ask Ss if they need to go to the bathroom or get a change of diaper.

- If needed, Interviewer informs Examiner of interaction setup location.)

3- Before bringing Ss to the interaction room, the Examiner gives mother the following Series 1 instructions.

Série 1

"Maintenant, on aimerait vous voir jouer ensemble. Comme tu sais, on va enregistrer ça sur vidéo. Donc, pour être sûr que vous restiez tous(tes) les deux bien en vue pendant qu'on filme, c'est très important que vous restiez assis(es) tous(tes) les deux sur le tapis qu'on a mis par terre. Moi, je vais rester silencieuse derrière la caméra pour être bien sûr qu'elle fonctionne bien. Donc, essayez d'être le plus naturels possible et faites comme si je n'étais pas là. Alors, la première chose qu'on aimerait que tu fasses est simplement de jouer avec (ENFANT) comme vous le faites d'habitude pendant environ 15 minutes. Vous pouvez prendre n'importe quel des jouets sur le tapis. Puis, quand tu entendras l'alarme sonner, tu pourras arrêter de jouer. As-tu des questions? C'est très important aussi que tu attendes mon signal avant de commencer à jouer, OK?"

Examiner then gets Ss settled on the carpet and instructs child (if s/he can understand such instructions) to remain within its limits; e.g.:

"Maintenant, (CHILD), tu vas jouer avec maman, mais j'aimerais que tu restes sur le tapis. Fais comme si le tapis était ton carré de sable et que c'est défendu de sortir du carré de sable..." etc.

Examiner goes behind the camera and tells mother they can begin. Examiner is responsible for timing Series 1,2, and 3. The beeper should be started and stopped over the microphone so the coders are clear about when to begin and end coding that episode. [If there is an interruption of filming during the **first** half of the series (e.g., bathroom), reset the timer to 15 min. and start over. If the interruption occurs in the **second** half of the series **and** lasts less than 2 min., just pause and restart timer when the interaction resumes; but if the trip takes **more** than 2 min., Series 1 will have to be repeated at the end of Day 2.]

At the end of Series 1, Examiner administers "Maternal perceptions" questionnaire. If mother reports a score of 1 or 2, thus indicating that either her or her child's behavior was not natural, Series 1 should be repeated on Day 2.

(±20 min.)

BREAK - Everybody leaves interaction room during break so that the
(±10 min.) Interviewer can reposition materials for Series 2, and position a barrier
(e.g., Fisher Price gate, a playpen) that will safely prevent 12-36 mo. child from leaving interaction room during separation episode.

- Bathroom check

4- While the Examiner supervises the child away from the interaction room, she asks mother to join the Interviewer there. The Interviewer will then give mother the following Series 2 instructions so as not to be heard by child. (If child becomes upset about his/her mother's departure, Examiner will give her the instructions in the child's presence.)

Série 2

FREE PLAY (4 MIN)

"La prochaine période de jeux va aussi être filmé mais va avoir 4 parties: En premier, tu va recommencer à jouer avec (ENFANT) comme tantôt, mais juste pour une couple de minutes jusqu'à ce que tu entendes l'alarme sonner, comme tantôt."

PUZZLES (7 MIN, 4 MIN for 12-36 cohort)

"A ce moment-là, pousse les jouets de côté et choisis un casse-tête à faire avec (ENFANT). (FOR OLDER COHORT, EXPLAIN TO MOTHER THE LABELLED BAGS OF PUZZLE PIECES AND THEIR CORRESPONDING BOARDS). Si vous finissez ce casse-tête-là, vous pouvez travailler sur un autre. Après quelques minutes, l'alarme va sonner de nouveau et je vais entrer pour m'asseoir ici." (PRESS BEEPER WHEN THEY BEGIN WORKING ON THE PUZZLE)

Interviewer comes in at the beep and waits next to the door until mother has left. Then s/he puts the barrier in place (for 12-36 mo. cohort) and sits down on a chair so as not to face child directly. Interviewer then gets busy with paperwork interacting as little as possible with child (i.e., s/he should not look at, speak to, or touch the child unless s/he is in danger of harming him/herself).

SEPARATION AND REUNION (2+4=6 MIN)

"A ce moment-là, tu sortiras de la pièce pour laisser (ENFANT) jouer tout seul avec les jouets. Et pour être sûr qu'il/elle ne te suivra pas quand tu va sortir, je vais placer une barrière en travers la porte/arche. Bien sûr, si (ENFANT) devient trop dérangé par ton absence, ou si tu te sens mal à l'aise, on arrêtera puis tu pourras le/la rejoindre. Sinon, après une couple de minutes, je vais sortir pour te dire que c'est le temps d'aller rejoindre (ENFANT) sur le tapis. Puis, tu passera 3-4 minutes de plus avec lui/elle et on te laissera savoir quand tout est fini."

