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Effects of Neighbourhood, Family, and Child Behaviour on Childhood Injury in Canada

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by

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This report is part of a set of research studies on the National Longitudinal Survey of Children and Youth. /
Le présent rapport fait partie d'un ensemble d'études sur l'Enquête longitudinale nationale sur les enfants et les jeunes.

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Abstract

This study addresses three groups of questions relating to childhood injury in Canada: (1) Is the relationship between family functioning and childhood injuries mediated or modified by parenting or child behaviour? (2) Which is more strongly related to childhood injuries, family socioeconomic status (SES) or indicators of neighbourhood disadvantage? Do they modify the effect of each other? The interaction of these factors with family functioning, parenting or child behaviour is also examined in order to identify the relevant units for intervention (family, neighbourhood or both). (3) Can the models developed based on the previous steps predict injuries two years later? Relevant data are taken from the National Longitudinal Survey of Children and Youth. All analyses are stratified by children's age groups.

Neighbourhood measures that were mostly associated with risk of injuries included neighbourhood disadvantage, in particular among aggressive children 2 to 3 years old, and prevalence of neighbourhood problems. Protective factors included neighbourhood cohesion, in particular among difficult children under 2 years old, and percentage of single-female-headed households among children 2 to 3 years old. The family measures mostly associated with risk of injury included inconsistent parenting among children 4 to 11 years old. Protective family factors included positive parenting. Among children aged 2 to 11 years, moderate but statistically significant interactions were found in the cross-sectional sample between level of family dysfunction, age and child's pro-social behaviour. Child characteristics included as risk factors being a boy, having a difficult temper (for younger children), and being physically aggressive. Protective factors included being a girl and having had an injury in the last two years (especially among preschoolers and school-aged boys and girls).

The most consistent predictors of injuries seem to involve parental perception of neighbourhood cohesion (protective factor) and neighbourhood problems (risk factor), in particular for children under two years old. Neighbourhood disadvantage as measured in this study by a combination of neighbourhood income, education and occupation seems to be a strong predictor of injury in the longitudinal sample among children 2 to 3 years old. Moreover, neighbourhood disadvantage may act synergistically with a child's behaviour described as physical aggression and opposition. The concentration of single-female-headed households seems to have a protective effect among children 2 to 3 years old, while the concentration of families with low income may increase the risk of injuries among children 4 to 11 years old.

The authors conclude that in early childhood attention should be paid to neighbourhood processes of cohesion and collective socialization, while for older children, increased focus should be placed on neighbourhood disadvantage and concentration of low-income families in the neighbourhood. Improved targeting of resource allocation to deprived areas must be combined with educational and environmental strategies to increase the level of social cohesion and community involvement. Finally, strategies focusing only on improving the socioeconomic positioning of families, without attention to the patterns of parent-child interactions, would not lead to significant reductions in childhood injuries.

Résumé

Cette étude s'intéresse à trois séries de questions ayant trait aux blessures chez les enfants au Canada : 1) la relation entre le fonctionnement familial et les blessures chez les enfants est-elle influencée ou modifiée par les pratiques parentales ou le comportement de l'enfant? 2) Du statut socioéconomique de la famille (SSE) ou des indicateurs de la situation défavorisée du quartier, quel élément est plus fortement corrélé aux blessures chez les enfants? Chacun modifie-t-il l'effet de l'autre? L'étude examine également l'interaction entre ces facteurs et le fonctionnement familial, les pratiques parentales et le comportement des enfants afin de déterminer les cibles pertinentes sur lesquelles il conviendrait de faire porter les interventions (la famille, le quartier ou les deux). 3) Les modèles élaborés à partir des étapes précédentes permettent-ils de prédire les blessures deux ans plus tard? Les données pertinentes ont été tirées de l'Enquête longitudinale nationale sur les enfants et les jeunes. Toutes les analyses ont été stratifiées en fonction des groupes d'âge des enfants.

