Université de Montréal

The Association Between Perinatal Complications and Behavior of School-Age Boys.

La relation entre les complications périnatales et le comportement des garçons d'âge scolaire.

Par

Katia Elkouby

École de psychoéducation
Faculté des arts et des sciences

Mémoire présenté à la Faculté des études supérieures
en vue de l'obtention du grade de
Maître ès sciences (M. Sc.)
en psychoéducation

December 1999

Université de Montréal

Faculté des études supérieures

Ce mémoire intitulé

The Association Between Perinatal Complications and Behavior of School-Age Boys.

La relation entre les complications périnatales et le comportement des garçons d'âge scolaire.

Présenté par

Katia Elkouby

a été évalué par un jury composé des personnes suivantes :

Linda Pagani Ph.D, directeur de recherche (Université de Montréal)

Frank Vitaro Ph.D, président-rapporteur (Université de Montréal)

Ron Barr M.D., membre du jury (McGill University Health Center)

Mémoire accepté le.....2000-02-11.....

Abstract

Research in the area of perinatal risk has attempted to establish links between perinatal complications and behavioral maladjustment. Little consensus has been found among the findings in this field of research and very few researchers have investigated the association of perinatal events and childhood behavior. The goal of the present study was to examine the relationship between perinatal complications and the behavior of school-age boys by addressing the following questions: (1) Do perinatal complications predict behavior problems in middle childhood? (2) Do parenting practices play a moderator or protective role on later behavioral maladjustment for boys with a history of perinatal complications? In the context of a longitudinal study, a sample of 585 boys from low socioeconomic areas of Montreal were rated by their peers physical aggression and withdrawal at ages 11/12. For each participant, perinatal data was extracted from hospital birth records. Parenting practice variables were measured using a questionnaire completed by the subjects at the age of 10. A series of hierarchical multiple regressions were used for the statistical analyses. No significant main effects were found for prenatal, delivery, or postnatal complications on the outcome variables, rejecting our first hypothesis that perinatal complications predict behavior problems in later childhood years. Results also revealed interaction effects for supervision on fighting outcomes in boys with a history of prenatal complications. Results showed that parental supervision is a significant protective factor in the prevention of fighting behaviors, particularly for boys who were exposed to prenatal complications. These results suggested that parenting practices influence children's behaviors, especially in a population where children are faced with multiple risk factors from the time of conception. The findings have raised important implications for prevention, health care services, and future research. Improved perinatal health care, through more accessible services, geared towards at-risk mothers may reduce the incidence of complications occurring during pregnancy and childbirth. Support and intervention programs in parent training may be crucial in preventing behavior problems in the offspring, especially when perinatal complications have occurred.

Résumé

La recherche dans le domaine du risque périnatal tente d'établir une relation entre les complications périnatales et l'inadaptation sociale. Les complications périnatales se définissent par toute déviation d'une grossesse ou d'un accouchement normal, c'est un facteur ou un groupe de facteurs qui menace le développement de l'enfant. Ces facteurs périnataux surviennent au cours de trois périodes: pendant la grossesse (prénatal), à l'accouchement, et jusqu'à 3 à 4 semaines dans la vie de l'enfant (postnatal).

Pasamanick, Rogers, et Lilienfeld, en 1956, ont été parmi les premiers à s'intéresser à la relation entre les complications périnatales et le comportement à l'enfance et ont conclu que les complications périnatales peuvent «désorganiser» le système neurologique, ce qui a comme effet de réduire le seuil de tolérance ou d'adaptation aux stresseurs psychologiques et sociaux. De nos jours, grâce à l'avancement de la technologie moderne et de la médecine préventive, les dommages permanents au cerveau causant des déficits graves sont plus rares. Les répercussions du dysfonctionnement neurologique suite à des complications périnatales, sont plus subtiles et se manifestent plutôt par des troubles de comportement (Rantakallio et al., 1992; Hadders-Algra et al.,1988). Plusieurs chercheurs ont tenté de démontrer une association entre les événements durant la période périnatale et le développement du comportement humain. Certains auteurs ont soulevé des effets à long terme des complications périnatales sur le comportement social. Quelques études prospectives ont associé la présence de complications périnatales à un taux élevé de violence et de criminalité à l'âge adulte (Kandel & Mednick,1991; Raine et al.,1996). D'autres, n'ont pas obtenu de tels résultats (Kandel, 1992; Pagani et al., 1998; Raine et al., 1994; Szatmari et al., 1986). Les enfants ayant des troubles de comportement n'ont pas tous vécu des complications périnatales. En outre, une proportion significative de jeunes ayant eu des complications lors de la période périnatale ne développent pas de comportements inadaptés au courant de leur vie (Kopp & Parmelee, 1979; McCurry et al., 1991; Sameroff & Chandler, 1975; Werner, 1993).

Dans les recherches récentes (Baker & Mednick, 1984; Gray & Dean,1991; Kandel & Mednick, 1991; Pagani et al., 1998; Raine et al., 1994;1996), les auteurs ont adopté une nouvelle approche pour étudier les liens entre les complications périnatales et le comportement, en intégrant les facteurs de risque biologiques avec les facteurs de risque sociaux pour mieux comprendre l'étiologie des comportements déviants. Ces auteurs postulent qu'une seule variable ne semble pas augmenter la probabilité de problèmes d'adaptation ultérieurs, mais la combinaison de plusieurs facteurs de risque sont de meilleurs prédicteurs de l'inadaptation. Selon ces auteurs, les caractéristiques environnementales et les facteurs familiaux agissent en tant que modérateur et amplifient ou atténuent les problèmes de comportement qui surgissent au courant du développement. La variable modératrice est celle qui intéragit avec la variable indépendante et affecte le niveau (la force et la direction) de la variable dépendante. Cette variable modératrice représente la condition par laquelle le prédicteur s'associe à la variable dépendante. D'ailleurs, la variable modératrice est surtout introduite dans un modèle où la corrélation entre le prédicteur et la variable dépendante est soit faible ou inconsistante. Les effets modérateurs les plus puissants surgissent lorsque la prédiction entre la variable indépendante et la variable dépendante est non-significative (Baron et Kenney, 1986; Holmbeck, 1997). Dans la littérature pédiatriques, les variables modératrices sont souvent représentées par des caractéristiques environnementales tel que le faible SSE, le chômage, la faible scolarisation des mères (Gray & Dean, 1991; Loeber & Stouthamer-Loeber, 1986) ou des variables familiales tel que le rejet maternel (Raine et al., 1994; Loeber & Stouthamer-Loeber, 1986), la psychopathologie parentale (Kandel & Mednick, 1991). Ce sont là des facteurs de risque qui, combinés aux facteurs périnataux, augmentent les problèmes d'adaptation de l'enfant (Gray & Dean,1991; Raine et al., 1996).

D'autres auteurs suggèrent un rôle médiateur de certaines variables (ex. l'attachement mère-enfant) pour expliquer le lien entre les complications périnatales et les problèmes de comportements à l'enfance et au début de l'adolescence. Dans le cas d'un effet médiateur, la variable indépendante et la variable dépendante ont

forcément une corrélation significative. En fait, dans ce modèle le prédicteur influence la variable médiatrice qui à son tour aura un impact sur la variable dépendante à l'étude (Baron et Kenney, 1986; Holmbeck, 1997). Par exemple, le stress économique et les conditions de pauvreté affectent négativement la santé mentale des parents, la qualité d'interaction mère-enfant et les compétences parentales. De plus, le traumatisme lors de la période périnatale crée des problèmes d'attachement et une qualité de soins moins favorable entre le parent et l'enfant, ce qui engendre des répercussions négatives sur le comportement de l'enfant à mesure qu'il se développe (Caputo et al., 1981; Levy-Schiff et al., 1994; Sigman et al., 1981).

Des études classiques (Baumrind, 1967; 1989; Loeber & Stouthamer-Loeber, 1986;. Maccoby & Martin,1983; McCord, 1988; Mills & Rubin, 1993; Rubin et al., 1990; Patterson, Reid, & Dishion, 1992) ont démontré que la qualité des pratiques éducatives parentales a un impact direct sur les compétences sociales des enfants. Les pratiques parentales adéquates sont des facteurs déterminants pour la prévention des troubles de comportements surtout dans un groupe d'enfants à risque (Baker & Mednick, 1984; Bradley et al., 1994; Brooks-Gunn et al., 1995; McLoyd,1998; Raine et al., 1996; Werner,1993).

Vu les nombreuses contradictions et le manque de recherche au niveau d'enfants d'âge scolaire, le but de la présente étude est de vérifier si les complications périnatales peuvent prédire des comportements (extériorisés, et intériorisés) des garçons âgés de 11/12 ans provenant de milieux défavorisés. De plus, quelques auteurs ont révélé l'effet modérateur de certains facteurs familiaux sur le comportement. Afin de mieux comprendre le rôle de la variable familiale, nous avons choisi d'étudier le rôle des pratiques parentales. Ceci a suscité les questions de recherche suivantes:

1-Les complications périnatales (documentées dans les dossiers hospitaliers) peuvent-elles prédire des problèmes de comportements tels que l'agressivité et le retrait, évalués par les pairs des garçons âgés de 11/12 ans provenant de milieux défavorisés?

2- Les pratiques éducatives parentales tels que la supervision et la communication (mesurées à 10 ans), ont-elles un effet modérateur ou un effet protecteur sur le comportement des jeunes ayant vécu des complications périnatales?

Méthodologie

Dans le cadre de l'étude longitudinale expérimentale des milieux défavorisés de Montréal, un échantillon de 585 garçons a été retenu parmi la cohorte des 1161 garçons recrutés à la maternelle en 1984 et suivis jusqu'à l'âge de 12 ans. Les données périnatales, les comportements, et les pratiques éducatives ont été recueillies pour chaque participant. L'information périnatale a été documentée dans les dossiers médicaux et a été classifiée en trois catégories: complications prénatales, complications à l'accouchement, et complications postnatales. Les comportements sociaux des enfants (la bataille et le retrait) ont été évalués par les pairs à l'âge de 11/12 ans à l'aide du Pupil Evaluation Inventory (Pekarik, Prinz, Liebert, Weintraub, & Neale, 1976). Les pratiques éducatives (la supervision et la communication parentale) ont été évaluées par les sujets, à 10 ans à l'aide du Boys Self-Report Scale (Haapasalo & Tremblay, 1994).

Résultats

Une série d'analyses de régression hiérarchique multiple a été effectuée dans le but de prédire si les complications périnatales (variable indépendante) sont des facteurs prédisposant aux comportements déviants (variable dépendante) plus tard dans le développement de l'individu. De plus, cette analyse à permis de vérifier les effets d'interaction entre les complications périnatales et les pratiques éducatives sur chacune des variables dépendantes à l'étude.

Les résultats de l'analyse de régression linéaire multiple ont démontré que les complications périnatales ne sont pas reliées significativement aux comportements chez les garçons de 11/12 ans. En fait, aucun effet principal significatif n'a été détecté pour les complications prénatales, périnatales, et postnatales sur chacune des variables dépendantes à l'étude. Donc, la première hypothèse qui postule que

les complications périnatales sont prédictrices des problèmes de comportements chez les garçons d'âge scolaire a été rejetée. Dans un deuxième temps, les résultats ont révélé un effet d'interaction significatif entre les complications prénatales et la supervision parentale sur les comportements agressifs. Ce résultat indique que la supervision joue un rôle protecteur et prévient le développement des comportements agressifs surtout pour le groupe de sujets ayant vécu des complications lors de la période prénatale. De même, un manque de supervision parentale dans ce groupe à risque est prédicteur de comportements agressifs lorsque les garçons atteignent 11/12 ans.

Discussion

Un effet d'interaction significatif (les complications prénatales × la supervision) a été détecté sur le développement des comportements agressifs des garçons à 11/ 12 ans. Ce résultat implique qu'un effet modérateur est nécessaire dans ce modèle afin d'expliquer le mécanisme entre les complications périnatales et les comportements inadaptés. En fait, sans l'influence de la variable des pratiques parentales aucun lien significatif existe entre les complications périnatales et le comportement des jeunes adolescents. Spécifiquement, notre étude a démontré que la présence de supervision parentale est une condition nécessaire afin de prévenir les comportements d'agressivité physique chez les jeunes ayant vécu des complications prénatales. Les résultats de l'étude suggèrent que les besoins en ce qui concerne les pratiques éducatives diffèrent selon l'histoire périnatale de chaque sujet. La littérature en psychologie développementale étant devenue de plus en plus complexe, il a été proposé pour les recherches futures d'inclure des effets médiateurs dans la conception de modèle (comme par exemple l'attachement parent-enfant) afin de mieux cerner la trajectoire à partir du risque périnatale jusqu'à l'inadaptation sociale dans la vie du jeune. De plus, les forces et les limites de l'étude ainsi que des questionnements sur la nature des variables et de l'échantillon sont abordés. Cette étude a des retombées importantes pour la prévention et l'intervention. Les chercheurs et les cliniciens doivent tenir compte des facteurs

psychosociaux ainsi que des facteurs biologiques afin de réduire avec succès les comportements déviants. Au niveau de la prévention, de meilleurs soins médicaux, facilement accessibles à la mère et à l'enfant devraient être offert. Plus de programmes éducatifs devraient être mis sur pied pour conscientiser les mères aux effets des complications périnatales. Au niveau de l'intervention, l'enseignement des habiletés parentales, et les programmes de stimulation parent-enfant sont nécessaires afin de favoriser les pratiques parentales surtout auprès des mères ayant vécues des grossesses ou des accouchements difficiles.

Table of Contents

List of Tables

List of Figures

Acknowledgments

I would like to express my gratitude to my advisor, Professor Linda Pagani who originally conceived the idea of this research project and who included me as part of her research team. Her invaluable contributions gave this project its context and focus.

In particular, a great debt of gratitude must be paid to Professor Sophie Parent for her critical guidance and statistical expertise. I also wish to thank Muriel Rorive for her statistical assistance.

Finally, I would like to express my sincerest appreciation to my family, friends, and colleagues for their great patience, encouragements, and support during the long period which I devoted to this work.

INTRODUCTION

Psychologists have long debated the biological and environmental determinants of development. More and more research has moved away from the simplistic and rigid linear models of explaining development to a more balanced perspective recognizing the complex interplay between biological and environmental influences in development. One area of biological risk seeks to examine the correlation between perinatal complications and behavioral maladjustment. Perinatal complications are any deviation from a normal pregnancy and/or childbirth caused by a combination of biological and environmental events that threaten the normal course of development. Perinatal complications can occur during pregnancy and before childbirth (prenatal period); during birth and delivery; and up to three to four weeks into the life of the newborn (postnatal period).

With the advent of technology, the rate of perinatal mortality and morbidity has been reduced considerably. Permanent brain damage resulting in serious deficiencies is rare. The repercussions of neurological dysfunction resulting from birth trauma are more subtle and are more likely to be manifested in cognitive deficits and behavioral problems (Brennan, Mednick, & Kandel, 1991; Hadders-Algra, Huisjes, & Touwen, 1988; Kawi & Pasamanick, 1958; McNeil, Wiegerink, & Dozier, 1970; Mungas, 1983; Pasamanick, Rogers, & Lilienfeld, 1956; Pasamanick, Constantinou, & Lilienfeld, 1956; Pasamanick & Knobloch, 1961; Rantakallio, Koiranen, & Möttönen, 1992). Despite these improvements, recent statistical reports of the "Ministère de la Santé et des Services Sociaux du Québec" indicated that one fifth of pregnant woman who live in poverty are likely to experience complications of pregnancy and birth, perhaps by virtue of maternal age, malnutririon, or use of drugs during the pregnancy (MSSS, 1993; Martin & Boyer, 1995). These reports suggest that children whose mothers experienced perinatal complications are at a greater risk for developing an array of adverse behavioral outcomes.

Assuming that perinatal complications are a risk factor associated with future developmental problems in the offspring, it becomes important to prompt the government to implement new political policies providing the public with more accessible and efficient services and to invest in research relating to the prevention

of perinatal complications. In the long term, it is hoped that the societal cost will be translated into reduced financial expenses for treatment programs and incarceration costs.

Although research suggests an association between perinatal complications and negative behavioral outcomes, studies have revealed the effects of certain environmental factors which exacerbate biological risk. There is growing evidence that the combination of perinatal complications and family adversity jeopardizes healthy development in children. This includes but is not limited to low SES and maternal education; maternal rejection; inadequate caregiver-infant interaction; ineffective parenting; and parental psychopathology (Caputo, Goldstein, & Taub, 1981; Gray & Dean, 1991; Kandel & Mendnick, 1991; McGee, Silva, & Williams, 1984; Raine, Brennan, & Mednick, 1994; Raine, Brennan, Mednick, & Mednick, 1996; Sigman, Cohen, & Forsythe, 1981; Tessier, Piché, Muckle, Gagnon, & Tarabulsky, 1992).

If it is true that children from impoverished backgrounds are at a greater risk of perinatal complications and that those with a history of perinatal complications are really at some disadvantage and in the long-term display special needs, then it becomes important to alleviate these vulnerabilities as much as possible. It could be argued that interventions during the school-age period are sufficient to reduce maladjusted behavior, however, these problems could probably be prevented by interventions starting before or soon after birth. Interventions geared towards young pregnant women from disadvantaged neighborhoods can firstly reduce the probability of complications during the pre and perinatal periods and secondly, should help prevent long-term negative outcomes which have wide ranging social consequences. Furthermore, identifying the pathways in which perinatal complications and adverse circumstances could have an impact on the child's behavior is important when deciding on a prevention strategy to be put in place. For example, children may show great benefits if exposed to appropriate parenting skills. Parenting can have protective effects on negative social adjustment and this may be especially true for

those high-risk children. Strengthening parenting skills may be crucial when perinatal complications occur. To our knowledge studies have yet to address this issue.

Even though causality cannot be established, perinatal complications are among the earliest measurable variables that can be associated with developmental dysfunction. The empirical literature for this set of biological factors has not been as extensive as for other biological phenomena. The field of perinatal complications is relatively new and represents a developing and potentially important field. The association of perinatal complications with later maladjustment warrants closer and serious clarifications. If we ignore the possible relevance of perinatal complications to maladjusted behavior, we run the risk of ignoring possible avenues of reducing the rate of behavior problems for our school-aged population. Such a mistake could be a major loss to society.

Thus, the purpose of this paper is to contribute to the body of knowledge about the early determinants of risk for later maladjustment by examining the association of perinatal complications to later behavioral maladjustment and by examining the complex interplay between perinatal risk and parenting practices on behavior problems in middle childhood (ages 11/12). To this end, this study aims to address the following questions: (1) Are perinatal complications predictive of subsequent behaviors such as aggression and withdrawal? (2) Do parenting practices play a moderator or protective role on later behavioral maladjustment?