Examiner programs beeper for 6 min. and presses "start" when mother exits the room. Then, after 2 minutes, she signals Interviewer to go get mother by pressing "pause" and presses "start" again when mother comes in. Examiner should keep child in view during separation and reunion episodes.

"Donc, pour résumer, commencez par jouer ensemble comme vous le faites d'habitude; puis, quand tu entendras l'alarme, pousse les jouets de côté et choisis un casse-tête. Quand tu me verras entrer, sors de la pièce jusqu'à ce que je te dise te rejoindre (ENFANT). J'ai une petite liste qui pourra t'aider à te souvenir des étapes, et je vais la placer juste ici. As-tu des questions? J'aimerais juste te rappeler encore de rester sur la

couverture pour que vous puissiez rester bien en vue. J'aimerais aussi quand tu sortiras que tu restes invisible pour (ENFANT), mais assez près pour entendre l'alarme. N'oublie pas d'attendre le signal avant de commencer, OK?"

At the end of Series 2, Interviewer takes cortisol sampling and **then** administers "Maternal perceptions" questionnaire If mother reports a score of 1 or 2, Series 2 should be repeated on Day 2. The interviewer then takes the final saliva sample from both the parent and her child.

(±25 min.)

5- At the end of Day 1, Interviewer administers Day 1 Touch Questionnaire, gives instructions for mother and father questionnaire packages, and summarizes Day 2 procedures.

N.B. If child needs to nap during Day 1, Interviewer can take that opportunity to begin interviews with mother.

Total time, 2-3 hours

Fill out the VideoTape log sheet. Clean Bayley II and toys between each visit

DAY 2 PROTOCOL:

1- Examiner reconnects with child. Rapport building between Interviewer and mother, this includes Day 2 general instructions.

(±15 min)

2- Examiner finishes Bayley II or SB4. If mother does not need to stay with child, Interviewer answers any questions she might have about the questionnaires and finishes interviewing her. But if mother still needs to stay with child, Interviewer can set up Series 3 materials.

BREAK **- Series 3 setup, if not done already**
(±10 min.)
- Bathroom check

3- While Examiner supervises child away from interaction room, she tells mother to go to the interaction room to meet Interviewer who gives her the following Series 3 instructions so as not to be heard by child. If child becomes upset about mother's departure, the Examiner gives her the instructions in the child's presence.

Série 3
FREE PLAY (4 MIN)

"C'est la dernière fois qu'on va vous filmer, et il y a 4 choses qu'on aimerait que vous fassiez ensemble. D'abord, comme l'autre jour, on aimerais que tu joues avec (ENFANT) comme vous le faites d'habitude avec les jouets jusqu'à ce que tu entendes l'alarme sonner.

COMMAND TASK (3 MIN) NOT DONE FOR 12-24 MO. CHILDREN

A ce moment-là, vous aller arrêter de jouer pour faire quelque chose de complètement différent. Pour les 2-3 prochaines minutes, j'aimerais que tu demandes à (ENFANT) de faire quelques petites tâches pour toi. Tiens, voilà une liste de tâches que tu peux utiliser (GIVE HER THE PAD). Comme tu peux voir, il y en a qui sont plus difficiles que d'autres; c'est parce qu'on visite différentes familles avec des enfants d'âges différents. Celles du début sont plus faciles que celles de la fin (READ FIRST 3 AND LAST 3). On aimerais que tu prennes au moins 4 ou 5 des tâches de la liste. Tu peux en prendre plus si tu veux et tu peux même inventer tes propres tâches, mais pourvu que (ENFANT) n'ait pas à sortir de la pièce. Le pad sera placé tout près du tapis. (PRESS BEEPER WHEN MOTHER BEGINS INTRODUCING TASK)

INTERFERENCE TASK (3 MIN)

Quand tu entendras l'alarme sonner, vous arrêterez pour faire autre chose encore. On aimerais voir comment (ENFANT) réagit quand tu es très occupée. Tu sais comment c'est des fois quand tu es au téléphone ou bien en train de faire à manger et que c'est pas possible de lui donner toutes l'attention qu'il/elle demande. Pour observer ça, on aimerais que tu tournes la page sur ton pad pour remplir les questionnaires qui sont juste en-dessous (SHOW HER). Et pendant que tu les remplis, on aimerait que tu te retournes un peu pour lui faire comprendre que ce que tu fais est très important. (ENFANT) pourra continuer à jouer avec les jouets pendant ce temps-là; mais assure-toi encore qu'il/elle reste assis(e) sur le tapis. Tu continueras de travailler sur les questionnaires jusqu'à ce que tu entendes une autre alarme. (PRESS BEEPER WHEN MOTHER BEGINS QUESTIONNAIRE)