Parmi les caractéristiques des quartiers principalement associées au risque de blessures, on retrouve la situation défavorisée du quartier, particulièrement pour les enfants agressifs de 2 à 3 ans, et la fréquence des problèmes dans le quartier. Les facteurs de protection comprennent la cohésion dans le quartier, en particulier pour les enfants difficiles de moins de 2 ans, ainsi que le pourcentage de ménages gynoparentaux pour les enfants de 2 à 3 ans. Les caractéristiques de la famille principalement associées au risque de blessures comprennent le manque de constance dans les pratiques parentales pour les enfants de 4 à 11 ans. Les facteurs familiaux de protection comprenaient les pratiques parentales positives. Chez les enfants de 2 à 11 ans, on a observé dans l'échantillon transversal des interactions modérées mais statistiquement significatives entre le niveau de dysfonction familiale, l'âge et le comportement prosocial de l'enfant. Parmi les caractéristiques des enfants qui constituaient des facteurs de risque, on retrouvait l'appartenance au sexe masculin, un tempérament difficile chez les enfants plus jeunes et l'agressivité physique. Parmi les facteurs de protection, on retrouvait l'appartenance au sexe féminin et le fait d'avoir subi une blessure au cours des deux dernières années, particulièrement chez les enfants d'âge préscolaires et les garçons et les filles d'âge scolaire.

Parmi les facteurs permettant le plus systématiquement de prédire les blessures, il semblait y avoir la perception que se faisaient les parents de la cohésion au sein du quartier (facteur de protection) et des problèmes dans le quartier (facteur de risque), en particulier pour les enfants de moins de 2 ans. La situation défavorisée du quartier, qui a été mesurée dans le cadre de cette étude en fonction du revenu, de la scolarité et de la profession des résidents, semble être un solide prédicteur de blessures chez les enfants de 2 à 3 ans dans l'échantillon longitudinal. De plus, la situation défavorisée du quartier peut avoir un effet synergique en se combinant avec les comportements d'agression physique et d'opposition chez les enfants. La concentration de ménages gynoparentaux semble exercer un effet de protection parmi les enfants de 2 à 3 ans, tandis que la concentration de familles à faible revenu peut accroître le risque de blessures chez les enfants de 4 à 11 ans.

Les auteurs concluent que pendant la petite enfance, il conviendrait d'accorder de l'attention aux processus de la cohésion et de la socialisation collective dans le quartier, tandis que pour les enfants plus âgés, il conviendrait de s'intéresser davantage à la situation défavorisée du quartier et à la concentration de familles à faible revenu. Il faut combiner un meilleur ciblage des ressources destinées aux régions défavorisées à des stratégies éducatives et environnementales pour accroître la cohésion sociale et la participation communautaire. Finalement, des stratégies ayant pour seul objet d'améliorer la situation socioéconomique des familles, sans se préoccuper du profil des interactions entre les parents et les enfants, ne donneraient pas lieu à des réductions significatives des blessures chez les enfants.

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Foreword

The National Longitudinal Survey of Children and Youth (NLSCY) is a unique Canadian survey designed to follow a representative sample of children from birth to early adulthood. It is conducted in partnership by Human Resources Development Canada (HRDC) and Statistics Canada. Statistics Canada is responsible for data collection, while HRDC, the major funder, directs and disseminates research. Data collection began in 1994 and continues at two-year intervals.

The survey for the first time provides a single source of data for the examination of child development in context, including the diverse life paths of normal development. The survey and the research program were developed to support evidence-based policy, using a human development view of the early decades of life. This research paper is part of an ongoing series of papers emanating from a program of research that examines NLSCY data collected in the first two cycles (1994, 1996) of the survey.

Introduction

Theoretical and empirical evidence from the injury literature suggest three identifiable sets of influences on childhood injury: the child, the family, and the neighbourhood. At the individual level, the risk of injury is linked to child age, gender, and behaviour (Davidson, 1987; Hillier & Morrongiello, 1998). At the family level, a high frequency of injuries among young children in the home indicates the importance of understanding how family can affect childhood injury occurrence (Matheny, 1988). For example, research suggests that differences in parenting practices may explain differences in injury rates among families (Zettle & Hayes, 1983; Aagran, Winn, Anderson, & Del Valle, 1998). At the neighbourhood level, studies suggest that neighbourhood and community characteristics have important influences on childhood injuries and other health-related issues (Bronfenbrenner, 1986; Jencks & Mayer, 1990; Kupersmidt, Griesler, DeRosier, Patterson & Davis, 1995; Malmstrom, Sundquist, & Johansson, 1999). Children who live in disorganized environments are known to be at increased risk for injury, as are children who live in low-income neighbourhoods (Jolly, Moller, & Volkmer, 1993; Matheny, 1986, 1987; Nersesian, Petit, Shaper, Lemieux & Naor, 1985; Valsiner & Lightfoot, 1987). Despite evidence of the importance of contextual variables, characteristics of neighbourhoods and families have been studied less frequently than individual characteristics. Consequently, little is known about the neighbourhood and family processes that influence childhood injuries (Gallagher, Hunter & Guyer, 1985; Hu, Wesson, & Kenney, 1993; Peterson & Stern, 1997). In the following sections, we will review some of the evidence that links characteristics of the child, the family and the neighbourhood to childhood injury.