REVIEW OF LITERATURE

In recent years, increasing attention has been directed toward the detection of early hazards which threaten the developmental integrity of the child. It has been postulated that children who survived pregnancy and birth complications may develop various sequalae of brain injury which depending on the severity, the localization or type of damage, could lead to a range of disorders in the course of development (Gray & Dean, 1991; Pasamanick & Knobloch, 1961). The term "continuum of reproductive casualty" was conceived to describe the range of deviant pregnancy outcomes extending from extreme conditions such as perinatal death, cerebral palsy, epilepsy, and mental deficiencies to more subtle forms of retardation, cerebral dysfunctions, learning disabilities, and behavior problems (Pasamanick & Knobloch 1961; Pasamanick et al., 1956; Sameroff & Chandler, 1975).

Defining and Screening Perinatal Data

Much of the research addressing the association of perinatal complications and later development is scattered about in the multidisciplinary literature. This is perhaps due to a vast selection of complications that can arise during the antepartum period (prior to birth), the intrapartum period (during labor and delivery), or the postpartum period (subsequent to birth). In fact, the definitions of obstetrical complications remain quite broad and lack precision, leading to the diagnosis of various complications. Pechtl (1967) defines obstetric complications as "any factor or group of factors in the pre or perinatal environment which increases the risk of fetal mortality. These are symptoms of maternal disease during pregnancy, signs of fetal distress, and mechanical intervention in the delivery. Few of these factors are independent of each other, yet many are causally related." According to McNeil and Kaij (1978), this definition is incomplete and should be extended to include postpartum complications, thus defining obstetric complications as " the general class of somatic deviations from an expected, normal course of events during pregnancy, labor and delivery, and the early neonatal complications."

Based on this terminology the range of possible predictor variables is wide. Perinatal complications include infections, radiation, preaclampsia, medical

interventions during delivery, asphyxia, prematurity (low birthweight and preterm birth), cardiac and respiratory distress, neonatal illness, and a host of other conditions. There has been considerable debate as to how the complications should best be screened so that both outcome and cost-effectiveness are maximized. Because the literature pertaining to the prediction of perinatal complications on behavior in later childhood has not yet developed a reliable scale or a standardized method of measuring birth complications, perinatal data is usually extracted from hospital medical records. Hospital birth records are not foolproof methods. These documents may be inaccessible for reasons of confidentiality or lack of authorization. During the perinatal period, care is often administered by several health professionals and medical files may be scattered across a number of different health-care facilities. As such, it is sometimes time-consuming to find these documents, increasing the risk of errors and omissions in the data gathered. Despite these disadvantages, medical records seem to be an objective, efficient, and rapid method for obtaining perinatal information. Hospital files contain a vast amount of diverse medical information needed for research purposes such as medical history, SES, ongoing records of patient care and treatment provided during pregnancy, results of physical examinations or laboratory testing, records of labor progress and delivery procedures, fetal monitoring, administered medications during labor or postnatally, and postnatal status of mother and infant. This mass of information recorded prospectively by the treating practitioners is by far more accurate than perinatal information collected through interviews with the mothers. Maternal reports are common in retrospective studies (Lewis, Shanok, & Balla, 1979; Szatmari, Reitsma-Street, & Offord, 1986). One should question the validity of mothers responses. Some medical information is never conveyed to the mother, especially in case of fetal distress. Also, mothers may have forgotten certain perinatal events. There is considerable variability in the accuracy with which the patients recall perinatal events and thus, mothers may report false perinatal information or for reasons of social unacceptability omit important details (Lewis & Murray, 1987; Molfese, 1989).

Once the medical data is gathered, the most common and traditional approach of measuring perinatal risk contributing to later developmental problems has been to categorize complications in terms of the major perinatal periods: prenatal, perinatal, and postnatal (Baker & Mednick, 1984; Cocchi Felici, Tonni, & Venanzi, 1984; Kandel & Mednick, 1991; Mednick, Mura, Schulsinger, & Mednick, 1971; Murai & Nihei, 1983; Pagani, Tremblay, Vitaro, & Parent, 1998; Raine et al., 1994; 1996; Szatmari et al., 1986). However, researchers have each developed their own methods of measuring the perinatal information collected. Some authors have used weighted scores to identify severe to mild complications (Baker & Mednick, 1984; Kandel & Mednick, 1991; Raine et al., 1996). Some have evaluated the severity of the complication by a frequency score (Arsenault, Boulerice, Saucier, & Tremblay, submitted; Szatmari et al., 1986), while others identified the presence or absence of a perinatal complication (Lewis et al., 1979; Pagani et al., 1998; Raine et al., 1994).

One of the most important studies designed to analyze long-term psychosocial outcomes of perinatal conditions is the "Original Danish 18-year Longitudinal Perinatal Study" (Baker & Mednick, 1984). Several researchers (Baker & Mednick, 1984; Kandel & Mednick, 1991; Raine et al., 1994; 1996) have collected their data from an initial birth cohort of 9125 children born between September 1st, 1959 and December 31st, 1961 in Copenhagen, Denmark. This large data bank was originally created to study the risks of human reproduction. In the process, many additional variables were included such as social and familial factors, allowing researchers to analyze in more depth and to better understand the underlying associations among variables. Given that the participants of the study had different environmental and familial backgrounds, the medical care prescribed to the mothers was highly controlled reducing variability that often causes methodological errors. Mothers were followed prospectively by highly qualified professionals and physicians from the onset of pregnancy, during the labor and delivery, and immediately after birth. A one-year follow-up examination was also conducted. The perinatal items collected were summarized into sets of composite scores and translated to the five following scales:

1. *Pregnancy Complications:* Items were recorded from the onset of pregnancy. All prenatal examinations were conducted by the same obstetrician in order to ensure uniform coding of social, medical, and obstetric variables.
2. *Delivery and Birth Complications*: At the time of delivery, an obstetrician and a midwife assisted in describing the events during delivery, and recording mother's and infant's status.
3. *Physiological Nonmaturity:* A pediatrician examined the neonates on the first and fifth day of delivery and recorded the infants physical status, gestational age, and birthweight.
4. *Neurological Status:* A thorough neurological examination was conducted by the same pediatrician on the first and fifth day after delivery.
5. *Motor development:* A team of three pediatricians conducted a follow-up assessment one year later. This examination included an evaluation of the infant's motor developmental level.

The scales were developed by a panel of American and Danish obstetricians and pediatric neurologists. For each item of each scale, the physician assigned a weighted score according to the severity of the condition (0 being no complication present to 5 extremely severe complication). The sum of all the items is calculated to obtain a cumulative weighted score for each scale. High scores indicate poor biological status Typically, heavier weight scores correspond to conditions that are thought to be of serious consequence to infant outcome, whereas smaller weights are assigned to events that are thought to have less impact. With this system, women with more serious complications should yield a higher global score than women with less severe complications. The main concern for researchers using this weight system is that moderate or high scores reflect either a series of minor complications (ex. 5 complications with each a scores equal to 1) or one severe complication yielding a high global score on the scale (ex. 1 complication scored 5).

In a recent study (Arsenault et al., submitted), the researchers created an innovative method of quantifying birth complications. Three scales were generated based on a statistical technique which assigned weights to each scale according to

the frequency of the birth complications and medical interventions. The premise underlying this technique is that the rarer a complication or a medical intervention is, the more likely it is severe. Thus, the following scales were used:

1. *Deadly risk situation:* comprised umbilical cord prolapsed, preaclampsia, and induced labor.
2. *Distress situation*: comprised fetal distress, asphyxia, anesthesia, forceps, medications, and episiotomy.
3. *Atypical presentation situation:* comprised cephalo-pelvic disproportion, irregular position of the baby, asphyxia, and cesarean section.

Although this recent method has strategically identified the combination of specific delivery complications and interventions which could lead to developmental risk, it wasn't designed for the study of prenatal or postnatal complications. Moreover, the accuracy and reliability of using a frequency measure as an indicator of severity has not been discussed. In many retrospective studies (Firestone & Prabhu, 1983; McNeil, Wiegerink & Dozier, 1970; Kawi & Pasamanick, 1958; Pasamanick et al., 1956; Szamarti et al., 1986) the selection of perinatal complications is based on two criteria: the presence or absence of the complication, and the frequency of complications. Overall, these studies have found that subjects with developmental problems compared with their normal siblings or matched with a control group had a higher incidence of perinatal complications in their medical history. The main problem encountered with this method is that frequency scores are often based on the accumulation of a variety of perinatal complications including prematurity (birthweight and/or gestational age), maternal complications (infections, obstetric history, bleeding, hypertension, etc.), abnormal fetal presentation, delivery interventions (cesarean section, episiotomy, etc.), neurological abnormalities, and minor physical anomalies which are often linked directly or indirectly to one another, and therefore provide redundant information (Lewis & Murray, 1987). For example, an infant who is born preterm or underweight may have been subject to some type of prenatal risk which has affected intrauterine growth (Kopp & Parmelee, 1979). Because perinatal complications are not independent events, it is difficult to sort out

the exact contribution of each item studied, and more so in the case where frequency measures are used.

From a review of the literature, Molfese (1989) addressed the difference between number of complications versus weighted scores as a measure of perinatal risk and reports that the number of complications (frequency scores) represent a more accurate and simple measure of perinatal risk than do weighted scores. It is not known whether items are appropriately weighted because the weight scores assigned to each item are for the most part arbitrary. Furthermore, complication items tend not to occur in isolation but are found to cluster together interdependently.

In order to avoid the biases of a weighted system and the redundant effects of associated variables within an additive method, some researchers have chosen to simply examine the presence or absence of complications (Lewis et al., 1979; Murai & Nihei, 1983; Pagani et al., 1998; Rantakallio et al., 1992). For several of these studies, the perinatal information extracted from medical records is organized into a structured format based on the perinatal definition where items are categorized according to their perinatal period: for example, the presence of the complication is determined if mother has experienced at least one complication during pregnancy or labor, or if the child experienced a medical complication at birth. As previously conducted in Pagani et al. (1998), the present study will combine the traditional method suggested by many researchers (Baker & Mednick, 1984; Murai & Nihei, 1983; Szatmari et al., 1979) whereby complications are classified according to the perinatal periods with a categorical system of identifying the presence of complications. At first glance, the use of dichotomous variables may seem too simplistic and lacking precision, however this method has been shown to be quite effective in eliminating the disadvantages found in the other methods.

Prematurity as a Risk Factor

The type of perinatal complications that are assumed to be predictive of later developmental problems vary across studies. Such variation may be due to the ambiguous nature of the term "perinatal". Throughout research, perinatal

complications not only include prenatal trauma, defects at birth, and labor interventions, but also that an infant can be born too small and/or too young or be too old and/or too large. Moreover, infants born of appropriate gestational age and weight may be severely ill as a result of any one of a number of infections, congenital disorders, and birth complications. Given the different kinds of existing problems during the perinatal period, it is logical to assume that infants who have experienced perinatal complications will not all suffer the same long-term consequences. Therefore, when investigating the impact of perinatal complications on later development, it would be important to distinguish among the different types of medical problems. Research thus far has not really attempted to discriminate among the different diagnoses. The goal here is not to review the literature on the effects of prematurity, but rather to highlight the importance of segregating this variable from complications during the perinatal period in an attempt to better identify the associations of these complications with later outcome.

The two indices of prematurity most commonly cited in the literature are birthweight and gestational age. While these risk indices were originally considered independent, it is now acknowledged that there are different categories of premature infants, each with different degrees of vulnerabilities. Low birth weight (LBW) applies to infants born at less than 2500g, very low birth weight (VLBW) applies to those born at 1500g or less. Birth weight is often associated with gestational age. In fact, among underweight neonates, there is a growing need to differentiate between those who are born preterm (gestational age of 37 weeks or less) and those born full term (gestational age at 40 weeks). These infants are labeled "small for gestational age" (SGA) or "small for dates". In the same way that infants are sometimes small for their age they can be large for their gestational age (LGA). These infants are those whose growth occurred at an accelerated rate prior to birth. Large for gestational age births are less common and less understood than the SGA births. These births are most frequently associated with mothers suffering from diabetes. Birth injuries and labor interventions often occur as a result of the baby's large size. In fact, medical risks increase proportionately to the size at birth. Common medical complications for

LGA births are prolonged labor, delivery by cesarean section and/or use of forceps and fetal asphyxia (Holmes, Reich, & Pasternack, 1984). Another subgroup of premature neonates are those who are born early but whose weight is appropriate for gestational age. These infants are labeled (AGA) appropriate size for gestational age.

Intrauterine growth retardation is often caused by maternal malnutrition prior or during pregnancy; insufficient transmission of oxygen from the mother to the fetus due to complications such as hypertension, chronic renal disease, cyanotic heart disease, use of drugs or smoking; infections such as the transmission of the rubella virus or syphilis, placental disease; and an overall lack of prenatal care. It is relevant to note that many of these complications are associated directly or indirectly to adverse social and economic conditions. Therefore, the incidence of prematurity is higher among disadvantaged mothers (Gray & Dean, 1991).

Some suggest that small for gestational age infants represent the highest risk group presenting the poorest prognosis (Telzrow, 1991; Tessier et al., 1992). Given these results, it has become essential to supplement birthweight with information regarding gestational age. Including these two factors produces a more accurate and parsimonious classification.

Even though much research has attributed a pessimistic prognosis for LBW-premature infants, many times it is not the case . Kopp and Parmelee (1979) suggest that many infants are healthy and seem to cope well in extrauterine life, despite being born premature. Research has not yet clearly determined whether later developmental outcomes are due to prematurity itself, or to associated birth complications or delivery interventions. As a theoretical example, assuming that two babies are born with a different weight for gestational age, these infants can have experienced different degrees of risk such that the lighter infant who has suffered respiratory distress would be expected to be at greater risk for developmental problems in comparison to his heavier peer even though both infants were born at the same gestational age. Children who are born with normal birthweights and adequate gestational age may still be at risk for later developmental disorders.

However, it remains difficult to sort out the effects of premature birth from the effects of birth complications. The question to be addressed and which remains unclarified is whether perinatal complications alone (controlling for birthweight and gestational age) can increase the risk for disturbed development.

The Association of Perinatal Complications to Later Maladjustment

A number of retrospective studies have investigated the predictive relationship of perinatal complications and subsequent developmental disorders. Pasamanick and his colleagues were among the first to reveal the association of perinatal complications to later maladjustment. Findings had shown that children with epilepsy (Lilienfeld & Pasamanick, 1954), cerebral palsy (Lilienfeld & Pasamanick, 1955), mental deficiency (Pasamanick & Lilienfeld, 1955), reading disabilities (Kawi & Pasamanick, 1958), and behavior disorders (Pasamanick, Rogers, & Lilienfeld, 1956) had a history of pregnancy and/or birth complications.

Others have examined the effect of pregnancy and birth complications on schizophrenia and autism. A recent review (McCurry, Silverton, & Mednick, 1991) has concluded that schizophrenic and autistic subjects are more likely to have a history of obstetric complications in comparison to a matched control group. Another study (McNeil et al., 1970) examined the history of pregnancy and birth complications in subjects undergoing treatment for behavioral or psychiatric disturbances. The children were divided into two categories: (1) those with serious behavioral disorders, including children diagnosed as psychotic schizophrenic or autistic, or children without such diagnoses who would likely be institutionalized through childhood or adolescence; and (2) those with mild to moderate behavioral problems, including children displaying oppositional, uncooperative, and aggressive behavior. These children were often placed in a special education classroom. For each subject, a control subject was chosen, and matched in sex, age of child, race, social class, and maternal age at birth. Findings showed that behaviorally challenged children, especially those with severe psychiatric problems, had a significantly greater history of birth complications than the control group. Prematurity, problems during labor and

delivery, and persisting respiratory problems were common in the histories of disturbed children when compared to the other groups. These subjects displayed more distractibility, persistence, opposition, and hyperactivity. Aggression was the only factor not associated with birth trauma or prematurity. The authors noted a high incidence of unmarried mothers in this group of aggressive children, and suggested the contribution of social or familial influences to the development of aggression. Although there is some evidence that links birth complications to psychiatric conditions, too many inconsistencies and discrepancies are found to support this hypothesis. Only some children with psychiatric disturbances experienced complications at birth. No consistent set of complications have been linked to their illness (McCurry et al., 1991; McNeil et al., 1970).

It is arguable that perinatal complications alone cannot predict negative behavioral outcomes, but that perinatal events combined with neurological dysfunctions represent good indicators of behavioral risk (Brennan et al., 1991; Gray, Dean, Strom, Wheeler, & Brockley, 1989; Hadders-Algra et al., 1988; Levy-Shiff, Einat, Mogilner, Lerman, & Krikler, 1994). Hadders-Algra et al. (1988), in a study measuring academic problems, hyperactivity, and distractibility, attributed neurological conditions as an indicator of perinatal problems, and contended that obstetrical factors play only an indirect role in behavioral and scholastic outcome. Supporting this data, Rantakallio et al. (1992) reported that neurological abnormalities and minimum brain dysfunctions occurring at birth were the best predictors of deviant behavior.

Today, due to the advances in medicine, severe brain damage is less common, milder forms of neurological dysfunctions are responsible for producing more subtle behavioral problems rather than the serious mental deficits and physical impairments reported in the past. Moreover research has turned its attention from the study of early deficits and their direct correlations with perinatal complications to more relevant questions of whether early hazards of perinatal events diminish with increasing age or persist with time leading to maladjustment later in life. In an early retrospective study, Pasamanick, Rogers, and Lilienfeld (1956) were pioneers in

establishing a link between perinatal complications and a relatively undefined category of behavioral problems. Reports of complications during pregnancy and birth, and records of premature births were obtained from hospital registers for 1151 children who demonstrated behavioral problems at the time of the study. The subjects were children born in Baltimore after 1939 and were referred to the Division of Special Services of the Baltimore Department of Education after being identified as behavior disordered. All cases had an IQ above 79. The control group was made up of children of the same sex and were selected from the same school and class than the subjects from the clinical group so that they are automatically matched for age , sex, and socioeconomic status. Analysis showed that in comparison to the control group, children in the clinical group had experienced more complications at birth. A history of pregnancy and delivery complications was most prevalent in the subjects who were classified as disorganized, confused, and hyperactive. Specifically, "non-mechanical" complications such as toxemias, hypertensions in pregnancy, and prematurity were notable in the prediction of later behavior problems. Pasamanick et al. (1956) speculated that perinatal complications can "disorganize" the neurological system, which lowers the tolerance threshold for adaptation to psychological and social stressors. The results of this research must be interpreted carefully, since the study was published in 1956 and the data dates from 1939. This greatly affects the external value of the study; medical advances since then raise doubts as to whether the generalizability, and even validity of these results are still applicable today. In 1939, there were higher rates of mortality, congenital deformities, and serious deficiencies as a result of perinatal complications. However, the Pasamanick et al. (1956) study is of methodological importance due to the fact that the collection of data was conducted at a time when the rate of perinatal complications was high. This study allows us a glance at the consequences of a number of perinatal complications.