FREE PLAY (4 MIN)

A ce moment-là, mets le pad de côté et recommence à jouer avec (ENFANT) comme vous le faites d'habitude jusqu'à ce l'alarme te dise que c'est fini. N'oublie pas de rester à l'intérieur des limites du tapis pour que la caméra puisse vous garder tous les deux bien en vue.

Donc, en résumé, commencez par jouer avec (ENFANT) comme vous le faites d'habitude; ensuite, quand tu entends la 1ère alarme, prends le pad et fais-lui faire des tâches; puis, à la 2e alarme, commence à travailler sur le questionnaire jusqu'à ce que tu entendes la 3e alarme. A ce moment-là, tu recommences simplement à jouer avec (ENFANT). Comme la dernière fois, on a une petite liste qui va t'aider à te rappeler des étapes. As-tu des questions? N'oublie pas d'attendre le signal avant de commencer, OK?"

At the end of Series 3, Interviewer administers "Maternal perceptions" and "Touch" questionnaires.

(±25 min.)

BREAK
±10 min.

4- Examiner administers the "Parenting Practices Interview", investigate any clinical concerns that might have arisen through other questionnaires, administers the remaining HOME interview items and the SCID modules (if required). Meanwhile, the Interviewer administers the Peabody to the child. When Examiner is done with her interviews, the Interviewer joins her for the wrap-up.

(±60 min. or more, as needed)

Total time, 2-3 hours.
Fill out the VideoTape log sheet. Clean Bayley II and toys between each visit

Appendix C- Demographic Information Questionnaire

Septembre 1996

N° d'identification _____
Date: _____

L'INDIVIDU DANS SON MILIEU

Renseignements sociodémographiques

Tous ces renseignements sont traités de façon totalement confidentielle

1.**Sexe** ☐ M ☐ F

2.**Âge** _____ ans Date de naissance AN ____ MO ____ JR ____

3.**État civil**

Note: "Conjoints de fait": désigne deux personnes qui vivent ensemble comme si elles étaient mariées. Il s'agit de ton état actuel; même si tu es légalement divorcé(e) ou autre, mais que tu vis avec un(e) conjoint(e) présentement, inscris conjoint de fait.

		Depuis quelle date?
☐ Célibataire	☐ Conjoint	
☐ Marié(e)	☐ Séparé(e)	AN MO JR
☐ Divorcé(e)	☐ Veuf/veuve	_____ _____ _____

4. **Nombre d'enfants** _____

Si enceinte (ou conjointe enceinte), bébé attendu pour: ____ ____
AN MO

Sinon, prévoyez-vous avoir un enfant dans les prochains 12 mois? OUI _____
NON ____

dans les prochains 24 mois? OUI _____
NON ____

Pour <u>chaque enfant</u>:

1 - Inscrire le nom, le sexe, la date de naissance

2 - Encercler "**TE**" si c'est ton enfant (tu es le parent biologique)
"**EC**" si l'enfant du conjoint (le conjoint actuel est le parent biologique)
"**EA**" si c'est un enfant adopté /"**FA**" en foyer d'accueil et qui vit chez toi
Si "TE" et "EC" sont vrais, encercler les deux.

3 - Indiquer si l'enfant vit avec toi, **OUI** ou **NON** ou **GP** (garde partagée)

4 - Inscrire l'année scolaire (si applicable) ainsi que si l'enfant fréquente une classe ou une école spéciale.

(Si tu as plus de quatre enfants, inscrire leurs informations sur une feuille séparée.)

1 NOM _____ SEXE ☐ M ☐ F AN ____ MO ____ JR ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP☐

Année scolaire: _____ Classe spéciale: _____

2 NOM _____ SEXE ☐ M ☐ F AN ____ MO ____ JR ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP☐

Année scolaire: _____ Classe spéciale: _____

3 NOM _____ SEXE ☐ M ☐ F AN ____ MO ____ JR ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP☐

Année scolaire: _____ Classe spéciale: _____

4 NOM _____ SEXE ☐ M ☐ F AN ____ MO ____ JR ____

L'enfant est: TE EC EA / FA Vit avec toi: OUI ☐ NON ☐ GP☐

Année scolaire: _____ Classe spéciale: _____

5. **Ta scolarité** complétée (dernière année terminée):

En quoi? (spécialisation/général): _____

Étudies-tu présentement? OUI : Temps plein ☐ partiel ☐ NON ☐

Si oui, quel diplôme postules-tu _____ pour quand?
____/____/____/

6. **As-tu un emploi** (rappel: renseignements gardés confidentiels)?