1.1 Child Characteristics and Childhood Injury

Injury risk is linked to a child's age. Young children tend to identify fewer risk factors, and do so more slowly than older children. In a study of 120 children aged 6-10 years, 6-year-old children identified fewer risk factors, and did so more slowly than 10-year-old children. The 6-year-old children also had more difficulty than the older children did in identifying how to prevent injuries (Hillier & Morrongiello, 1998).

Injury risk is also linked to gender. From birth to 24 years of age, boys are more likely than girls to sustain injuries (Soubhi, Raina et al., 1999). Boys are also more likely than girls to suffer the most severe forms of injury and be hospitalized (Vital Statistics Agency, 1996). These gender differences tend to be more pronounced in older children (Baker, O'Neill, & Karpf, 1984; Canadian Institute of Child Health, 1994; Matheny, 1988; Rivara & Mueller, 1987).

The causes of increased risk of injury among boys are not well known. Using data from 197,516 consumer product-related injuries, Rivara, Bergman, LoGerfo, and Weiss (1982) found that differences in exposure to risks only partly explained gender differences in injury rates. Gender differences in injury rates may be related to differences in behaviour or to differences in risk perception.

According to parental reports, boys are more active than girls and are more likely to sustain injuries (Bijur, Stewart-Brown, & Butler, 1986; Langley, McGee, Silva & Williams, 1983; Kohen, Soubhi, & Raina, 2000). In experimental studies, boys were observed to be more active, disruptive, less manageable, and to have more contact with hazards than girls (Matheny, 1986; Matheny, 1988; Cataldo et al., 1992). Manheimer & Mellinger (1997) found an association between the frequency of injury occurrence and maternal reports of child activity levels. The association was not significant when child activity ratings were reported by teachers. However, in Manheimer and Mellinger's study, injuries were retrospectively reported and the analyses were not adjusted for socioeconomic factors.

Boys tend to be more aggressive than girls (Bijur, Stewart-Brown, & Butler, 1986). There seems to be general agreement that aggressiveness is a risk factor for injury (Davidson, 1987). Studies show that early infant temperament characterized as "difficult" is associated with increased risk of injury during the preschool years (Bijur, Golding, Haslum, and Kurzon, 1988). In a review of the literature, Wazana (1997) found aggressive behaviour to be consistently related to general injuries but not to pedestrian injuries.

Aggressive behaviour is often highly correlated with hyperactivity. However, the link between hyperactivity, aggressive behaviour and injury is not clear, and in most studies the level of risk of injury due to hyperactivity is low (Bijur, Stewart-Brown & Butler, 1986; Davidson, 1987). In a critical review

of the literature, Davidson (1987) reported that with all prospective designs hyperactivity did not predict the occurrence of injury while aggressive behaviour always did. Using a sample from the British Births Survey that included 11,966 children from a representative birth cohort, Bijur, Stewart-Brown, and Butler (1986) found that aggressive behaviour was more strongly associated with injuries than was hyperactivity. The authors also reported an interaction between hyperactivity and aggressive behaviour. They concluded that aggressive behaviour might increase risk-taking and impulsiveness among over-active children.

Another study by Davidson, Taylor, Sandberg, and Thorley (1992) used a prospective cohort (16-month follow-up) to examine hyperactivity as a risk factor for subsequent injury. The cohort included 1,740 boys from age six to eight years, attending school in a borough of London, England. The rate of injury occurrence among the boys was assessed from the records of five emergency departments in the borough. The behaviour of the boys was measured by three sources: the parents, the teachers, and by direct observation by the investigators. The study accounted for the socioeconomic characteristics of the boys' parents that included income, education, and occupation. The study also accounted for whether the parents would allow the same degree of independence in their boys if they were hyperactive as they would if they were non-hyperactive. Although the length of follow-up may not have been long enough to detect any changes in the boys' behaviour, the study did not find any relationship between hyperactivity and injury, regardless of the source that measured the behaviour.