Since then, some researchers have attempted to demonstrate an association between events occurring during the perinatal period and the subsequent development of human behavior. It is important to note that these studies are mainly

correlational in nature, that is to say, no causal relationships among the variables can be revealed. Thus, results must be interpreted with vigilance. It is impossible to establish a causal link between perinatal complications and later disorders without questioning if another variable or treatment has caused the disorder. In fact, causal explanations are not possible unless experimental procedures are used. In the field of perinatal complications, such a procedure would be unethical because perinatal complications cannot be assigned to human subjects. Thus, it is virtually impossible to fully uncover the mechanisms between early perinatal hazards and later outcome. Nevertheless, these studies grant some insight into the problem, especially when specific perinatal complications are observed and outcome is measured at periodic intervals in the child's development. .

A number of studies have associated the presence of perinatal complications with heightened rates of delinquent behavior during adolescence and adult violence and criminal behavior. Others have found no such association.

In recent literature, many authors have collected their data from the original "Danish Perinatal Study" described earlier. In some studies, subjects were followed from birth until 17 to 19 years of age (Raine, Brennan, & Mednick, 1994), and in others, until 20 to 22 years of age (Kandel & Mednick, 1991; Kandel, 1992; Raine, Brennan, Mednick, & Mednick, 1996). A number of these studies have focused specifically on adult crime and violence, as related to perinatal factors. Kandel and Mednick (1991) and Raine et al. (1994) have compared a group of violent criminals (ex. threats, assaults, murders) versus a group of nonviolent criminals (ex. theft, breaking and entering) with a group of noncriminals in relation to perinatal complications. Because the rate of female violent offenders is low in the general population, the samples consisted of only male subjects drawn from the Copenhagen study. Even though the same data bank was used, both these studies yielded conflicting results. Kandel and Mednick (1991) reported that violent offenders (especially the violent recidivists) had the highest incidence of delivery complications. Pregnancy and delivery complications were not associated with

nonviolent crime. In contrast to these results, no significant link was detected between perinatal complications and violent offending in Raine et al.'s (1994) study.

Similar contrasting results were noted in studies on juvenile delinquency. In Pagani et al., (1998) main effects were not significant for delivery complications and for medical conditions at birth on juvenile delinquency. However, other studies have detected a significant association between perinatal complications and delinquent behavior. Lewis, Shanok, and Balla (1979) investigated perinatal histories of incarcerated delinquents and non-incarcerated delinquents. The incarcerated group had committed more violent offenses than the non-incarcerated group. They found that the incarcerated subjects had experienced significantly higher rates of perinatal complications. Rantakallio et al. (1992) have also studied the association of perinatal complications with juvenile delinquency and suggested that birth trauma related to perinatal brain damage may be a predictor of delinquent acts. Brain damage appeared in a high number of male subjects who committed violent crimes. In fact this prospective design showed that perinatal trauma to the central nervous system is the predominant factor in the prediction of juvenile delinquency.

The literature presents a very different result for antisocial behavior. Kandel (1992), has speculated that criminal subjects with an antisocial personality would be more likely to have a high incidence of pregnancy and birth complications in comparison to criminal subjects who do not display antisocial traits and in comparison to nonantisocial-noncriminal subjects. Kandel found no signifant relationship between perinatal complications and antisocial behavior, but did discover a link between violent crime and perinatal complications. She found that criminal offending and antisocial behavior are two different entities, which may have different etiologies. Yet another study has yielded similar results. Szatmari, Reitsma-Street, and Offord (1986) did not find any long-term effects of perinatal complications on antisocial behavior. These researchers compared a group of antisocial adolescents with their non-antisocial siblings, on the frequency of perinatal complications as reported in hospital records. One major limit of studies in this field is the difficulty in establishing a strong association between events occurring during

birth and their influence on subsequent development. This study is noteworthy for its use of siblings as a control group, allowing greater control over variables such as race, religion, and socioeconomic status, as well as a host of other psychosocial variables.

In sum, while some authors have found long-term associations between perinatal complications and deviant adult behavior (Lewis et al., 1979; Mednick & Kandel, 1991; Raine et al., 1996), others have found no such relationships (Raine at al., 1994). Moreover, significant associations were not detected for children with perinatal complications on juvenile delinquency (Pagani et al., 1998) and on antisocial behavior (Kandel, 1992; Szatmari et al., 1986). Thus, some children who developed behavior problems have a recorded history of perinatal complications but a sizable percentage of children who encountered perinatal complications do not develop maladaptive behaviors (Kopp & Parmelee, 1979; McCurry et al., 1991; Sameroff & Chandler, 1975; Werner, 1993). There are a few limitations found in the research that may provide possible explanations for the conflicting findings between studies. First, samples have not been representative of the general population. Some studies have controlled rigorously for SES and others have not. Similarly, many studies have accounted for maternal characteristics such as maternal age, maternal education and maternal psychopathology while other studies have not consistently taken these variables into account. Second, many studies have not considered the possibility that perinatal complications may require an additional psychosocial risk factor to result in a specific outcome of behavior in childhood. While the interaction between biological and environmental variables are considered to be important in explaining deviant behavior, much of the previous research does not include moderator variables within the design. Furthermore for those that have tested interaction effects, the moderator variables used vary across studies. Third, studies in general have not used a standard method in selecting and categorizing perinatal complications, consequently , it is unclear whether a specific type of perinatal complication is associated to a specific subsequent maladjusted behavior. In addition, perinatal information throughout studies has been obtained from many

different sources (medical records, maternal reports..). Finally, there is considerable variation in the nature of the outcome variables studied and the instruments used in assessing the different outcomes. It is unclear whether the associations found are specific to violent behavior or can also be observed for aggressive-nonviolent behavior or even other types of outcomes. Most of the literature focuses on adulthood maladjustment. There is little empirical evidence to support findings during the school-age period. Thus, these many variations found in the methodologies may lead to the lack of congruence among studies

Protective mechanisms of perinatal complications

A few researchers (Bradley, Whiteside, Mundfrom, Casey, Kelleher, & Pope, 1994; O'Grady & Metz, 1987; Rutter, 1990; Werner, 1993) have studied individuals who seem to be on a path for developmental disorders and yet do not develop deviant behaviors. Within these groups of resilient children there may be clues to prevention and early intervention. In order to help vulnerable individuals, it becomes important to identify the protective mechanisms which trace the path from risk to adaptation (Rutter, 1990). These investigators seek to understand why some individuals who are at risk early on in life develop problems while others do not.

Werner (1989; 1993) has conducted a large-scale prospective study in the Hawaiian island of Kauaii. From 1955, she followed a birth cohort along three decades. The primary goal of this study was to examine the vulnerabilities of a sample of high-risk individuals who were susceptible to develop adverse outcome given a history of perinatal stress, poverty, and family instability. Findings indicated that children who experienced the accumulation of several risk factors before the age of 2 developed serious learning problems and behavior disorders by the age of 10 and by the time they turned 18, had developed mental health problems, had delinquency records, or had become pregnant as teens. During the course of this study, it had been realized that a significant proportion of the sample, one out of three children despite their exposure to perinatal complications, poverty, and unstable families, had developed into competent adults. Werner sought to identify

the protective factors which led these individuals to become resilient adults and suggested that much of the detrimental effects during the perinatal period fades during childhood and adolescence as more potent environmental factors (such as social and familial variables) exert their influences. The results indicated that among the subjects who had experienced perinatal complications such as anoxia, LBW, and preterm birth, the impact of biological risk was either buffered or exacerbated according to the quality of the caregiving environment. More specifically, boys who had experienced perinatal stress in combination to being exposed to an unfavorable environment including chronic poverty, low level of parental education, parental discord, divorce, presence of parental psychopathology, were the most vulnerable. Resilient children differed from their problematic peers in that many had easier temperaments and fewer health problems as infants, were more independent as toddlers and had greater problem solving and communication skills in early childhood. Resilient boys were often first born who did not have to share parent's attention with another sibling. In middle-childhood, these children established a close bond with one main caregiver, also other caretakers such as grandparents served as positive role models for the resilient children. In adolescence, structured discipline such as assigned household rules and chores reduced the risk of delinquent acts.

In fact, this study suggested that maladjustment was related to poor environmental conditions rather than to the impact of perinatal complications and that only a small proportion of infants who suffered perinatal complications will develop maladjustment (O'Grady & Metz, 1987; Sameroff & Chandler, 1975; Werner, 1993). Thus, the Kauaii study concluded, that what increases a child's resiliency or vulnerability is not determined by a single factor, rather it is a balance between biological plus environmental factors which contributes to risk or resiliency.

Even though some authors have established a link between perinatal complications and developmental maladjustment retrospectively, the majority of children who had experienced such complications did not display developmental problems when followed prospectively (O'Grady & Metz, 1987; Sameroff & Chandler,

1975). It appears that main-effect models in the study of perinatal complications have been unsuccessful and have yielded inconsistent results as to the prediction of adjustment in older children (Sameroff & Chandler, 1975). Interaction effect models are generally more efficient in as much that they indicate which groups of individuals are at greater risk and furthermore offers explanations as to which protective factors buffer the liabilities found in a high-risk population.

Moderators are variables which influence the direction or intensity between the predictor variables and outcome (Baron & Kenny, 1986). They are often introduced in a model where the correlations between independent and dependent variables are weak or inconsistent. Few predictions can be made about outcome unless the moderator (ex. environment variable) is included in the model (Baron & Kenny, 1986; Holmbeck,1997). A recurrent theme throughout the review of literature is the moderating effects of the child's environment and how this environment interacts with perinatal complications to either protect or place the child at even greater risk for developmental problems (Baker & Mednick, 1984; Gray & Dean, 1991; Pagani et al., 1998; Raine et al., 1994; 1996; Sameroff & Chandler, 1975; Werner, 1993).

The cumulative risk model supported in recent research contends that the combination of multiple risk factors are better predictors for adjustment problems than any single factor (Liaw & Brooks-Gunn, 1994; O'Grady & Metz, 1987). For example, children who had experienced perinatal complications and who were raised in less favorable conditions (i.e. poverty, family instability, undereducated parents) were more likely to have poorer outcomes in comparison to children with a similar birth status but who lived in a more favorable environment (Bradley et al., 1994; Liaw & Brooks-Gunn, 1994; Werner, 1993). Thus, perinatal complication is one risk factor leading to deviance and adverse environmental conditions would be a second. Rather than being considered independent, these two sources of risk interact in conjunction to either minimize or amplify the quality of adaptability.

Interaction between perinatal and environmental characteristics

A number of designs have emphasized the importance of a biosocial approach to the understanding in the etiology of deviant behavior. As such, researchers can no longer address biological and social determinants separately.

Recent publications (Gray & Dean, 1991; Raine et al., 1994; 1996) have used this approach to study links between perinatal complications and behavior, integrating biological and social risk factors to better understand the determinants of deviance. Even if a significant relationship of perinatal complications with later deviant behaviors is found, environmental factors remain crucial in determining developmental outcome. A number of researchers treat environmental (social and familial) conditions as factors which modify behavior. Studies have shown that negative environmental factors exacerbate the risk of maladjustment in children.

For example, Baker and Mednick (1984) studied the 9125 babies from the Copenhagen data at 18 years of age. Among the variables analyzed were: medical factors, such as perinatal complications, gestational age, birthweight, neonatal neurological status; outcome variables studied were academic functioning, aggression, impulsivity, and social withdrawal (derived from teacher ratings); the moderating effect of family structure was also studied. Findings showed that *impulsivity* is the only factor associated with medical risk. Family factors had almost no influence on the appearance of impulsive behavior. This result strongly supports the hypothesis that impulse control disorders appear to be determined by organic antecedents. *Aggression* was shown to be significantly related to medical risk and family structure. The authors suggest that a stable family environment can compensate for biological vulnerability. The variable identified as family intactness acts as a protective factor, favoring the development of prosocial behaviors in infants with medical risks. As was the case with aggression, medical complications did lead to academic difficulties (reading and mathematics), however this association was weak without the inclusion of the familial variable. The negative consequences of medical risk decreased when family was intact, whereas in the non-intact families, academic difficulties increased especially for those subjects at medical risk . The

behavior identified as *social withdrawal* is different from the previous models. Analyses showed that family structure was the predominant variable that contributes to social withdrawal, washing out the contribution of medical risk. These results indicate that social withdrawal is determined solely by environmental, and not biological factors. This study did not only confirm the link between perinatal complications and behavior problems such as impulsivity, but also indicated that the presence of an environmental stress (familial instability) exacerbates deviant behaviors such as aggression.

In another recent study (Pagani et al., 1998), unique interaction effects were noted. These researchers have speculated that boys who had a history of perinatal complications would be at heightened risk for delinquency during early adolescence and that these boys would benefit from a preventative preschool intervention program to escape from this risk. Unexpectedly, those boys who had a history of perinatal complications and who attended the preschool program were at an increased risk of reporting delinquency. The findings indicated that the children who did not experience complications during the perinatal period benefited the most from a preschool program and were less at risk for delinquent behavior in adolescence. Thus, the preschool experience had detrimental effects for children with past perinatal complications, placing them at risk for later delinquency. School readiness was one interpretation put forth to explain these results. It has been suggested that children with a history of birth complications may not be prepared to receive early stimulation in comparison to their peers and consequently, may not be as ready to enter preschool. Hence, these children may experience repeated failures impeding their sense of belonging to school. It is also possible that these children are socially rejected hindering their ability to learn and to interact with their peers. Pagani et al. recommend the use of a similar prospective sample to investigate this hypothesis.

Other moderating factors often discussed in the literature are low SES (Gray & Dean, 1991; Loeber & Stouthamer-Loeber, 1986), and parental characteristics such as maternal rejection (Loeber & Stouthamer-Loeber, 1986; Raine et al., 1994),

parental psychopathology (Kandel & Mednick, 1991), and inadequate parental supervision (Haapasalo & Tremblay, 1994; Loeber & Stouthamer-Loeber, 1986).

Environmental conditions such as low SES, unemployment, and mothers with low levels of education are risk factors which, when combined with perinatal factors, increase the chances of a child's developing psychosocial problems (Gray & Dean, 1991; Liaw & Brooks-Gunn, 1994; McLoyd, 1998; Raine et al., 1996). Children who experienced complications during the perinatal period and who grow up in conditions of poverty are considered at "double jeopardy ". Mothers of children with a biological risk are more economically disadvantaged due to low-income, high unemployment, and low-levels of education and are more socially disadvantaged because of a lack of access to health care, underprivileged neighborhoods, and lack of resources. Thus, poverty and its related factors not only contribute to perinatal complications, but also result in negative long term outcome for the child (Brooks-Gunn, Klebanov, & Liaw, 1995; McLoyd, 1998; Werner,1989). One of the major salient risk factors clearly pointed out in the literature is the age of the mother at the time of conception. Younger mothers (under 16 years of age) are at risk for problem pregnancies, and show higher incidence of infant developmental problems, neurological, and behavioral implications arise as the child progresses in his development. Often being a young mother implies a number of educational and social consequences for the mother herself such as incomplete schooling, unemployment, low income, unstable family situations, and increased psychological and social stresses which can impinge upon a positive developmental outcome. Also, young mothers are not physically ready to give birth and are more susceptible to perinatal complications. Consequently, children born to teenage mothers are more likely to perform poorly in academic and behavioral functioning during their early childhood years as well as later in their development. (Caputo et al., 1981; Coley & Chase-Landsdale, 1998; Goldstein, Caputo, & Taub, 1976). Numerous studies have also shown a strong association between poverty and maladjustment. Loeber and Stouthamer-Loeber (1986) have reported that the juvenile delinquency rate is significantly higher in families receiving welfare. Haapasalo and Tremblay (1994)

have also determined that deviant behavior is more prevalent in children of disadvantaged families. According to these authors, economic stress and poverty negatively affect the mental health of the parent, the quality of mother-child interaction, and parental competencies. In fact, socioeconomic status has been clearly correlated with factors such as poor home conditions (Gray & Dean, 1991; Raine et al., 1994), quality of caregiver-infant interaction (Caputo et al., 1981; Sigman et al., 1981; Tessier et al., 1992), unstable family environment (Baker & Mednick, 1984; Raine et al., 1996), marital conflict (McGee et al., 1983), and parental mental health (Kandel & Mednick, 1991).

Parental psychopathology is another factor which can exacerbate the risk of maladjustment in a child's development. Kandel and Mednick (1991) examined three groups of children drawn from the Danish sample: The first group consisted of high-risk children who had a schizophrenic parent, the second group had a character-disordered mother or a psychopathic father, the third were children of parents without a psychiatric history. The three groups were matched for social class, sex, race, multiple birth status, pregnancy number, sex of ill parent, and parents' age. Criminal acts were recorded when subjects were between the ages of 20 to 22. From the sample, violent offenders (ex. threats, assaults, murders), property offenders (ex. theft, breaking and entering) and non-offenders were compared. The results showed that violent offenders had the highest incidence of delivery complications. This result was especially notable for violent recidivists and in the two high-risk groups (exposed to a psychiatric parent). The rates were equally high for those subjects with a psychiatric parent. In their interpretation of the results, Kandel and Mednick (1991) suggested that deviant mothers may neglect their health during their pregnancy, increasing the risk of a difficult birth. Moreover, there may be a connection between the inability of deviant mothers to care for themselves during their pregnancy and poor parenting skills, leading to violent behavior in the offspring.

Parent-child interaction seems to be the factor most affected by perinatal stress. Cocchi et al. (1984) and Tessier et al. (1992) report that the birth of premature infants or their exposure to perinatal complications constitutes a difficult

task for parents because their children are frequently irritable, inconsolable, and in distress. For these reasons, it is more difficult for mothers to interact with their infants, and consequently, problems of attachment and quality of care arise. Many other researchers, without exclusively looking at a premature population, support and agree with the possibility that intensive birth trauma can alter parent-child interaction for an extended period, affecting the child's later development (Caputo et al., 1981; Levy-Schiff et al., 1994; Raine et al., 1994; Sigman et al., 1981).

Raine et al. (1994) reported that mothers who experienced complications during pregnancy or childbirth are more likely to reject their child at one year of age. They speculated that perinatal complications combined with maternal rejection may predispose children to deviant adult behaviors. The findings indicated that boys of mothers who experienced difficult births and who were rejected early by their mothers were more at risk in becoming violent criminals in adulthood. The interaction effect observed between perinatal complications and maternal rejection was specific to violent acts and was not detected for nonviolent offenses. Supporting this hypothesis, Loeber and Stouthamer-Loeber (1986) suggested that parental rejection is associated with aggressive behavior and juvenile delinquency. Meanwhile, the study conducted by Raine et al. (1994) seems to have some difficulty at the level of control variables. They did not implement controls for the mother's age, or for other important parental characteristics which might influence their children's risk of developing deviant behavior. It has been well-documented that good perinatal care, close bonding to the caregiver, and an adequate home environment provided in the first year of life are all protective factors that can significantly reduce the detrimental effects of birth complications. Many investigators (Caputo et al., 1981; Cocchi et al., 1984; Kopp & Parmelee, 1979; Murai & Nihei, 1983; Sigman, Cohen, & Forsythe, 1981; Tessier et al., 1992) have postulated that infants who are deprived of human interaction and early stimulation due to extended isolation in an incubator or due to birth trauma may place the child at risk for developing behavioral problems. The hypothesis underlying this result is that newborns of mothers who experienced perinatal complications display difficult temperaments and unmanageable behaviors

(such as inconsolability, irritability, and unpredictability) which impedes on the parent-infant interaction. Caregivers respond to their newborn characteristics in specific ways. Distressed and disorganized behavior occurring early in life may lead to disrupted patterns of parent-infant interactions, which in turn will exacerbate behavioral problems.