OUI ☐

NON ☐

Occupation: _____
_____

Tes tâches: _____
_____
_____

Combien d'heures/sem.? _____

Salaire de l'heure _____ $

travailler:
Depuis quand es-tu à cet emploi? inscrire la date
AN MO
____/____/

As-tu déjà eu un emploi?

Oui ☐ Non ☐
⇓
En quoi?

Pendant combien de temps?
____ an(s) ____ mois

Quand as-tu arrêté de

date: ____/____/
AN MO

Au cours des 12 derniers mois, as-tu bénéficié de:

Oui ☐ Non ☐ l'Assurance chômage?

Oui ☐ Non ☐ Prestations d'aide sociale?

Oui ☐ Non ☐ la CSST? (préciser:_____)

7. **Informations sur le conjoint (renseignements gardés confidentiels):**

AN MO JR

a) Son nom:_____
b) Date de naissance ____ ____ ____

Son occupation:_____

Ses tâches:_____

Son salaire: _____ $/ heure Nombre d'heures _____ / semaine

AN MO

Il/Elle travaille là depuis: date ____ ____

b) Au cours des 12 derniers mois, a-t-il/elle bénéficié de:

Oui ☐ Non ☐ l'Assurance chômage?

Oui ☐ Non ☐ Prestations d'aide sociale?

Oui ☐ Non ☐ la CSST? (préciser:_____)

c) Sa scolarité complétée (dernière année terminée):

En quoi? (spécialisation/général):_____

Étudie-t-il (elle) présentement? OUI : Temps plein ☐ partiel ☐ NON ☐

Si oui, diplôme postulé?_____ pour quand?
(date) ____/____/

8. **Informations sur le père\la mère de tes enfants (si n'habite pas avec toi)**

AN MO JR

a) Son nom:_____

b) Date de naissance ____ ____ ____

Son occupation:_____

Ses tâches:_____

Son salaire: _____ $/ heure Nombre d'heures _____ / semaine

AN MO

Il/Elle travaille là depuis: date ____ ____

b) Au cours des 12 derniers mois, a-t-il/elle bénéficié de:

Oui ☐ Non ☐ l'Assurance chômage?

Oui ☐ Non ☐ Prestations d'aide sociale?

Oui ☐ Non ☐ la CSST? (préciser:_____)

c) Sa scolarité complétée (dernière année terminée):

En quoi? (spécialisation/général):_____

Étudie-t-il (elle) présentement? OUI : Temps plein ☐ partiel ☐ NON ☐

Si oui, diplôme postulé?_____ pour quand? (date)____/____

S.V.P. Vérifier l'adresse et les numéros de téléphone.

_____ _____

No Rue app.

_____ _____ _____

Ville Code postal

Téléphones: Personnel: (_____) _____ - _____

Travail: (_____) _____ - _____

Parents: (_____) _____ - _____

Autre _____: (_____) _____ - _____

Ton numéro de téléphone est à quel nom dans l'annuaire téléphonique: Nom complet et lien avec toi:

_____

Adresse électronique: _____

Adresse des parents: _____

_____

_____

_____

_____

_____

Appendix D-Behavioural Style Observational System

Free play-4 minutes

Coding will begin when mother and child start interacting and will continue until the tier sounds or until the experimenter stops the interaction. Coding will stop at the end of the 4 minutes regardless of whether the mother and child continue to interact. The counter display on the screen will be used to determine the length of time and will be set by the principal coder.

1) Mood (child)
1= negative i.e. Whining, frowning, screeching, tantrums, crying
2= neutral i.e. neither positive nor negative, lack of expressiveness
3 = positive i.e. Laughing, positive vocalizations, smiling
-> for majority of time (more than 2 minutes)

2) Quality of Physical Contact
-for DIR (DIRECTION) do 1 = M-C only, and 3 =mutual
-if child is comfortable in mother's lap then 3, if not then 1
-for quality of contact does not include inappropriate behaviour such as kissing child on the mount
-examples of appropriate are hug, pat kiss, arm around shoulders, holding hands, ruffling hair, stroking caressing, child sitting in mother's lap, child learning on mom
-does not including touching as part of playing game or teaching something ex. Counting fingers on hand
-does not include restraining child in lap or arms.
->YES-1, No=2