Despite the presence of poverty and perinatal risk, some authors argued that certain environmental factors can lead to resiliency. Bradley et al. (1994) found that among the premature children living in poverty who showed signs of resiliency in terms of cognitive functioning, behavioral functioning, health and growth status at the age of three were living in a safer, less crowded environment and received more responsive, accepting, stimulating, and structured care by their caregivers in caparison to their non resilient peers. Children who were not exposed to several of these protective factors (three or more) were more unlikely to show early signs of resiliency. Werner (1993) has also pointed out protective factors which differentiate the high-risk resilient from high-risk non resilient individuals. Parental competence, caregiving styles, and emotional support were positively associated to adaptability and coping in the offspring. The authors noted that despite underprivileged conditions in which the families lived, the better educated parents provided their children with more positive interactions and emotional support early on in their life which had a direct positive impact from early to middle childhood on development until adult years.

Similar interaction effects were noted by Raine et al., (1996). These researchers followed three groups from birth to adulthood: a group of children with perinatal risk (i.e. pregnancy and birth complications, prematurity, physiological deficits); a group targeting subjects with poverty risk factors (i.e. poverty, unemployment, marital conflict, familial instability), and a group with biosocial risk (i.e. a combination of neurological deficit and unstable family environment). Results showed that among the groups of boys studied, the biosocial risk group and the obstetric group had the highest rate of adult violence and crime and were at high risk for academic and behavioral problems during adolescence, while the group of boys

exposed to only poverty risk factors rated the lowest on crime and violence. This is an interesting finding, which challenges our common belief that poverty is always associated with negative outcome. Raine et al. (1996) suggested that the low-income group had two protective factors that the others did not have: good parenting and healthy development which compensated for the negative effects of poverty. It is important to note that the researchers did not specify whether the age of the mothers influenced the results. Some researchers suggest a link between the mother's age and deviant behavior in their children (Patterson & Capaldi, 1991). It should also be noted that the initial sample from which the three groups were extracted had a lower SES than the population as a whole, due to the greater number of young and single mothers. Furthermore, the subjects were mostly children of women who have had difficult pregnancies and who were at risk for complications during birth.

Childrearing Practices

To our knowledge, there is yet no study which examines the moderating effects of parenting practices on the behavior of children who have experienced perinatal complications. However, researchers have revealed the effects of certain environmental factors which modify biological risk and have hinted that parental characteristics may hold a protective role which can explain why many children who experienced perinatal complications cope well in their development (Bradley et al., 1994; Kandel & Mednick, 1991; Raine et al., 1994; 1996; Werner, 1993). Adequate childrearing practices may be one of those characteristics necessary to prevent later developmental problems especially for children born at-risk. Most children in their early years display some forms of conduct problems. As toddlers, temper tantrums, attention-seeking behaviors, and even forms of aggression are acceptable. As children shift from early childhood to middle childhood, these behaviors are usually outgrown. Over time, children have acquired the ability to tolerate frustrations, to comply, delay gratification, and to control aggressive or impulsive reactions. Children who fail to outgrow such behaviors, display more serious conduct problems in middle childhood which can escalate to severe adjustment problems in adolescence. Not all

children display persisting conduct problems. Effective childrearing practices play an important protective role in stagnating this process and preventing behavior problems from getting worse (Loeber & Stouthamer-Loeber,1986). The literature on parenting has abundantly shown that patterns of parent behaviors namely parenting styles are predictive of child behavior outcomes (Baumrind, 1967; 1989; Loeber & Stouthamer-Loeber, 1986;. Maccoby & Martin,1983; McCord, 1988; Pattersonet al., 1992) Baumrind's works aimed to investigate the impact of different parenting styles on child development. She identified three styles of parenting, authoritative, authoritarian, and permissive which are classified in terms of the degree of parental nurturance, communication, firmness, and demandingness (Baumrind,1967). The authoritative parent, by definition, were highly nurturant, supportive, and responsive toward their children. Authoritative parents were demanding in that they were firm in setting limits, and consistent when guiding their children. When communicating with their children, parents were receptive, warm, rational, and encouraged autonomy. These parents typically had children who were cooperative, and interacted positively with their peers. Also, children from this group were confident, energetic, and independent. Authoritarian parents valued authority, obedience, and did not encourage verbal exchanges. When disciplining, these parents favored power-assertive techniques, they were often harsh, punitive, controlling, and were rigid in enforcing rules. Their children were moody, apprehensive, easily upset, and had negative interactions with their peers, or were more likely to be socially withdrawn. Parents who were neither demanding nor controlling were labeled permissive. These parents did not structure or monitor their children's activities. They did not insist on the child's compliance, were accepting, and somewhat warm. Permissive parents had impulsive and undercontrolled children. Findings from a follow-up study (Baumrind, 1989) showed that by middle childhood (9 years old), children raised by authoritative parents continued to be the most socially competent in comparison to the authoritarian and permissive environments. In sum Baumrind concluded that parental warmth and noncoerciveness was associated to general competence, and parental responsiveness generated prosocial behaviors.

Other researchers have supported Baumrind's conclusions in that patterns of interaction between parent and child are important factors in social development. Maccoby and Martin (1983) and Mills and Rubin (1993), have reported that cooperative and socially competent children were raised by warm supportive parents who provide open communication, who set clear expectations, and who view authority rationally. Mothers of «withdrawn-internalizing» children were significantly more controlling, overprotective, overinvolved, more directive, and often used coercive punishment in comparison to children labeled «aggressive-externalizing» and «average» children (Mills & Rubin, 1993). Furthermore, Rubin, Lemare, and Lollis, (1990) studied the distinction between social isolation and rejection in school-age children. These researchers found subtle but nevertheless important differences among children who were isolated from their peer group versus those who were more likely to be rejected. Parents of unpopular and socially rejected children are described as overcontrolling, rigid, and punitive, whereas parental insensitivity, and inconsistent or unpredictable maternal responsiveness is associated to social withdrawal. Drawn from attachment theories, Rubin et al., (1990) suggested that particular patterns of infant temperament might, given certain patterns of maternal responses lead to secure or insecure relationships. These relationships may in turn predispose a child to later maladaptive behaviors with peers such as social isolation or rejection by peers. Consistent with these studies, Rothbaum (1988) established a link between maternal acceptance (rated according to levels of support, openness, approval, and closeness) and positive social functioning.

In contrast, punitive (especially physical coercion), rejecting, and harsh disciplining parents who do not demonstrate parental acceptance and parental warmth tend to have noncompliant, impulsive, and/or aggressive children (McCord, 1988; Loeber & Dishion, 1983; Loeber & Stouthamer-Loeber, 1986; 1998; Patterson et al., 1992). Haapasalo and Tremblay (1994) compared aggressive and non-aggressive youths. The group of non-aggressive boys were better supervised, punished less frequently, and were subject to fewer rules at home than the aggressive group. The authors concluded that adequate levels of supervision seem

to prevent delinquency. Similarly, Loeber and Stouthamer-Loeber (1986) reported that poor parenting skills were associated with deviant behavior in middle childhood and adolescence. From a meta-analysis, findings showed that deficiencies in parental involvement (neglectful, indifferent, ignoring, and uncooperative parents) or highly rejecting parents (not warm, not loving, unaffectionate parents) were good predictors of juvenile conduct disorders and adolescent delinquency. Also, in their review, Loeber and Stouthamer-Loeber (1986) reported that children who displayed conduct problems in comparison to those who didn't, were poorly monitored by their parents. Although, strict supervision may be beneficial in preventing delinquency in cases where children are living in underprivileged environments and are already at great risk of developing deviance, as a general rule, the amount of parental supervision is correlated to the frequency and the variety of maladjusted behaviors in children. Recently, Loeber and Stouthamer-Loeber (1998) have specified that different types of parenting can lead to either overt or covert behaviors. Covert acts such as theft and truancy, are fostered by parental neglect and by a lack of open conflict within the family. It has been suggested that parents who are authoritarian, who avoid confrontations and for whom physical punishment is common, encourage their children in becoming concealing in their actions. Overt behaviors such as fighting and attacking seem to be generated in environments where parent and child are perpetually in open conflicts with each other and, in which parents have somewhat surrendered from their supervision and parenting roles.

Patterson et al. (1992) proposed a transactional theory that a child's behavior influences parental behavior, and the quality of parent-child interactions. For example, a child's hostile behavior may be negatively reinforced by the parents coercive response used to control the behavior, which in turn will create more aversive and hostile interchanges in the dyad. This escalating cycle of hostile exchanges occurs more frequently in families living under stressful conditions, such as economic hardship. Therefore, it is possible that children who experienced complications at birth (especially those from disadvantaged families) develop difficult temperaments, which leads to inadequate parental responses, negatively influencing

the child and resulting in deviant behavior later in the child's development. Some authors (Cocchi et al., 1984; Murai & Nihei, 1983) postulated that preschool children who experienced perinatal complications are more likely to display difficult temperaments. In addition, Loeber and Stouthamer-Loeber (1986) report that some children have temperaments difficult enough to challenge even the most competent parent. Families having to cope with multiple risk factors such as dealing with a difficult child (i.e. impulsive and irritable), and being faced with a lack of resources (i.e. economic hardship, unemployment, and deficits in parenting skills) are at high risk of producing children who develop adjustment problems.

Several studies have shown that poverty can also affect parenting and child development adversely (Brooks-Gunn et al., 1995; Conger, Ge, Elder, Lorenz, & Simons, 1994; McLoyd,1998; Werner, 1989). Poverty is often associated to stressful events such as unemployment, financial uncertainties, and a host of other pressures that increase the irritability and conflicts between family members (Conger et al., 1994). These ongoing stresses constrain parents from providing a stimulating environment and adequate parenting for their children. Firstly, poverty clearly affects parental involvement; Parents responsible for raising a large family or parents of single-parent families are less available to spend time with their children (Brooks-Gunn et al., 1995). Secondly, parents who are exposed to high levels of stress have a tendency to use a harsh, inconsistent, and dominating childrearing approach (Bradley et al., 1994; McLoyd, 1998). Thus, poverty negatively influences parenting, placing children at risk for externalizing and internalizing behavior problems (McLoyd, 1998).

In conclusion, the literature has shown some evidence that biological risk, especially in high risk environments, leads to later maladjustment. Environmental factors are important in protecting or exacerbating the effects of perinatal complications on later adjustment. The quality of caregiving was a crucial factor in distinguishing between the resilient children from the non-resilient children. Adequate parenting served as a protective factor in high risk groups; i.e. children at biological

risk and /or children living in poverty (Baker & Mednick, 1984; Bradley et al., 1994; Brooks-Gunn et al., 1995; McLoyd,1998; Raine et al., 1996; Werner,1993).

It remains difficult to trace the events leading to maladjustment, and unrealistic to believe that behavioral problems can be explained by only one model. There are surely a number of trajectories that can lead to the same result. In addition, research in the area of perinatal risk investigated the link between perinatal complications and the risk of difficult temperament in the infants and have not specified if the effects of perinatal complications persist until middle-childhood. The literature focuses mainly on associations between perinatal complications and infant temperament and directly goes to the study of late adolescent and adult maladjustment.

Given the many contradictions and the lack of research on school-age children, it is important to examine the association between perinatal factors and the behavior of children in their middle childhood years. It is also important to understand the moderating role of parenting practices in this model. From these comments and concerns, the following research questions have emerged.

Research questions and hypotheses

1- Are perinatal complications (as documented in hospital files) predictive of maladjusted behavior (externalizing or internalizing) reported by peers of boys from underprivileged backgrounds at ages 11/12 years old?

It is expected that boys who have experienced perinatal complications will exhibit a greater risk for behavior problems in middle childhood. Generally, the literature suggests that perinatal complications cause cerebral damage, which lowers the individual's threshold for resilience at a young age, and increases the likelihood of behavior problems in later development. In addition, some studies, prospective in nature, have clearly established an association between perinatal complications and later maladjustment (Baker & Mednick, 1984; Raine et al., 1996).

Studies on school-age children (Rubin et al., 1990) report that developmental changes in peer interactions are apparent during the latency period. During middle childhood years, children acquire new ways of relating to one another, at this stage

children have improved their ability to communicate with others, and in comparison to preschoolers, they express their prosocial and aggressive tendencies differently. Furthermore, young children do not seem to view socially withdrawn behavior as problematic, however, increasing in age, children's views of social withdrawal is quite negative. By 11 years old, children appear quite sensitive to socially withdrawn behavior, and as such, become more adept at this age to assess these forms of behaviors. By middle childhood, these behaviors become more and more stable and better indicators and predictors of later maladjustment (Rubin et al., 1990). Similarly, Olweus (1979), reports that aggressive reaction patterns displayed at age 12 can show high degrees of stability for a period as long as 10 years leading to considerable predictive capacity for later aggression. Because of the high degrees of stability to later maladjustment reported in middle childhood and because older children are more accurate in rating their peers, we chose to examine outcome behaviors, at age 11/12 (mean scores). The advantage of using average scores is that in the case where data may be missing for an outcome variable at age 11, it is likely to be recuperated at age 12 and vice-versa. This method seems reliable because it reduces the incidence of missing values which may have occurred if data was available for one year only.

One of the first decisions to be faced was selecting which type of assessors would yield more sensitive and stable assessments of aggressive and withdrawn behavior. Often times assessments are made through standardized forms based on the evaluative judgment of a teacher or a parent. Other evaluations consist of the use of sociometric techniques in which the peer group evaluates the behavior of a child. In the current study peer ratings are selected as a measure of the dependent variables primarily because ratings by peers have been found to be relatively powerful predictors of later maladjustment and reflect observations of multiple observers. Because peers are directly involved in the social interactions with their classmates and develop relationships with each other in various settings, it is assumed that they are better equipped to accurately evaluate behaviors such as aggression and withdrawal (Pekarik, Prinz, Liebert, Weintraub, & Neale, 1976). In

fact, Ledingham and Younger (1985) have reported that peer and adult ratings predict quite different behaviors. Aggression and motor activities are more likely carried out in the company of their classmates. Also, increasing in age, withdrawal appears to become a much more cohesive and meaningful category. Young teens are more capable of differentiating aggression and withdrawal. In contrast, in the presence of an adult, children display less physical contacts, more verbal interactions, and appear more controlled. Moreover, while teacher ratings can be biased by a child's academic behavior in a classroom, parent ratings may be affected by a child's compliance to parental rules and demands. A parent's emotional involvement with their children and less extensive experience with other children make their reports less valid to identify behaviors of aggression and cooperation. Peer ratings reduce some of these biases and consequently avoid the occurrence of much of the measurement errors. It is important to note that despite the qualities and advantages involved with peer ratings, this method is not without limitations (a description of the disadvantages of this method are found on p.61). Other types of evaluators may elicit different behavioral patterns. The evaluation of the same individual may yield different results depending on factors such as the context in which the evaluation occurs or the characteristics of the evaluator.

2- Do parenting practices moderate the link between perinatal complications and behavioral outcome? That is, will parenting practices serve as a protective factor of perinatal complications on later maladjusted behaviors in children, or will deficiencies in childrearing practices exacerbate developmental problems?

It is hypothesized that any association between perinatal complications and behavior outcome would be moderated by childrearing practices. Therefore, when parenting practices are inadequate, the incidence of problem behavior should increase in 11 and 12 year-olds with a history of perinatal complications. In contrast, effective childrearing practices should buffer the negative impact of perinatal complications. This hypothesis was supported by Werner (1993) and Bradley et al. (1994), who reported that high risk individuals (biological and poverty risk combined) exposed to positive environmental factors became resilient and inversely, children at

biological risk who were exposed to adverse environmental conditions developed psychosocial problems (Baker & Mednick, 1984; Brooks-Gunn et al., 1995; McLoyd, 1998; Raine et al., 1996).

METHODOLOGY

Participants

The sample is drawn from the Montreal Longitudinal-Experimental Study of Kindergarten Boys. It consists of 1161 boys who were first assessed in Kindergarten in 1984 and followed-up annually until age 12. The boys were attending one of 53 French-speaking schools in the most disadvantaged neighborhoods of Montreal. In order to create a culturally homogeneous group, only Caucasian Francophone boys whose parents were born in Canada were retained in the sample (N=1037). Of the entire sample, perinatal data was available for 831 subjects. Only subjects for whom data was complete for the variables studied were retained for the analysis, reducing the sample to 585 boys. Subjects who were not retained in the analyses showed a tendency toward being more disruptive and less popular than the rest of the sample at ages 11/12. Mothers in our sample were slightly older at the first birth than mothers from the non-retained group (c.f. Appendix A).

Measures: Independent Variables

The collection of perinatal data took place at the end of kindergarten (age 6). Hospital records revealed whether boys experienced perinatal complications. The perinatal information extracted from the medical files included any complications during pregnancy, childbirth, or the postnatal period which increases the infant's mortality risk; or any other conditions not directly related to immediate risk, but which influence the health and development of the child. Table 1 shows the number of subjects per category of perinatal complications.

Table 1. Number of Subjects per Category of Perinatal Complications

Variable	Yes	No
Prenatal complications	170 (29%)	415 (71%)
Delivery complications	314 (54%)	271 (46%)
Medical condition at birth	421 (72%)	164 (28%)

Based on the subjects' medical records, a research assistant reported perinatal information on a systematic instrument pre-designed by the researchers.

This instrument contains 172 items, presented as closed questions, with binary (between yes and no) choices. The presence or absence of items was graded by the examiner according to nominal scales described below.

Prenatal complications. The child received a positive score if medical records revealed that the mother experienced any of the following complications during pregnancy: oedema, blood loss, infection, rubella, preaclampsia, radiation, blood type incompatibility, hypertension, syphilis.

Delivery complications. The child obtained a positive score if one or more of the following complications occurred during childbirth: use of forceps, an elapsed time of more than 24 hours between amniotic membrane rupture and delivery, foetal cardiac distress, incubation, prolapsed umbilical cord.

Infant illness at birth. The child obtained a positive score if, at birth, there was the presence of an illness: apnea, respiratory distress, retinopathy, ventricular hemorrhaging, or if the records revealed that the infant received medication postnatally to treat a medical condition.

Outcome Variables

Pupil Evaluation Inventory (PEI, Pekarik, Prinz, Liebert, Weintraub, & Neale, 1976; Appendix B). Fighting (2 items) and withdrawal (9 items) at ages 11/12 (average score) were generated from peer ratings. This instrument consists of 34 items used to predict three categories of social adjustment (aggression, withdrawal, and likeability) in school-age children. Participants were asked to nominate a number of classmates for each item (example of item: those who start a fight over nothing). Each child then receives a value corresponding to the sum of votes obtained for each item. Then a global score for each outcome behavior is derived by grouping items according to their category so that aggression, withdrawal, and likeability scores are computed by averaging across the items for each scale. This

data was transformed into *z* scores in order to standardize the results across classes and schools. Scores for the dependent variables vary between -2 and 2 with a mean of 0 and a standard deviation of 1. Average scores for ages 11/12 were used in the analyses. The PEI was chosen due to its good psychometric qualities: As previously mentioned, children are not only observers, but are also participants in the social behavior of their peers in various situations and activities offering the researcher a unique assessment of behaviors. Consequently, this instrument avoids some of the biases that are typically present when adults rate children's behaviors, and it allows testing of a large sample of children in a relatively short time span. Moreover, researchers have reported strong validity and reliability scores of the PEI (Johnston, Pelham, Crawford, & Atkins, 1988; Pekarik et al., 1976; Vitaro & Boivin, 1989). Internal consistency scores showed correlation values above .70 for the likeability and prosocial scales and above .90 for aggression (Pekarik et al., 1976). Test-retest reliability scores demonstrated stability scores of .75 after 4 months on all PEI factors (Johnston et al., 1988).

Moderating Variables

Parenting practices assessed at age 10 (c.f. Table 2). Parenting practices are evaluated using a questionnaire completed by the boys in our sample (Haapasalo & Tremblay, 1994; Tremblay, Pagani-Kurtz, Vitaro, Mâsse, & Pihl, 1995). At age 10, boys reported two parenting behaviors extracted from this questionnaire. The two scales include parental supervision (alpha= .63; 2 items), and communication (alpha= .70; 7 items). The questionnaire targeted the boys' perceptions of their parents childrearing practices during the previous 12 months. The items corresponding to each scale is presented in table 2. Each item is scored on a Likert-type scale where the boys chose to answer never, sometimes, often, or always. The more the boys were supervised, the greater the score of supervision. Similarly, the more communication was used between parents and their sons, the greater the score on communication.

Table 2. Parenting Practice Scales.

Parenting Practices	Items
1-Supervision	– Do your parents know where you are when you go out?
	– Do your parents know who you hang around with?
2-Communication	– Do your parents congratulate you for things you have done?
	– Do your parents explain to you the reasons for some decisions they make with regards to you?
	– Do you tell your parents what you would like to become when you grow older?
	– Do your parents acknowledge your personal feelings?
	– Do you speak to your parents about your feelings and personal thoughts?
	– Do your parents share their thoughts and feelings with you?
	– When your parents ask you to do something you don't like, do they first give you some explanation?

Control Variables

SES indicators. Maternal age at the birth of the first child and maternal educational level are considered indicators of sociodemographic characteristics.

Weight for gestational age. Information on weight and gestational age at the time of birth was obtained from medical records. Weight for gestational age was expressed in terms of standard deviations in which the infants' birthweights ranged from 1230g to 5180g (mean = 3240 ± 540g) and gestational age between 28 weeks and 43 weeks (mean = 39 ± 2 weeks) (Lavoie et al.,1998; Lubchenco, 1976).

Procedure

Data analyses. A series of hierarchical multiple regressions were performed using SPSS to investigate whether a history of perinatal complications were predictive of behavioral maladjustment in middle childhood. The predictive relationship between prenatal complications (model 1), delivery complications (model

2), and postnatal conditions (model 3) were examined separately on the dependent variables. These analyses also tested interaction effects between perinatal complications and two different types of parental practices on each of the behavioral outcomes at ages 11/12.

Linear multiple regression was chosen because this study aims to establish a predictable relationship between a number of dichotomous independent variables and continuous dependent variables. Had the dependent variable been dichotomous, a logistic regression model would have been chosen. It is important to note that the use of linear multiple regression analyses was simply to establish an association and not a causal relationship between the variables.

The considerable variability in the degree to which children with a history of perinatal complications exhibit adjustment problems has led us to investigate which mechanisms buffer or exacerbate the association between perinatal risk factors and psychosocial outcome. In fact, it is the moderator variable that specifies the conditions under which a given predictor-outcome effect operates. Furthermore, the moderator affects the strength and direction of the relationship between the predictor and the dependent variable. Unlike the mediator variable, the moderator is introduced when the relationship between a predictor and the outcome variable is weak or inconsistent; it is not a prerequisite for the predictor and outcome variables to be significantly correlated in order to test for a moderating model. On the other hand, a mediator specifies the mechanism by which the predictor affects the dependent variable. In testing a mediator, the model requires a significant correlation between the variables tested. In fact, in a mediating model, the predictor influences the mediator which in turn, has an impact on the criterion variable. Unlike the moderator, a mediator is introduced only when strong associations between the predictor and the dependent variables have been detected. In the current study, no significant univariate correlations (c.f. correlation matrix; Appendix C) were detected between perinatal (pre-, peri-, and postnatal) complications and the outcome variables (i.e. fighting and withdrawal). Hence, it has been hypothesized that the

expected relationship between perinatal complications and negative outcome exists, but only under certain conditions, implying a moderator effect.

Several attempts to identify the conditions under which perinatal stress is or isn't associated to problematic outcome have been made. A good deal of attention has been paid to family resources in understanding children's adaptation to stress (Brooks-Gunn et al., 1994; Rutter, 1990; Werner;1993). As previously noted, numerous studies have revealed that good-quality parenting served as a protective factor especially within a high-risk population (Baker & Mednick, 1984; Bradley et al., 1994; Brooks-Gunn et al., 1995; McLoyd,1998; Raine et al., 1996; Werner,1993). In line with these conclusions, two distinct categories of parenting behaviors were chosen for our analyses; supervision and communication. Communication and supervision reflect two different aspects of parenting practices. Both these variables are important components of many conceptual schemes of parenting and are consistently associated to indices of child and adolescent adjustment including internalizing and externalizing symptoms (Maccoby & Martin, 1983; Patterson et al., 1992). While parental supervision reflects a disciplinary technique, parental communication reflects openness, responsiveness, and warmth of the parent toward the child. Many investigators (Loeber & Stouhammer-Loeber,1986; McCord,1988; Patterson et al., 1992) have suggested that children who are poorly supervised by their parents are likely to display more aggression and fighting behaviors than children who are highly supervised. Similarly, some authors (Baumrind, 1989 & Rothbaum, 1988) have found that parents who favored openness, responsiveness, and support in their communication with their young teens, had children who were more socially competent. In an investigation of 10 year old children, Rutter (1997), found lower rates of conduct disorders among those subjects with a good parent-child relationship compared to the rates among those lacking positive parental interactions. Interestingly, in his analyses, having a positive parent-child relationship emerged as an important predictor of adjustment in the presence of high levels of stress indicating that warm, supportive and uncritical parent-child relationship could be particularly beneficial to young teens and may shield the child from negative

outcome. Thus, positive parenting provides a relatively enduring resource for young adolescents, which strengthens their ability to cope effectively with stresses. In light of this research, both communication and supervision were hypothesized as resistance or protective factors within our conceptual model. Given the distinct nature of these variables, it seems useful to compare the differential parenting practices and the behavioral adjustment of children with a history of perinatal complications. It is felt that these different parenting skills would add significantly to the prediction of child behavioral outcome and would both, be worthy of attention.

In many cases throughout the literature, parenting practices interact with the independent variable in such a way that the outcome varies according to the level of the parental behavior. Similarly, in our study, parenting practices may also moderate the differential outcome. Prior to analyses, interaction terms were developed based on the product of the two main effects (perinatal complications X. parental practice variable). As such, the perinatal complications X parental supervision term was used to test for interaction effects on fighting and withdrawn behavior. Similarly, the perinatal complications X communication term was used in testing interaction effects on the same criterion variables (i.e. fighting and withdrawn behavior).

In hierarchical linear multiple regression, the researcher determines the order of the entry of the predictor variables in the model. This decision is based on principles of theory and logic. For each of the regression analyses, maternal education and maternal age at the birth of the first child were first entered to control for SES characteristics that could either be related to the independent or dependent variables. In light of findings (Telzrow, 1991; Tessier et al., 1992) that inappropriate weight for gestational age is significantly associated to later adjustment problems, this variable could have influenced the results. As such, this study was designed to control for the factor of weight for gestational age in order to maintain its effect constant while main-effect variables and interaction effects were tested. Hierarchical regression analyses were recomputed without controlling for this variable to determine if the results would have been different. The analyses yielded similar outcomes (only slight variations emerged when controlling for weight for gestational

age). The more conservative results were reported. In the second step, perinatal complications were entered separately into the model. This procedure was repeated for each of the three perinatal periods on each of the two outcome variables, yielding six independent analyses. As a third step, the parental practice variable was entered into the model to examine statistical main effects on each dependent variable, but was mainly used to introduce the subsequent interaction effects. This step was repeated twice; once with the supervision variable and another with the communication variable, yielding 6 interaction terms. The corresponding interaction term for each outcome was entered in the last step.

Many rationales have justified this analytical strategy. Control variables were entered into the model before introducing perinatal information in order to examine the main effects of the independent variable once control variables have been accounted for. Also, perinatal data was entered before parenting data, because chronologically, perinatal events occurred before parental practices were assessed. All main effects were examined first, prior to interaction effects.

RESULTS

This study aims to examine the relationship between perinatal complications and behavioral maladjustment in middle childhood. A second goal is to examine the moderating or protective role of parenting practices on maladjusted behaviors for school-age boys with a history of perinatal complications. In total 12 multiple regression analyses were performed using three types of perinatal complications: prenatal complications (PC, model 1), delivery complications (DC, model 2), and postnatal complications (PNC, model 3). These tested each outcome variable (fighting and withdrawal). Prior to statistical analyses, preliminary steps were taken to verify that the basic assumptions of multiple linear regression were met. Regression analyses addressing the first hypothesis of the study followed by the results for the second will be presented in the following section.

Preliminary Analyses

Normality of distributions. According to Tabachnick and Fidell (1996) screening continuous variables for normality is an essential early step in multivariate analysis, unless the sample size is large enough. The quality of the solution is improved when the variables are normally distributed. Two measures of normality are skewness and kurtosis. Skewness, refers to the symmetry of the distribution. When a variable is skewed its median does not correspond to its mean such that the mean is not at the center of the distribution. Kurtosis, refers to the peakedness of the distribution. A distribution which is too peaked (kurtosis > 0) or flat (kurtosis < 0) is considered abnormal. A normal distribution is one where the values of skewness and kurtosis are not significantly different than zero. However, a distribution can be considered normal if the confidence interval at 95% determined by the equations (CI= skewness score $\pm$ 2*standard error of skewness and CI =kurtosis score $\pm$ 2*standard error of kurtosis) includes zero (Stevens, 1992).

In this study, the normality of continuous variables was evaluated by statistical and graphical methods. Variables were screened for skewness and kurtosis by examining a histogram (with a normal plot superimposed) and by calculating the confidence intervals to assess the adequacy of assumptions underlying multiple

regressions. Mild deviations from normality were noted in the frequency graphs. Transformations were computed to restore normality, however no changes in the results were noted. The sample size was large enough (n>500) so that these distributions did not affect the results.[1] Stevens (1992) has suggested that in large samples, the distributions will not deviate enough to make a substantial difference in the solution. Given a large sample, skewness and kurtosis values which differ significantly from zero will either have a minimal impact (n > 100) or no impact at all (n > 200) in the analyses (Tabachnick & Fidell, 1996).

Outliers. Some cases may poorly fit the regression equation, their predicted scores may differ substantially from their actual scores, thereby greatly affecting the results. Outliers are those cases with an unusual combination of scores on several variables (SPSS, 1990; Stevens, 1992). For each of the 12 analyses performed, three statistical tests (standardized residual scores, Mahalanobis' distances, and Cook's distances) were examined to detect outlying scores.

The standardized residual scores were used to detect univariate outliers among the cases. Standardized residuals should have a normal distribution with a mean of 0 and a standard deviation of 1. In each of our analyses, these prerequisites were satisfied. The Weisberg equation[2] suggested by Stevens (1992) was used to detect any subjects with outlying scores on the criterion variable. The critical value for the Weisberg outlier test yielded a score of 3.92 (p= .05 with 6 predictors and 500 subjects). None of the subjects in our analyses exceeded this value, and therefore, none of the cases were considered to be outliers.

Mahalanobis distance is another method of identifying outliers among the cases. This measure indicates how far a case is from other central cases for the set of predictors. The critical value for 585 subjects and 6 predictors was impossible to

---

[1]Square root and logarithmic transformations were attempted. Distributions and analyses results remained unchanged.

[2] $t = r_i \left(\frac{n-k'-1}{n-k'-r_i^2}\right)^{1/2}$ where

t= weisberg statistic

K= number of predictors :k'=K+1

n= number of subjects

r_i= standard residual

obtain from the tables reported by Stevens (1992) and Barnett and Lewis (1978). Therefore, the critical value for 500 subjects and 5 predictors with an alpha of 0.01 was used. This value corresponded to 28.62. The SPSS output indicated that a few scores were above this critical value. However, examinations of Cook's distance did not reveal the presence of influential points in the solution. These outlying cases, according to Cook's distance were not sufficiently deviant in order to affect the analyses. Therefore, it was unnecessary to remove these points from the analyses.

Tests of assumptions. Multicollinearity refers to high intercorrelations among the predictors. Stevens (1992) has reported that correlations greater than 0.80 are problematic for the interpretation of results. When multicollinearity is high it becomes difficult to determine which variable has best contributed to the variance of the dependent variable. All correlation coefficients in our study had an $r < .80$, indicating that the test of the assumptions of multicollinearity were satisfactory (c.f. correlational matrix; Appendix C).

A minimum of 15 subjects per predictor is required for a reliable equation (Stevens, 1992). This ratio (n / k) is important in determining whether the regression model can be cross-validated to other samples with minimal loss in predictive power. The present study was composed of 6 predictors in each analysis, hence requiring 90 subjects. This sample consisted of 585 subjects, which well satisfied the condition of the assumption.

Further examinations of the probability plot and the standardized scatterplot indicated multivariate normality and linearity of the data distribution as well as homoscedasticity of the residuals.

At the time of the data collection, the selection of highly reliable and valid instruments is extremely important in order to reduce the risk of measurement errors. The instruments used in the current study were chosen according to their psychometric qualities (c.f. method section). Given that linear multiple regression is particularly sensitive to measurement errors, a careful examination of extreme values and outlying scores were carried out. The extreme values observed in our analyses appear to be due to a high-risk sample rather than to measurement errors.

A final assumption postulates that all relevant predictors must be included in the model, and inversely, all irrelevant predictors must be excluded. This refers to the *specification errors* assumption. The main purpose for the current analyses was to create parsimonious models by including only essential predictors in order to increase the accuracy of the prediction. The combination of predictors for each model was cautiously selected on theoretical and statistical grounds, so that only the pertinent predictors were studied.

Perinatal complications and parental supervision as predictors of fighting

A first series of hierarchical multiple regressions was conducted to examine the statistical main effects of prenatal, delivery, and postnatal complications on physical aggression (fighting). Interaction effects between perinatal complications and parental supervision on fighting at ages 11/12 was also tested. Weight for gestational age, maternal age, and maternal education were entered in the first step. Perinatal complications were entered separately in the second step, parental supervision in the third step, and the interaction term was entered in the last step. Table 3 reports the standardized β coefficients and the coefficients of multiple determination (R^2) yielded by the first set of analyses. β coefficients are weight-values assigned to each predictor in the equation, indicating the contribution of a particular predictor on the dependent variable while partialing out the effects of all other predictors in the analysis. Given the different measures and scales used for each predictor, it was more advantageous to report standardized β scores (where the raw β scores were translated into *z* scores and where differences were calculated in terms of standard deviations (Stevens, 1992). The coefficient of multiple determination (R^2) was used to measure the proportion of variance on the criterion variable that is accounted for by the set of predictors. The greater the R^2, the more the total variance of the dependent variable was due to the combination of predictors within the equation.

Table 3. Hierarchical Regression Analyses for Perinatal Variables and Parental Supervision in the Prediction of Fighting at Ages 11/12.

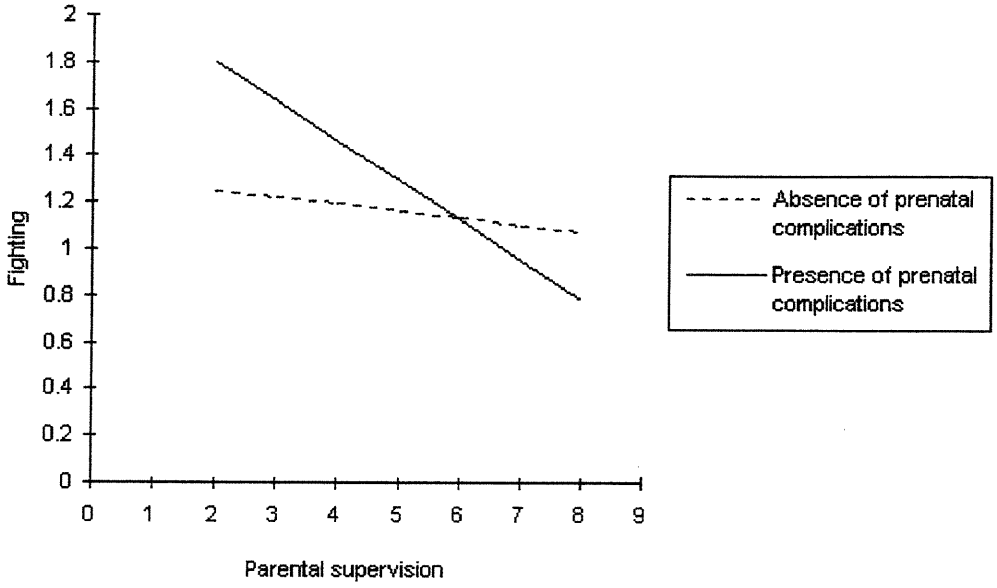
	Model 1		Model 2		Model 3	
	std β	R^2	std β	R^2	std β	R^2
Weight for gestational age	-0.03		-0.03		-0.03	
Maternal age	-0.09*		-0.09*		-0.09*	
Maternal education	-0.12**	0.03	-0.12**	0.03	-0.12**	0.03
prenatal complications	-0.02	0.03				
delivery complications			-0.05	0.03		
postnatal condition					0.03	0.03
supervision at age 10	-0.11**	0.04	-0.11**	0.04	-0.11**	0.04
PC × Supervision	**-0.45****	0.05				
DC × Supervision			0.21	0.04		
PNC × Supervision					0.02	0.04

**p<0.01
* p<0.05
‘ p<0.10
PC = prenatal complications
DC= delivery complications
PNC= postnatal complications

Main effects. No main effects were found for children who had prenatal complications, delivery complications, or a postnatal condition on the fighting scale. These results indicate that perinatal complications did not account for a significant proportion of the variance on fighting behavior, even after control variables have been accounted for. In fact, the addition of perinatal complications to the covariates did not strengthen the variance (R^2 change = .001). Among the control variables, maternal age and maternal education were good predictors of fighting behaviors at ages 11/12 with respective standardized betas of -0.09 (p<.05) and -0.12 (p<.01). These figures indicate that higher maternal age and education level are significantly predictive of a decrease in children's fighting. However perinatal complications were not significant predictors of fighting behavior at ages 11/12.