3) Quality of Mother Warmth
-physical warmth is defined by affectionate physical contact such as hugging, kissing touching, holding
-verbal warmth is define by engaging child in conversation being lively and animated talking sweetly to child with affectionate terms
1=minimal physical and/or verbal warmth i.e. Not affectionate physical contact and verbal interaction is rare
2=low physical an high verbal warmth i.e. Not to some degree of physical warmth, large degree of verbal
3=low verbal and high physical warmth i.e. No to some degree of verbal warmth, high degree of physical
4=high physical and verbal warmth i.e. Large degree of both physical and verbal warmth
-> in more that one time period

4) Mother's Involvement with Child
-based on body orientation eye contact and verbal interaction
1= somewhat disengaged i.e. Mother who does not make effort to interact with child, eye contact and verbal interaction are rare sitting away from child
1>mother is detached from play or preoccupied with toys

2= involved i.e. Mother who verbally and physically interacts with child, lots of eye context, child sitting in mother's lap or facing ach other closely
->includes joint attention on toy, book
->in order to coded, behaviour must occur for over 30 seconds in each minute segment

5) Child Involvement with Mother
-based on body orientation, eye contact and verbal interaction
1=somewhat disengaged i.e. Child who does not make effort to interact with mother, eye contact and verbal interaction are rare sitting away from mother
->child is detached from play or preoccupied with toys
2= involved i.e. Child who verbally and physically interacts with mother, lots of eye contact, child who sits in mother's lap or facing her
->includes joint attention on toy, book
-> in order to be coded, behaviour must occur for over 30 seconds in each minute segment

6) Activity Level
-refers to how active child is during free play on mat
-getting up refers to getting toy, moving to change sitting position, moving closer or farther away from mother
-does not include child sliding across mat to move to other side without getting up
-for child 1-2 year old, if crawling off mat considered getting up
1= child who sits for entire free play without getting u
2=child who gets up once o twice
3=child who gets up three or more times

7) Vocal level
-refers to child' emotional reactivity but not in response to any specific event
-examining whether child gets upset or frustrated easily
1=low reactivity, even-tempered child, very calm, not bothers by little things
2=somewhat reactive at times but calms down on own -> more than once occurrence
3=high reactivity, expressed by loud verbalizations, crying whining, often cannot calm down on own

8) Approach to toys
-refers to child's approach to toys
1=child who resists playing with toys, sulks, wants to be left alone
2=child who take some initiative to play but mostly follows mom's lead i.e. Mother reading book
3=child who actively seeks out toys to play with, take initiative to get toys, stats games
->for more that 2 minutes

9) Mood Regularity
-Refers to how consistent child's mood is across free play
1=consistent i.e. No fluctuation for majority of time

2=fluctuates once or twice i.e. Fluctuates from positive to negative, or negative to positive
3=fluctuates three or ore time i.e. Fluctuates back and forth from positive to negative or negative to positive

Interference tasks- 3 minutes

Coding begins when timer goes off to signal the beginning of the interface task and ends when timer sounds to signal the end of the interference tasks. The counter display on the screen will be used to determine the length of time and will be set by the principal coder.

1) Adaptability
-refers to child' initial adaptation to interference task (first 30 seconds)
1=child who becomes quite upset at beginning of interference, whines, cries
2=child who becomes fussy, tires to get mom's attention, does not try to play with toys immediately
3=child who moves easily into interference without making fuss, starts to play with toys right away

2) Mother on Tasks
-refers to extent to which mother focuses on task at hand, without attending to child for each 15 second interval
-off tasks does not include mother telling child that she is busy
-off tasks does not include mother making sure that child stays on mat or sits down unless it takes mother completely away from tasks fro majority of time interval
-when other is off task, give reason why
->could be because mother is interacting with child, talking to them, watching them do something **CODE AS 1 IN RSN (REASON)**
->could be because mother is trying to keep child on mat but child is restless and un avoidably take mother's attention away from task **CODE AS 2 IN RSN (REASON)**
-on tasks refers to mother who completes questionnaire, does not look or interact with child

3) Mood
1=negative i.e. Does not have to be as pronounced as in free play, can include frowning, whining
2=neutral i.e. Lack of vocalizations
3=positive i.e. some positive vocalizations (more than one)

6) Approach to Toys
2=picking up objects but not as engaged with them
3=showing enthusiasm, playing game, building something
-for children 1=3, if showing enthusiasm but not actively playing still 3
->for all other codes under interference tasks refer to free play definitions