Interaction effects. The results reveal a significant interaction, suggesting a moderator effect of parental supervision on fighting behavior for boys with a history of prenatal complications (*F change* = 6.24, $p<.05$). No other significant interaction effects were reported. To fully understand this result, the relationship between supervision and fighting variables were examined through SPSS interaction plots. The prenatal X parental supervision interaction is depicted in Fig.1. In this graph, the two regression lines were generated from the following regression equation: Y= 1.31 + 0.83 (pc) - .03(sup) - .14(pcxsup) + e, where in one case PC=0 (absence of prenatal complications) and in another PC=1(presence of prenatal complications). The plots showed that supervision (x-axis) and fighting (y-axis) are inversely proportionate, so that as supervision scores increased, fighting scores decreased. This inverse relationship between supervision and fighting was particularly marked for the group of boys with a history of prenatal complications. The slope is significantly steeper for boys with a complication than for those without (Jaccard, Turrisi, & Wan,1990; SPSS,1990). Thus, boys whose mothers experienced prenatal complications and who reported high levels of supervision at age 10 displayed less fighting behaviors at ages 11/12. Conversely, boys whose mothers experienced prenatal complications and who reported poor levels of supervision at age 10 developed more fighting behaviors by ages 11/12. These results confirmed the second hypothesis, which suggests that the association between perinatal complications and behavior outcome is modified by parental practices (more specifically parental supervision). However, this hypothesis, was only true for prenatal complications (model 1); no interaction effects were noted for delivery complications (model 2) or for postnatal complications (model 3), indicating that parental supervision is an important protective factor in the prevention of fighting behaviors, particularly for children with a history of prenatal complications.

Figure 1. The interaction of prenatal complications and parental supervision predicting fighting.



In this analysis, model 1 (i.e. prenatal condition X supervision) on fighting explained 5% of the total variance on the criterion variable. An additional step was undertaken to estimate the generalizability of this model to our target population. The Herzberg formula[3] was computed to estimate the amount of shrinkage to be expected under cross-validation for the multiple regression equation (Stevens, 1992). The set of predictors in model 1 yielded an adjusted r^2 equal to 0.03 indicating that the estimated variance of fighting behavior accounted for by the set of predictors in model 1 would be 3% in the general population.

Perinatal complications and parental communication as predictors of fighting

A second series of hierarchical multiple regressions was conducted to examine the interaction effects between perinatal complications and parental communication on fighting behavior at ages 11/12. Similar to the previous procedure,

[3] $r^2 = 1- (n-1/n-k-1) (n-2/n-k-2) (n+1/n) (1- R^2)$
Where n= number of subjects=585
k= number of predictors=6
R^2 = coefficient of multiple determination= 0.04

the covariates were entered in the first step. Perinatal complications were entered separately in the second step, parental communication in the third step, and the interaction term (perinatal complications X parental communication) was entered in the last step. Table 4 reports the results of these analyses.

Table 4. Hierarchical Regression Analyses for Perinatal Variables and Parental Communication in the Prediction of Fighting at Ages 11/12.

	Model 1		Model 2		Model 3	
	std β	R^2	std β	R^2	std β	R^2
Weight for gestational age	-0.03		-0.03		-0.03	
Maternal age	-0.09*		-0.09*		-0.09*	
Maternal education	-0.12**	0.03	-0.12**	0.03	-0.12**	0.03
prenatal complications	-0.02	0.03				
delivery complications			-0.05	0.03		
postnatal condition					0.03	0.03
communication at age 10	0.06	0.03	0.06	0.03	0.06	0.03
PC × communication	0.03	0.03				
DC × communication			0.03	0.03		
PNC × communication					0.15	0.03

**p<0.01
* p<0.05
' p<0.10
PC = prenatal complications
DC= delivery complications
PNC= postnatal complications

Results reveal no significant interactions across the models. This result is somewhat expected since communication is not significantly correlated to fighting and does not predict fighting behavior. The addition of this variable to the model does not contribute to any changes.

Perinatal complications and parental supervision as predictors of withdrawal.

A third series of hierarchical multiple regressions was conducted to examine the main effects of prenatal, delivery, and postnatal complications on withdrawal. Interaction effects between perinatal complications and parental supervision (c.f. table 5) on withdrawn behavior at ages 11/12 were also tested. Covariates were entered in the first step. Perinatal complications were entered separately in the second step, parental practice in the third step, and the interaction term was entered in the last step. Table 5 reports findings for the withdrawal scale across all models.

Table 5. Hierarchical Regression Analyses for Perinatal Variables and Parental Supervision in the Prediction of Withdrawal at Ages 11/12.

	Model 1		Model 2		Model 3	
	std β	R^2	std β	R^2	std β	R^2
Weight for gestational age	-0.06		-0.06		-0.06	
Maternal age	0.01		0.01		0.01	
Maternal education	-0.06	0.01	-0.06	0.01	-0.06	0.01
prenatal complications	0.03	0.01				
delivery complications			-0.02	0.01		
postnatal condition					0.03	0.01
Supervision at age 10	-0.02	0.01	-0.02	0.01	-0.02	0.01
PC × Supervision	0.01	0.01				
DC × Supervision			0.03	0.01		
PNC × Supervision					0.04	0.01

**p<0.01
* p<0.05
‘ p<0.10
PC = prenatal complications
DC= delivery complications
PNC= postnatal complications

Main effects. As presented in Table 5, the results reveal no main effects for any of the perinatal complications on boys' withdrawn behavior at ages 11/12. Similar to the previous analyses, the addition of a perinatal variable to the covariates did not increase the variance on the criterion variable (R^2 change = .001).

Interaction effects. An interaction model was tested between perinatal complications and parental supervision on withdrawal . Interaction effects were not significant across the models.

Perinatal complications and parental communication as predictors of withdrawal.

A final series of hierarchical multiple regressions was conducted using the same procedure to examine the interaction effects between perinatal complications and parental communication on withdrawn behavior at ages 11/12.

Table 6. Hierarchical Regression Analyses for Perinatal Variables and Parental communication in the Prediction of Withdrawal at Ages 11/12.

	Model 1		Model 2		Model 3	
	std β	R^2	std β	R^2	std β	R^2
Weight for gestational age	-0.06		-0.06		-0.06	
Maternal age	0.01		0.01		0.01	
Maternal education	-0.06	0.01	-0.06	0.01	-0.06	0.01
prenatal complications	0.03	0.01				
delivery complications			-0.02	0.01		
postnatal condition					0.03	0.01
communication at age 10	-0.16**	0.03	-0.16**	0.03	-0.16**	0.03
PC × Communication	-0.27	0.04				
DC × Communication			0.06	0.03		
PNC × Communication					0.07	0.03

**p<0.01
* p<0.05
‘ p<0.10
PC = prenatal complications
DC= delivery complications
PNC= postnatal complications

Main effects. As presented in Table 6, the results reveal no main effects for any of the perinatal complications on boys' withdrawn behavior at ages 11/12. Similar to the previous analyses, the addition of a perinatal variable to the covariates did not increase the variance on the criterion variable (R^2 change = .001). Results reveal a main effect of maternal communication as a predictor of withdrawal behavior (β=-.16, $p<.01$) indicating that the use of communication reduces the occurrence of withdrawn behavior.

Interaction effects. Similar to the previous analyses, interaction effects were not significant across the models. Moreover, very minimal changes were noted in the R^2 values for both the equations. With such weak results, these models could not predict withdrawn behavior.

In summary, no significant main effects were observed for prenatal, delivery, or postnatal complications on the outcome variables studied. These results did not support our first hypothesis that perinatal complications would predict behavior problems in later childhood years. Our results revealed a moderator effect for parental supervision on the fighting outcomes in boys with a history of prenatal complications. The presence of prenatal complications combined with a lack of parental supervision predicted fighting behaviors in boys at ages 11/12. Hence, the results show that supervision had a significant protective role in the development of fighting behavior, especially in the group of boys with a history of prenatal complications.

DISCUSSION

This study examined two questions concerning the impact of perinatal complications in predicting behavior problems during middle-childhood. The first question attempted to ascertain whether perinatal complications were associated with detrimental effects on the behavior (externalizing and internalizing) of 11/12 year-old boys coming from a disadvantaged background. The second question addressed the role of parenting practices in moderating the link between perinatal complications and behavioral outcome.

In light of findings that perinatal complications place children at risk for later maladjustment (Baker & Mednick, 1984; Brennan et al., 1991; Gray et al., 1989; Hadders-Algra et al., 1988; Kandel & Mednick, 1991; Levy-Shiff et al., 1994; Lewis et al., 1979; McCurry et al., 1991; Mungas,1983; Pasamanick et al.,1956; Rantakallio et al., 1992), it was hypothesized that boys who were exposed to perinatal complications would develop behavior problems by middle childhood. No support was found for this hypothesis. Our results revealed that perinatal complications were not predictive of behavior problems for boys at ages 11/12 and are consistent with other longitudinal studies that have found no main effects of perinatal complications on later adjustment problems (Kandel,1992; Pagani et al., 1998; Szatmari et al., 1986; Raine et al.,1994). These findings support the idea that only a portion of children with a history of perinatal complications are predisposed to behavior problems in later development raising the question of what other factors may be involved and may modify the outcome (Sameroff & Chandler, 1975; Werner, 1993).

The conflicting findings may be explained by the nature of the outcome variable assessed. Our first analysis revealed no main effects of perinatal complications on fighting behavior. In light of the research on perinatal complications and later violence (Kandel & Mednick, 1991; Lewis et al. 1979; Mungas, 1983; Rantakallio et al., 1992), it was speculated that if fighting items were retrieved from the disruptiveness scale, it would ensure the use of items which best identified violent behavior, increasing the quality of the prediction model. However, this hypothesis was rejected. Perinatal complications did not predict fighting behavior for boys at ages 11/12.

The varying results are, perhaps, due to the wide range of instruments chosen across studies to measure outcome variables. Research investigating the impact of perinatal complications have typically used maternal ratings (Raine et al., 1996), teacher ratings (Baker & Mednick.,1984; McGee et al., 1984), self-ratings (Pagani et al., 1998), criminal or court records (Kandel & Mednick, 1991; Lewis et al., 1979; Rantakallio et al.,1992), and clinical records (McNeil et al.,1970; Pasamanick et al., 1956) to assess outcome variables. To our knowledge, no other study in this field has used a sociometric method to measure behavioral outcome. In this study, the use of a sociometric instrument may have made an important contribution toward a more accurate assessment of children's social functioning. Sociometric methods allow the investigator to assess children's behavior from a different angle. The results reflect the quality of social interactions of the child as reported by his peers. As mentioned previously, the PEI provides a unique assessment of behavior which differs from teacher or parent ratings because adult observers may have an entirely biased perception of a child's behavior. Thus, this instrument was chosen due to its longitudinal predictive power and its strong validity and reliability (c.f. method section). In spite that peer ratings have been found to be powerful predictors of later maladjustment, the use of peer judgment has several disadvantages: Through peer ratings, little information is revealed about the nature or the source of the behavior, it is simply an indicator of the problem. To understand the nature of a child's behavior problems (i.e. is the aggressive behavior due to cognitive skills or to a deficiency in itself), further assessments must be conducted. Also, within a peer group, there may be a high variance in evaluative judgments, given the number of evaluators. Furthermore, peer raters have been found to be systematically biased and inaccurate in their perceptions and judgments of others. Peers are not merely objective external evaluators. They often label a child as «aggressive» or «rejected» and promote the deviant behavior. Because children interact in a social context, it is important to note that the raters being an active part of these social interactions may influence the behavior (Johnston et al., 1988; Lardon & Jason, 1992; Ledingham & Younger, 1985; Pekarik et al., 1976; Vitaro & Boivin, 1989).

The literature indicates that perinatal complications are significantly associated with violent criminal offending in adults (Kandel & Mednick, 1991; Lewis et al., 1979). This leads to the interpretation that violent crime and school-age fighting are distinct constructs that stem from different etiological factors. Criminal and violent offenses are more extreme and severe behaviors compared to school-age fighting. As such, it is conceivable that perinatal complications are better predictors of highly deviant behaviors. In fact, Kandel and Mednick (1991) and Lewis et al. (1979) have observed that perinatal complications were particularly prevalent in the history of violent recidivists and incarcerated delinquents, which implies that not only is the severity of the behavior problem important for the prediction, but also is the persistence of the behavior. Furthermore, persistent antisocial behavior is perhaps best assessed in late adolescence or in adulthood, once the behavior is more stable and anchored in the individual's personality. Thus, in this study, it could be that no evidence of a significant link between perinatal complications and fighting was detected because our sample was comprised of 11/12 year-old boys who did not display extremely severe and persistent behavior problems.

In addition, our results indicate that perinatal complications do not significantly predict social withdrawal. Although the long-term consequences of perinatal complications on social competence are largely unknown, one prospective study has reported similar results to our findings; Baker and Mednick (1984) showed that medical risk had no influence in the prediction of socially withdrawn behavior. Family structure was the only variable to significantly contribute to social withdrawal. The authors concluded that social withdrawal was determined solely by environmental factors and not by biological risk. In parallel to these results, Eisenberg and Mussen (1989) postulated that the environment is the predominant determinant of prosocial behavior. Without discarding that biological factors (i.e. genetics) play an important role in the predisposition for prosocial behavior, these authors suggest that socialization agents such as parent-child interactions and childrearing practices are critical in molding a child's prosocial behavior.

It is also important to note that gender is among the principle characteristics associated to socially withdrawn behavior. There is some evidence to suggest that social withdrawal is more prevalent among girls than boys (Mills & Rubin, 1993). The association of stressful events with conduct problems is stronger for boys than for girls indicating that externalizing behavior such as fighting may be a more common stress response for boys. Several authors (Wagner, Cohen, & Brook, 1996) have noted that girls were more likely than boys to display internalizing symptoms and less likely than boys to have symptoms of aggression or conduct disorders. As such, the fact that our sample solely consisted of boys may account for why, in the current study, perinatal complications were not significant predictors of withdrawal. Analyses could have yielded a positive prediction for a sample of girls. This hypotheses remains to be explored in future research.

In summary, it appears that although several researchers have established an association between perinatal complications and maladjustment, many children who are exposed to perinatal complications do not develop behavior problems. It is possible that the effects of perinatal complications disappear with age. Any behavior or deficits that were detected in the first years of life may have disappeared by middle childhood. A second possibility is that these school-age boys, who do not currently have any behavior problems, will develop problems later in life. However, this is highly unlikely given the stability of behavioral predisposition. These are interesting issues to be examined in future studies.

The results from this study do not support the assumption that perinatal complications are strong predictors of later behavioral problems in school-age children. These findings lead to the assumption that other factors are responsible for behavioral outcome. Numerous recent studies have highlighted ways in which biological and environmental factors interact to influence development. Several longitudinal studies (Baker & Mednick, 1984; Bradley et al., 1994; Kandel & Mednick, 1991; Liaw & Brooks-Gunn, 1994; Pagani et al., 1998; Raine et al., 1994; Sameroff & Chandler, 1975; Werner, 1993) have shown that for children exposed to perinatal complications, long-term behavioral outcome was detected only when environmental

variables were considered in the model. Baumrind's work (1967; 1989) and others (Loeber & Stouthamer-Loeber, 1986; Maccoby & Martin, 1983; McCord, 1988; Mills & Rubin, 1993; Rubin et al., 1990; Patterson, Reid, & Dishion, 1992) have shown that childrearing styles are closely associated to behavioral outcome in later development. In these studies, childrearing practices were identified as the predominant domestic-environmental factor to affect behavior. If adequate, parenting abilities may act as a buffer to children who experienced perinatal complications and may prevent them from displaying behavior problems by middle childhood. However, if inadequate, parenting may exacerbate a problematic outcome.

In testing for interaction effects, the current study highlights a moderator mechanism in the prediction of perinatal complications on behavior problems. These analyses reveal that perinatal complications are associated to externalized behavior but only under the influence of parenting behavior. More specifically, a significant association of parental supervision with physical aggression was found for boys who experienced prenatal complications. This result suggests that parental supervision can be a protective mechanism on school-age fighting for the boys who were exposed to poor prenatal conditions, whereas poor supervision can increase the risk for fighting behaviors by ages 11/12 for those subjects. The results herein are useful in identifying from the parenting factors the one (parental supervision) that places a child with a history of prenatal complication at-risk for experiencing externalized behavior. It is important to note that the data here allows only a narrow explanation as to the mechanisms by which parenting may modify the association between early medical hazards and symptoms of externalized and internalized behavior. Our results do not articulate how a child's perinatal history could influence parenting and lead to adjustment problems. In fact, very little is known about the ways in which parenting may combine with a stressful event such as perinatal complication to produce a more adapted individual later in life. The challenge for researchers is to refine understanding of individual differences in the resources available to young teens and their influences on their ability to cope. Our results suggest that parental supervision is significantly associated to the adjustment of boys with a history of

prenatal complications. However, a complete explanation of the psychosocial outcome in this population may need to include several other factors in addition to the parenting variables. More comprehensive models must be investigated because other constructs (such as child temperament and maternal attachment) may have mediated the relationship between perinatal complications and parental practice offering a more complete pathway towards maladjustment. Research in developmental psychology has become quite complex especially when investigating the long-term associations between a predictor and a later outcome. Often in investigating a phenomenon, researchers seek to examine factors that mediate and moderate the associations between independent and dependent variables. In order to generate more comprehensive explanations of the areas studied, more and more investigators take into account the body of research relevant to their results and integrate mediator and moderator interpretations in explaining their conceptual models (Holmbeck,1997). Our interpretations of the results presented below are inspired by this integrative approach. However, because mediating variables were not tested in our model, these interpretations warrant scrutiny.

It can be speculated that our sample of disadvantaged women were prone to prenatal complications, perhaps because they lacked the skills to care for themselves, or to reach out to accessible resources at the time of the pregnancy. The sample was drawn from a high-risk population living in the most disadvantaged neighborhoods of Montreal and is comprised of young mothers, women of low socio-economic status, and women who have not completed school. Very little recent data is available regarding the rates of perinatal complications especially for a given population such as a sample of underprivileged women in Quebec. In fact, individual hospitals mainly keep registrations of births and mortality rates. Vital statistical records do not contain data on rates of pre-, peri-, and postnatal complications. Under provincial and territorial jurisdictions attempts have been made to compile rates for specific complications such as the incidence of episiotomy or cesarean. However, this information does not offer a global complication score of prenatal or obstetric complications. Furthermore, most statistical records do not contain the

necessary socioeconomic data. Perinatal rates are practically never associated to the individuals' socioeconomic status or other relevant sociodemographic variables such as maternal age, family structure etc.. Despite the limited information available, a very recent national report (Wershler, 1998) examined the provincial variations in women's hospital use during pregnancy and childbirth. Their data base comprised of hospital admissions submitted by all general hospitals from Quebec and other provinces. Wershler (1998) has reported that 15% of Quebec women who gave birth were admitted to hospitals at least once during the six months prior to giving birth. However, it is important to note that the reasons for admission and the leading diagnoses for childbirth complications varied considerably. Over half of all perinatal complications reported were minor, while others were classified as conditions complicating the pregnancy. Thus, the findings of this statistical survey reflects birth-related hospital-use for which hospital admissions data are available. Although this study has given us some insight on the prevalence of pregnancy complications experienced by Quebec women, it has not taken into account the sociodemographic situation of these women and consequently, the results cannot be compared to the rates found in our study. In our study, 27% of the sample comprised of women with a history of pregnancy complications. The marked discrepancy between the 27% rate in the current study and the 15% in the Wershler (1998) study can probably be explained by the nature and extent of the social inequalities of the populations studied. Moreover, perinatal variables included within a category of complications differs from one study to another, limiting the generalizability to other studies. After an extensive search, a provincial document investigating the impact of poverty on pregnancy outcome was found (Martin & Boyer, 1995). This Quebec investigation reports that 20% of women living in unfavorable conditions experience pregnancy and birth complications. According to this data, our sample which represents 27% of disadvantaged women with a history of pregnancy complications is somewhat representative of the general population. Consistent to these findings, there is considerable evidence in the literature that the incidence of perinatal risk is greater among women living in adverse social and economic conditions. Financial strains

and stresses brought on by living under difficult conditions, are negative correlates to childbearing. Poverty has been frequently associated with poor health standards which have direct negative consequences on pregnancy and delivery outcomes (Gray & Dean, 1991; Liaw & Brooks-Gunn, 1994). At-risk pregnant women under-use the perinatal services available. They tend to consult medical personnel later and less frequently during the course of their pregnancies, despite the fact that these services are offered at no cost in Quebec (Bedics, 1994; Larson, 1980; Lepage & Colin,1989; Martin & Boyer, 1995). Prenatal complications such as infections, syphilis, blood loss, hypertension, etc. are often affected by the level of maternal care during pregnancy. In fact, women who neglect their health through the use of harmful agents (i.e. drugs and alcohol), malnutrition, and who do not seek medical services on a regular basis during pregnancy are at high risk for prenatal complications (Caputo et al., 1981; Gray & Dean, 1991; Kopp & Parmelee, 1979). Kopp and Parmelee (1979) have noted that complications during the prenatal period are more serious than those occurring later in the pregnancy because perinatal and postnatal hazards are often consequences of a foetus that has been compromised early on in the pregnancy. Hence, it is probable that mothers who are less proficient at parenting their children are also those that have neglected their own personal health during their pregnancies.

In line with this possibility, several researchers (Gray & Dean; 1991; Raine et al., 1994; Sigman et al., 1981) have noted that the presence of pregnancy and birth complications affect the nature and quality of caregiving. Findings suggest that mothers who experienced perinatal complications are more at risk of being insensitive and unresponsive to their children. Such disruptions in parent-child interactions may negatively affect the child's behavior in later development. Kandel and Mednick (1991) have also concluded that the connection between perinatal health and maladjustment is through poor parenting. According to these authors, poor prenatal care is predictive of poor mothering after birth. Especially when applied to high-risk subjects, deficiencies in parenting skills, rather than the birth complication itself, may contribute significantly to the deviant behavior. Thus, these

authors have concluded that parents who are themselves poorly adjusted or who suffer from some degree of deviance may be unable to provide an optimal environment for their offspring. Moreover, drawn from Baumrind's theory, the most socially incompetent children were those raised by unengaged parents. These parents were by definition rejecting and neglecting and did not supervise their child's activities. Others (Haapasalo & Tremblay, 1984; Loeber & Stouthamer-Loeber, 1986) have postulated that this type of parenting generates externalizing behaviors in children.

To summarize thus far, our model has revealed that the interplay between prenatal complications and parental supervision is predictive of aggression in middle-childhood. Our assumption that perinatal complications is associated to behavioral adjustment was confirmed, but only under a certain condition; the presence of parental supervision. This study confirms earlier findings (Baker & Mednick, 1984; Pagani et al, 1998; Raine et al, 1994) that behavioral outcome can be predicted by an interactional process between perinatal complications and psychosocial factors. Moreover, consistent with other investigations (Bradley et al., 1994; Liaw & Brooks Gunn, 1994; Werner, 1993), this study shows that the environment (i.e. childrearing practices) can serve to exacerbate or buffer the effects of perinatal complications. More importantly, our results suggest that boys of a specific medical background may have a specific need in terms of childrearing practices. For example, boys who were exposed to prenatal complications seem to benefit from close supervision in the prevention of fighting behaviors. These findings should be interpreted with caution given that other factors (not considered in this study) could explain the results. Other variables with a mediating function may have been integrated into the model to better explain the pathway from perinatal complications to adverse outcome, one might assume that disadvantaged mothers may care poorly for themselves, thereby increasing the risk of complications during pregnancy. After birth, problems of attachment and quality of care are more likely to arise. As time progresses, mothers may become more "disengaged". As such, the lack of supervision by the parent may be associated with hostile aggressive behaviors displayed in middle childhood. It

may be useful in the future for researchers to combine mediating and moderating effects in view of in depth explanations of developmental processes.

The results of the present study need to be considered in light of several limitations. First, in measuring perinatal complications, the presence or absence of the condition was identified and classified according to its specific perinatal period. Many authors (Baker & Mednick,1984; Murai & Nihei, 1983; Szatmari et al., 1986) have examined whether a child's development was affected by events that occurred during the entire perinatal time range including pregnancy, labor, delivery, and the postpartum period. It was hypothesized that the use of specific types of complications could yield useful information concerning the types of outcome. Moreover, this categorical method of identifying the presence or absence of the complication seems to constitute a simpler and more valid measure than weighted score systems or frequency measures. Our method has been shown to be quite effective in avoiding the biases and arbitrariness encountered in weighted scores, and the redundant effects often obtained by the accumulation of various complications or interventions that are sometimes interdependent. Despite these advantages, it is important to note that the severity of perinatal complications is not reflected in our method, which limits our interpretation of the results. It is probable that among the variables included within a category (for example prenatal complications), a single item would be severe enough to predict negative outcome, but because this variable is combined to other, perhaps less damaging complications, its effect becomes diluted. To our knowledge, researchers have not examined in sufficient depth the effects of a single perinatal complication on later developmental outcome. Our advice for future investigations is to determine which perinatal factors significantly influence child development and, perhaps, to replicate the study by splitting perinatal complications into a group of major complications (i.e. those factors that have greater probabilities of inflicting physical or neurological damage) versus a group of minor complications (i.e. those factors which are more common and that can be simply treated by a modern medical intervention without jeopardizing the fetus or the neonate's health status). Such a study may contribute

to determining whether physical or neurological sequelae are prerequisites in predicting later adjustment problems.

Information on perinatal events, birth complications, and medical interventions were collected by consulting hospital records. However, in order to increase the accuracy of the information extracted from the medical records, a list of categorical perinatal items was used by the research assistant to indicate whether the item was present within each patient's medical file. Other publications (Arsenault et al., submitted; Pagani et al, 1998) have also used this method but have not given a description of the grid, and have not mentioned its origin or its reliability. After a thorough search with several members responsible for the data collection, it became clear that the perinatal information scale, in the current study, represents a consensus derived from previously used scales from both, the obstetric and psychiatric literature. The items of this instrument were generated from complications appearing in agreement on several of these rating scales (Hobel et al., 1973; Lewis, Owen, & Murray, 1989; Littman & Parmelee, 1978; Parnas et al.,1982; Pechtl, 1967; Woerner et al., 1973; Zax et al.,1977). The purpose in constructing the rating scale was to produce an atheoretical instrument that was useful in identifying perinatal variables effectively. However, it is difficult to determine the accuracy of the perinatal information scored given that there is no evidence of interater reliability tests.

The complication items comprised in the pre-, intra-, and postpartum categories were replicated from a previous study (Pagani et al., 1998). In fact, it is interesting to note that slightly different results were generated even though the same variables were tested (refer to Pagani et al., 1998). The selection of the items for each category of risk used in this study was based on the following criteria: The first set of items were selected according to the prevalence of the complication or the medical intervention as an indicator of the severity of the perinatal event. As such, the more a birth complication is common, the less severe it may be. . Severe and rare complications have greater probabilities of inflicting physical or neurological harm on the newborn (Arsenault et al., submitted). From this perspective, some complications, such as an episiotomy, a cesarean section, induction of labor, use of

anesthetics and jaundice were excluded in the current study due to their high incidence in the general population and therefore, are of doubtful significance for our results. According to recent statistical reports (Lepage et Colin, 1989; Werschler, 1998), one of the most common procedures performed during childbirth is an episiotomy. It is estimated that one out of three women giving birth undergo a routine episitomy. Another common procedure during labor is the use of anesthetics. One in five (22.3%) women receive an epidural during delivery. (Lepage et Colin, 1989). Similarly, the rates for a cesarean section has tripled since the 70's. The rate increased from 6% to 19% in Quebec. This figure is consistent with estimates reported by Health Canada (Werschler, 1998) suggesting that 18% of all births in 1998 were delivered by cesarean section. Also, pregnancy may often be extended past the anticipated date of childbirth. In these cases labor is induced. One in seven labors are induced according to the Health Canada survey (Werschler, 1998). In general, this procedure involves reduced risk, because induced labor is often scheduled during traditional work hours when the attending physician and hospital staff are readily available. Because these complications are so widespread, some researchers suggest that the routine use of these medical interventions can be performed without adversely affecting normal development. Other perinatal variables were omitted from our data to avoid redundancies. For example, although atypical presentation may be considered as an abnormal birthing situation, the abnormal way in which the foetus presents itself may not be the damaging factor. Several babies who are born with an atypical presentation do not develop anomalies. However, this situation can cause important complications such as foetal distress or anoxia. Anoxia is oxygen deprivation, which is often caused by asphyxiation due to breech delivery. Sameroff and Chandler (1975) have addressed anoxia as a cause of neurological impairment leading to maladjustment. They argued that anoxic infants had bleaker prognosis on measures of irritability, impulsivity, and personal adjustment. Variables pertaining to maternal medical history (i.e. emotional disorders, blood transfusions, allergies, etc..) and information on past birth mortality experience (i.e. recurrent

abortions, stillbirths, miscarriages) were omitted since these are indirect risk factors that do not conform to the chosen definition of perinatal complications.

A major methodological flaw found in this field is that it is impossible to use an experimental procedure whereby perinatal complications would be assigned to subjects. Such a procedure is unethical. Therefore, it is difficult to fully uncover the processes from birth to middle childhood maladjustment. In fact, behavior problems may not be directly associated to the complications themselves, but rather, a mitigating factor may influence behavioral outcome. Parenting practices appears to be such a variable. In the present study, childrearing practices were assessed in terms of the quantity of supervision and communication at 10 years of age. However, the quality of caregiving may be a critical element in determining the course of child development. In the future, this variable should be included as a measure of parenting practices.

In light of the literature that shows parenting styles to be predictive of childhood behavior, we chose to examine the moderating effects of childrearing practices at 10 years of age on the behavior of school-age children who have experienced perinatal complications. However, other variables are undoubtedly significant and should be explored. Parental psychopathology is an example of such a variable. Kandel and Mednick (1991) have suggested that for children who have experienced complications during the perinatal period, having a parent with a psychiatric condition increased their risk of later deviancy. Unfortunately, the data bank did not provide a measure of parental psychopathology. Due to this constraint, sociodemographic variables (maternal age at birth of first child and maternal education) served, to a certain extent, as indicators of parental characteristics. One can assume that young, undereducated mothers, living in unfavorable conditions are at risk of developing a condition like antisocial personality disorder.

Finally, there are reasons to believe that the results of this study are not generalizable to the population as a whole. Subjects were recruited in kindergarten, so, the medical information gathered is actually retrospective to the sample selection. It can be speculated that the infants who are the most at risk for later developmental

problems are also the ones most likely to die in the early stages of life. Moreover, infants who have suffered early neuropsychological damage are probably more likely to be institutionalized. Thus, it may be that some subjects who have experienced perinatal complications attended a specialized institution, making them unavailable to our study.

Another limitation found in this study is that the sample retained for the analyses was slightly less disadvantaged and less behaviorally challenged than the nonretained subjects. This indicates that our results are more conservative and our analyses may have been more powerful if the nonretained subjects had been included. In fact, the magnitude of these differences are quite important and may have contributed to potential « null » results of the study.

One of the strengths of this study is that it represents an approach that considers the moderating effects of parental childrearing practices. Second, the findings show that specific behavioral outcomes can be predicted by a combination of complications during a specific perinatal period and certain parental practices. Third, the results are based on peer nominations which appear to be a valid and innovative measure of school-age behaviors. Peer assessments have been shown to be more reliable and less biased than teacher or parent ratings. Most studies on perinatal risk have focused on externalizing behaviors (violence, delinquency, etc.), our study has also incorporated internalizing behaviors as outcome measures.

Although a causal relationship cannot be established between perinatal complications, childrearing practices, and deviant behavior, the prospective nature of this large-scale study helps to gain insight on the protective role of parental practices.

In conclusion, our findings demonstrate that environmental and biological variables interact with each other in a transactional way: psychosocial factors alter the relationship between biological risk variables and behavioral outcome. These findings have important implications for prevention and intervention. Researchers and clinicians must tackle both psychosocial and biological risk factors to successfully reduce deviant behaviors. From a biological viewpoint, better pre- and

perinatal health care must be provided through improved medical services, educational and prevention programs (e.g., programs for the prevention of substance abuse during pregnancy) geared towards underprivileged mothers to reduce the rate of perinatal complications. From a psychosocial viewpoint, interventions aimed at educating parents on child care and parent-child management, as well as programs of early parent-child stimulation are needed to reduce additional vulnerabilities, which, when combined with perinatal complications, predispose children to deviant behaviors.

On a final note, the findings of the present study demonstrate the need to prioritize how and where public funds should be invested. Prevention and treatment programs need to focus on individuals faced with multiple risks who lack the necessary financial, psychological, and social resources, that would otherwise buffer their adversity. Focusing on the protective factors rather than on the vulnerabilities of children with perinatal complications offers an opportunity for prevention and early intervention. Future research must investigate, in more depth, the impact of policies and programs offered in order to better understand how to prevent perinatal complications.

REFERENCES

Arsenault, L., Boulerice, B., Saucier, J -F., & Tremblay, R. E. (Submitted). The pathway from birth complications to adolescent violent behavior. Child Development.

Baker, R. L., & Mednick, B. R. (1984). Influences on human development: A longitudinal perspective. Boston: Nijhoff.

Barnett, D., & Lewis, T. (1978). Outliers in statistical data. New York: Wiley.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in psychological research: Conceptual, strategic, statistical considerations. Journal of Personality and Social Psychology, 51, 1173-1182.

Baumrind, D. (1967). Child care practices anteceding three patterns of preschool behavior. Genetic Psychology Monographs, 75,43-88.

Baumrind, D. (1989). Rearing competent children. In W. Damon (Ed.), Child development today and tomorrow (pp.349-378). San Francisco: Josey-Bass.

Bedics, B. C. (1994). Nonuse of prenatal care: Implications for social work involvement. Health and Social Work, 19, 84-92.

Bradley, R. H., Whiteside, L., Mundfrom, D.J. Casey, P. H., Kelleher, K. J., & Pope, S. K. (1994). Contribution of early intervention and early caregiving experiences to resilience in low birthweight, premature children living in poverty. Journal of Clinical Child Psychology, 23, 425-434

Brennan, P., Mednick, S. A., & Kandel, E. (1991). Congenital determinants of violent and property offending. In D. J. Pepler, & K. H. Rubin (Eds.), The development and treatment of childhood aggression (pp.81-92). Hillsdale, NJ: Lawrence Erlbaum Associates.

Brooks-Gunn, J., Klebanov, P. K., & Liaw, F. (1995). The learning, physical, and emotional environment of the home in the context of poverty: The infant health and development program. Children and Youth Services Review, 17, 251-276.

Caputo, D. V., Goldstein, K. M., & Taub, H. B. (1981). Neonatal compromise and later psychological development: A 10-year longitudinal study. In S. L. Friedman & M. Sigman (Eds.), Preterm birth and psychological development (pp.353-382). New York: Academic Press.

Cocchi, R., Felici, M., Tonni, L., & Venanzi, G. (1984). Behavior troubles in nursery school children and their possible relationship to pregnancy or delivery difficulties. Acta Psychiatrica Belgica, 84, 173-179.

Coley, R.L., & Chase-Lansdale, P. L. (1998). Adolescent pregnancy and parenthood: Recent evidence and future directions. American Psychologist, 53, 152-166.

Conger, R. D., Ge, X., Elder, G. H., Lorenz, F. O., & Simons, R. L. (1994). Economic stress, coercive family process, and developmental problems of adolescents. Child Development, 65, 541-561.

Eisenberg, N. & Mussen, P.H. (1989). The roots of prosocial behavior in children. New York: Cambridge University Press.

Firestone, P., & Prahbu, N. A. (1983). Minor physical anomalies and obstetrical complications : Their relationship to hyperactive, psychoneurotic and normal children and their families. Journal of Abnormal Child Psychology, 11, 207-216.

Fortin, M. F., Taggart, M. E., Kérouac S., & Normand, S. (1988). Introduction à la recherche. Montréal: Décarie.

Goldstein, K. M., Caputo, D. V., & Taub, H. B. (1976). The effects of prenatal and perinatal complications on the development at one year of age. Child Development, 47, 613-621.

Gray, J. W., & Dean, R. S. (1991). Behavioral implications of perinatal complications: An overview. In J. W. Gray & R. S. Dean (Eds.), Neuropsychology of perinatal complications (pp. 1-23). New York: Springer.

Gray, J.W., Dean, R.S., Strom, D. A., Wheeler, T. E., & Brockley, M. (1989). Perinatal complications as predictors of developmental disabilities. Developmental Neuropsychology, 5, (105-113).

Haapasalo, J., & Tremblay, R.E. (1994). Physically aggressive boys from ages 6 to12: Family background, parenting behavior, and prediction of delinquency. Journal of Clinical and Consulting Psychology, 62, 1044-1052.

Hadders-Algra, M., Huisjes, H. J., & Touwen B. C. (1988). Perinatal risk factors and minor neurological dysfunction: Significance for behavior and school achievement at nine years. Developmental Medicine and Child Neurology, 30, 482-491.

Hobel, C., Hyvarinen, M., Okada,D., & Oh, W. (1973). Prenatal and intrapartum high-risk screening: Prediction of the high-risk neonate. American Journal of Obstetrics and Gynecology, 117, 1-9.

Holmes, D. L., Reich, J. N., & Pasternak, J. F. (1984). The development of infants born at risk. Hillsdale, NJ: Lawrence Erlbaum Associates.

Holmbeck, G.N. (1997). Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child-clinical and pediatric psychology literatures. Journal of Consulting and Clinical Psychology, 65, 599-610.

Jaccard, J., Turissi, R., & Wan C.K. (1990). Interaction effects in multiple regressions. Newbury Park, CA: Sage.

Johnston, C., Pelham, W. H., Crawford, J. J., & Atkins, M. S. (1988). A psychometric study of positive and negative nominations and the pupil evaluation inventory. Journal of Abnormal Child Psychology, 16, 617-626.

Kandel, E. (1992). Biology, violence and antisocial personality. Journal of Forensic Sciences, 37, 912-918.

Kandel, E., & Mednick, S. A. (1991). Perinatal complications predict violent offending. Criminology, 29, 519-529.

Kawi, A. A., & Pasamanick, B. (1958). Association of factors of pregnancy with reading disorders in childhood. Journal of the American Medical Association, 166, (1420-1423).

Kopp, C. P., & Parmelee, A. H. (1979). Prenatal and perinatal influences on infant behavior. In J. D. Osofsky (Ed.), Handbook of infant development (pp.29-75). New York: John Whiley and Sons.

Lardon, C., & Leonard, J. A. (1992). Validating a brief pupil evaluation inventory. Journal of Abnormal Child Psychology, 20, 367-377.

Larson, C. P. (1980). Efficacity of prenatal and postpartum home visits on child health and development. Pediatrics, 66, 191-197.

Lavoie, M. E., Robaey, P., Stauder, J., Glorieux, J., & Lefebvre, F. (1998). Extreme prematurity in healthy 5-year-old children : A re-analysis of sex effects on event-related brain activity. Psychophysiology, 35, 679-689.

Ledingham, J. E. & Younger, A. J. (1985). The influence of the evaluator on assessments of children's social skills. In B.H. Shneider, K.H. Rubin, & J.E. Ledingham (Eds.), Children's peer relations : Issues in assessment and intervention (pp.102-111). New York: Springer-Verlag.

Lepage, M. C., & Colin, C. (1989). Mortalité et morbidité périnatales et infantiles: Santé et qualité des enfants et des parents. Québec: Ministère de la santé et des services sociaux.

Levy-Shiff, R., Einat, G., Mogilner, M. B., Lerman, M., & Krikler, R. (1994). Biological and environmental correlates of developmental outcome of prematurely born infants in early adolescence. Journal of Pediatric Psychology, 19, 63-78.

Lewis, S. W., & Murray, R. M. (1987). Obstetric complications, neurodevelopmental deviance, and risk for schizophrenia. Journal of Psychiatric Research, 21, 413-421.

Lewis, S. W., Owen, M. J., & Murray, R. M.(1989). Obstetric complications and Schizophrenia: Methodology and mechanisms. In S.C. Shultz & C. A. Tamminga (Eds.), Schizophrenia a scientific focus (pp.56-68). New York: Oxford University Press.

Lewis, D.O., Shanok, S.S., & Balla, D.A. (1979). Perinatal difficulties, head and face trauma and child abuse in the medical histories of seriously delinquent children. American Journal of Psychiatry, 136, 419-423.

Liaw, F., & Brooks-Gunn, J. (1994). Cumulative familial risks and low-birthweight children's cognitive and behavioral development. Journal of Clinical Child Psychology, 23, 360-372.

Lilienfeld, A. M., & Pasamanick, B. (1954). Association of maternal and fetal factors with the development of epilepsy. I. Abnormalities in the prenatal and paranatal period. Journal of the American Association, 155, (719-724).

Lilienfeld, A. M., & Pasamanick, B. (1955). The association of maternal and fetal factors with the development of cerebral palsy and epilepsy. American Journal of Obstetrics and Gynecology, 70, (93-101).

Littman, B., & Parmelee, A. (1978). Medical correlation of infant development. Pediatrics, 61, 470-474.

Loeber, R., & Dishion, T. (1983). Early predictors of male delinquency: a review. Psychological Bulletin, 94, 68-99.

Loeber, R., & Stouthamer-Loeber, M. (1986). Family factors as correlates and predictors of juvenile conduct and delinquency. In M. Tonry & N. Morris (Eds.), Crime and justice: An annual review of research (pp.29-149). Chicago: University of Chicago Press.

Loeber, R., & Stouthamer-Loeber, M. (1998). Development of juvenile aggression and violence. American Psychologist, 53, 242-259.

Lubchenco, L. O. (1976). The high risk infant. Philadelphia: Saunders Co.

Maccoby, E. E., & Martin, J. A. (1983). Socialization in the context of the family. In E. M. Hetherington (Ed.), Handbook of child psychology: Socialization personality and social development (vol. 4). New York: Wiley.

Martin, C., & Boyer, G. (1995). Naître égaux grandir en santé: un programme intégré de la santé et de prévention en périnatalité. Québec: Ministère de la santé et des services sociaux.

McCord, J. (1988). Parental behavior in the cycle of aggression. Psychiatry, 51,15-23.

McCurry, C., Silverston, L., & Mednick, S.A. (1991). Psychiatric consequences of pregnancy and birth complications. In J. W. Gray & R. S. Dean (Eds.), Neuropsychology of perinatal complications (pp. 186-203). New York: Springer.

McGee, R., Silva, P. A., & Williams, S. (1984). Perinatal neurological, environmental, and developmental characteristics of seven-year old children with stable behavior problems. Journal of Child Psychology and Psychiatry, 25, 573-586.

McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. American Psychologist, 53, 185-204.

McNeil, T. F., & Kaij, L. (1978). Obstetric factors in the development of schizophrenia: complications in the births of preschizophrenics and in reproduction by schizophrenic parents. In L. C. Wynne, R. L. Cromwell, & S. Mathysse (Eds.), The nature of schizophrenia (pp.401-429). New York: Wiley.

McNeil, T. F., Wiegerink, R., & Dozier, J. E. (1970). Pregnancy and complications in the births of seriously, moderately, and mildly behaviorally disturbed children. Journal of Nervous and Mental Disease, 151, 24-34.

Mills, R. S. L., & Rubin, K. H. (1993). Socialization factors in the development of social withdrawal. In K. H. Rubin & J. Asendorpf (Eds.), Social withdrawal, inhibition, and shyness in childhood. Hillsdale, NJ: Lawrence Erlbaum Associates.

Ministère de la santé et des services sociaux (1993). Politique de périnatalité. Québec: Bibliothèque Nationale.

Molfese, V.J. (1989). Perinatal risk and infant: Assessment and prediction. New York: Guilford Press.

Mungas, D. (1983). An emperical analysis of specific syndromes of violent behavior. Journal of Nervous and Mental Disease, 171, 354-361.

Murai, N., & Nihei, Y. (1983). Relations des facteurs prénatals et périnatals avec les caractéristiques de comportement des nouveau-nés. Enfance, (1-2), 153-167.

O'Grady, D., & Metz, R. (1987). Resilience in children at high risk for psychological disorder. Journal of Pediatric Psychology, 12, 3-23.

Olweus, D. (1979). Stability of aggressive reaction patterns in males: A review. Psychological Bulletin, 86, 852-875.

Pagani, L., Tremblay, R.E., Vitaro, F., Parent, S. (1998). Does preschool help prevent delinquency in boys with a history of perinatal complications? Criminology, 36, 245-267.

Parnas, J., Schulsinger, F., Teasdale, T.W., Schulsinger, H., Feldman, P.M., & Mednick, S.A. (1982). Perinatal complications and clinical outcome within the schizophrenia spectrum. British Journal of Psychiatry, 140, 416-420.

Pasamanick, B., & Lilienfeld, A. M. (1954). Association of maternal and fetal factors with the development of mental deficiency. I. Abnormalities in the prenatal and paranatal period. Journal of the American Association, 159, (155-160).

Pasamanick, B., Rogers, M. E., & Lilienfeld, A. M. (1956). Pregnancy experience and the development of behavior disorder in children. American Journal of Psychiatry, 112, 613-618.

Patterson, G. R., & Capaldi, D. (1991). Relation of parental transitions to boys' adjustment problems. Developmental Psychology, 27, 489-504.

Patterson, G. R., Reid, J .B., & Dishion, T.J. (1992). Antisocial boys. Eugene, OR: Castalia.

Pechtl, H. F. R. (1967). Neurological sequelae of prenatal and perinatal complications. British Medical Journal, 47, 763-767.

Pekarik, E.G., Prinz, H.I.J., Liebert, D.E., Weintraub, S., & Neale, J.M. (1979). The Pupil Evaluation Inventory: A sociometric technique for assessing children's social behavior. Journal of Abnormal Child Psychology, 4, 83-97.

Raine, A., Brennan, P., & Mednick, S. A. (1994). Birth complications combined with early maternal rejection at age 1 year predispose to violent crime at age 18 years. Archives in General Psychiatry, 51, 984-988.

Raine, A., Brennan, P., & Mednick, B. (1996). High rates of violence, crime, academic problems, and behavioral problems in males with both early neuro-motor deficits and unstable family environments. Archives in General Psychiatry, 53, 544-549.

Rantakallio, P., Koiranen, M., & Möttönen, J. (1992). Association of perinatal events, epilepsy, central nervous system trauma with juvenile delinquency. Archives of Diseases in Childhood, 67, (449-461).

Rothbaum, F. (1988). Maternal acceptance and child functioning. Merill-Palmer Quarterly, 34, 163-184.

Rubin, K. H., LeMare, L., & Lollis, S. (1990). Social withdrawl in childhood: Developmental pathways to peer rejection. In S. Asher & J. Coie (Eds.), Peer rejection in childhood (pp.217-249). Cambridge, England: Cambridge University Press.

Rutter, M. (1990). Psychosocial resilience and protective mechanisms. In J. Rolf, A. S. Masten, D. Cicchetti, K. H. Nuechterlein, & S. Weintraub (Eds.), Risk and protective factors in the development of psychopathology (pp.181-214). New York: Cambridge University Press.

Sameroff, A. J., & Chandler, M. J. (1975). Reproductive risk and the continuum of caretaking casualty. In F. D. Horowitz, M. Hetherington, S. Scarr-Salapetek, & G. Sigel (Eds.), Review of Child Development Research (Vol. 4, pp.187-244). Chicago: University Press.

Sigman, M., Cohen, S. E., & Forsythe, A. B. (1981). The relation of early infant measures to later development. In S. L. Friedman & M. Sigman (Eds.), Preterm birth and psychological development (pp.313-327). New York: Academic Press.

SPSS Inc. (1990). SPSS base system user's guide. Chicago: SPSS Inc.

Stevens, J. (1992). Applied multivariate statistics for the social sciences. Hillsdale, NJ: Lawrence Erlbaum.

Szatmari, P., Reitsma, M., & Offord, D. R. (1986). Pregnancy and birth complications in antisocial adoloescents and their siblings. Canadian Journal of Psychiatry, 31, 513-516.

Tabachnick, B. G., & Fidell, L. S. (1996). Using multivariate statistics. Harper: Collin

Telzrow, C. F. (1991). Impact of perinatal complications on education. In J. W. Gray & R. S. Dean (Eds.), Neuropsychology of perinatal complications (pp. 161-186). New York: Springer.

Tessier, R., Piché, C., Muckle, G., Gagnon, J., & Tarabulsy, G.M. (1992). La part du risque social dans le développment des enfants nés prématurés et de très petit poids. Apprentissage et Socialisation, 15, 208-221.

Tremblay, R. E., Loeber, R., Gagnon, C., Charlebois, P., Larivée, S., & LeBlanc, M. (1991). Disruptive boys with stable and unstable high fighting behavior patterns during junior elementary school. Journal of Abnormal Child Psychology, 19, 285-300.

Tremblay, R. E., Pagani- Kurtz, L., Vitaro, F., Mâsse, L. C., & Pihl, R. O. (1995). A bimodal preventive intervention for disruptive kindergarten boys: Its impact through mid-adolescence. Journal of Consulting and Clinical Psychology, 63, 560-568.

Vitaro, F., & Boivin, M. (1989). Rejet social et problèmes d'adaptation chez l'enfant: instrumentation et intervention. Science et Comportement, 19, 271-294.

Wagner, B.M., Cohen, P., & Brook, J.S. (1996). Parent /adolescent relationships: Moderators of the effects of stressful life events. Journal of Adolescent Research, 11, 347-374.

Werner, E. E. (1990). Vulnerability and resiliency: A longitudinal perspective. In M. Brambring, F. Lösel, & H. Skowronek (Eds.), Children at risk: Assessment, longitudinal research, and intervention (pp.157-172). Berlin: Gruyter.

Werner, E. E. (1993). Risk, resilience, and recovery: Perspective from the Kauai Longitudinal study. Development and Psychopathology, 5, 503-515.

Werschler, T. (1998). Pregnancy-related hospital use. Health Reports, 10, 21-27.

Woerner M. G., Pollack, M., & Klein, D.F. (1973). Pregnancy and birth complications in psychiatric patients. Acta Psychiatrica Scandanavia, 49, 712-719.

Zax, M., Sameroff, A., & Babigian, H. (1977). Birth outcomes in the offspring of mentally disordered women. American Journal of Orthopsychiatry, 47, 218-230.

APPENDIX A

Differences Between Subjects Included in the Analyses and Those not Included Relative to Predictor and Outcome Variables.

Differences Between Subjects Included in the Analyses and Those not Included Relative to Predictor and Outcome Variables

	Retained Subjects m (sd)	Nonretained Subjects m (sd)	t
Socioeconomic variables			
Maternal age at the first birth	22.58 (3.95)	21.00 (3.24)	-3.55**
Maternal education level	10.55 (2.73)	10.40 (2.89)	-0.85
Outcome variables			
Disruptiveness	0.06 (0.90)	0.22 (0.93)	2.59**
Fighting	0.03 (0.91)	0.11 (0.93)	1.32
Withdrawal	0.05 (0.92)	0.03 (0.93)	-0.32
Popularity	0.1 (0.87)	-0.16 (0.89)	-2.68**
Moderator variables			
supervision	6.45 (1.51)	6.36 (1.60)	-0.83
communication	20.47 (4.14)	20.55 (4.16)	0.29
punishment	8.63 (2.24)	8.54 (2.38)	-0.62

**p<0.01
* p<0.05

APPENDIX B

Pupil Evaluation Inventory

□□□ □□□ □ □□ □ □□□□ □□□□□

1 (1-18)

PEI - DA-92

	LES AUTRES				MOI	
1. Ceux ou celles qui sont plus grand(e)s que les autres.						2 (9-18)
2. Ceux ou celles qui sont trop gêné(e)s pour se faire des ami(e)s facilement.						2 (19-28)
3. Ceux ou celles que tu as déjà vu(e)s fumer.						2 (29-38)
4. Ceux ou celles qui encouragent les autres enfants à s'en prendre à quelqu'un qu'ils n'aiment pas						2 (39-48)
5. Ceux ou celles qui se sentent trop facilement blessé(e)s et qui sont faciles à faire pleurer.						2 (49-58)
6. Ceux ou celles qui commencent une bataille à propos de rien.						2 (59-68)
7. Ceux ou celles que tout le monde aime.						2 (69-78)

	LES AUTRES				MOI	
8. Ceux ou celles que tu as déjà vu(e)s boire de l'alcool (bière, vin).						3 (9-18)
9. Ceux ou celles qui disent des choses méchantes dans le dos des autres.						3 (19-28)
10. Ceux ou celles qui rient des autres (les ridiculisent).						3 (29-38)
11. Ceux ou celles qui ont très peu d'ami(e)s.						3 (39-48)
12. Ceux ou celles qui n'aiment pas l'école.						3 (49-58)
13. Ceux ou celles qui dérangent les gens qui essaient de travailler.						3 (59-68)
14. Ceux ou celles qui ne portent pas attention au professeur ou qui ne l'écoutent pas.						3 (69-78)

	LES AUTRES				MOI	
15. Ceux ou celles qui sont malheureux(ses) ou tristes.						4 (9-18)
16. Ceux ou celles que tu inviterais à ton party d'anniversaire ou avec qui tu aimes le plus jouer.						4 (19-28)
17. Ceux ou celles qui menacent ou malmènent les autres enfants afin d'obtenir ce qu'ils (elles) veulent.						4 (29-38)
18. Ceux ou celles qui souvent ne veulent pas jouer.						4 (39-48)
19. Ceux ou celles qui disent qu'ils (elles)peuvent battre tout le monde.						4 (49-58)
20. Ceux ou celles que l'on ne remarque pas beaucoup ou qui sont seul(e)s dans leur coin.						4 (59-68)
21. Ceux ou celles que tu n'inviterais pas à ton party d'anniversaire ou avec qui tu n'aimes pas jouer.						4 (69-78)

	LES AUTRES				MOI	
22. Ceux ou celles qui exagèrent et qui racontent des histoires.						5 (9-18)
23. Ceux ou celles qui se plaignent toujours et qui ne sont jamais content(e)s: qui sont chialeux(ses).						5 (19-28)
24. Ceux ou celles qui semblent toujours bien comprendre ce qui se passe.						5 (29-38)
25. Ceux ou celles qui se fâchent facilement et qui frappent les autres enfants lorsqu'ils(elles) se font agacer ou menacer.						5 (39-48)
26. Ceux ou celles qui agissent comme des bébés.						5 (49-58)
27. Ceux ou celles qui trichent.						5 (59-68)
28. Ceux ou celles qui disent des mensonges.						5 (69-78)

	LES AUTRES				MOI	
29. Ceux ou celles qui sont tes meilleurs ami(e)s.						6 (9-18)
30. Ceux ou celles qui aiment faire des choses dangereuses.						6 (19-28)
31. Ceux ou celles qui sont capables de dire ce qu'ils/elles pensent vraiment.						6 (29-38)
32. Ceux ou celles qui se pensent plus vieux (vieilles) que les autres.						6 (39-48)

APPENDIX C

Univariate Correlations Among All Variables used in the Analyses

Table 8. Correlations Among all Variables used in the Analyses.

	Scolmer[a]	agempre[b]	poidgest[c]	qascom[d]	qassup[e]	compre[f]	compobs[g]	malenf[h]	peibat[i]	peire[j]
scolmer[a]		.19**	.11**	.08	.04	.02	.04	.02	-.14**	-.07
agempre[b]			.02	.06	.10*	-.06	.01	-.01	-.11**	-.01
poidgest[c]				-.03	-.04	-.03	-.04	-.04	-.05	-.06
qascom[d]					.34**	-.06	-.01	.02	.05	-.16**
qassup[e]						-.01	.01	.05	-.12**	-.02
compre[f]							.12**	.05	-.01	.03
compobs[g]								.04	-.05	-.02
malenf[h]									.03	.03
peibat[i]										-.17**
peire[j]										

**p<0.01
*p<0.05

[a] Maternal education [b] Maternal age at the first birth [c] Weight for gestational age [d] Parental Communication at age 10
[e] Parental supervision at age 10 [f] Prenatal complications [g] Delivery complications [h] Postnatal complications
[i] Fighting at age 11/12 [j] Withdrawal at age 11/12.