Gender differences in injury occurrence also seem to be related to differences in risk perception. In addition to displaying higher activity levels than girls, boys tend to underestimate risks and engage in more risk-taking behaviours than girls do (Alexander, Somerfield, Ensminger, Kim, & Johnson, 1995). Boys are more likely to repeat behaviours that led to previous injuries (Coppens & Gentry, 1991; Ginsburg & Miller, 1982; Hillier & Morrongiello, 1998). Boys are also more likely to attribute injuries to bad luck, while girls are more likely to attribute injuries to their own behaviour (Morongiello, 1997).

In summary, there is a consensus that injury risk among children varies by child age and gender. Differences in risk perception and risk management as well as behavioural differences seem to be related to gender differences in injury rates. Younger children tend to identify fewer risk factors, and do

so more slowly than older children. Finally, the link between hyperactivity, aggressive behaviour, and injury remains unclear. The elevation of risk of injury due to hyperactivity is small in most studies while aggressive behaviour in children is more frequently linked to an increased risk of injury.

1.2 Family Characteristics and Childhood Injury

Childhood injuries are linked to factors such as a child's age, gender and behavioural traits. They are also linked to home and family characteristics (Cataldo et al., 1992; Ciastko, 1997; Davidson, 1987; Matheny, 1987). Schor (1987) examined 693 two-parent families with one, two, and three children aged from birth to ten years that were enrolled in the Columbia Medical Plan from 1974 to 1979. The study found a clustering of individuals within families that exhibited similar unintentional injury patterns. These patterns were stable over time for the individuals and their families. Boys were at greater risk for injury than girls were and children aged 6 to 14 years were the most likely to be injured. Schor (1987) could not determine whether the clustering of injuries was due to similar behavioural risk factors, similar physical and emotional environments, or to familial patterns of health care utilization. However, Schor's study supports the hypothesis that a child's injury experience can be influenced by home and family characteristics.

Dershewitz & Christophersen (1984) indicate that most injury related deaths of children younger than 5 years of age occur in the home. Gallagher, Hunter and Guyer (1985) reported that the percentage of injuries that occurred in the home was approximately two thirds of all childhood injury ocurrences, and 91% of these injuries occurred to children under the age of 5 years. Hu, Wesson and Kenney (1993) conducted a study using injury surveillance data gathered from the emergency department of the Hospital for Sick Children in Toronto from 1990 to 1991. During this one-year period, 66 percent of injuries among children two years old or younger occurred in the home. The authors found that 35% of home injuries were head injuries, 17% of these were severe enough to require hospital admission. Two-thirds of all home injuries occurred in the living room or bedroom. Falls accounted for the greatest percentage of home injuries among 1 to 4-year olds (55%), followed by being struck with an object (18%), while cutting, piercing, and poisoning injuries accounted for 6%. A recent analysis of data gathered from 1990 to 1996 by the emergency department of British Columbia's Children's Hospital

found that 49% of all injuries occurred in the home, and 18% occurred at school or in a public building. Forty-seven percent of injuries among boys occurred in the home, and approximately 19% occurred at school or in a public building. Fifty-one percent of injuries among girls occurred in the home, and 17% occurred at school or in a public building (Soubhi, Raina et al., 1999).

The influence of family characteristics on childhood injury seems to vary according to child age. Using cohorts of children from the longitudinal Louisville Twin Study, Matheny (1987) surveyed two groups of children for the occurrence of injuries. The children in the first group were monitored for the first three years of their lives (n = 96), while those in the second group were monitored from age 6 to 9 years (n = 76). Independent variables included parental temperament, home injury hazards, family functioning, and family socioeconomic status. In the younger cohort, there was a high risk of injury for children with irregular sleeping and eating habits, and noise and confusion in the home. A high risk was also observed for children whose mother was less active and less emotionally stable, and whose father was impulsive and less sociable. In the older cohort, parental characteristics were less likely to influence the occurrence of injury. Instead, child variables showed a stronger association with injury occurrence: active boys with irregular sleeping and eating habits sustained more injuries that required medical attention.

The high frequency of injury occurrence in the home is an indication of the importance of understanding family characteristics and how they influence childhood injury (Matheny, 1988). Matheny (1987) suggested that cohesive families, families governed by rules, families that stressed active involvement in family activities, and families that supported child autonomy had fewer childhood injuries. Schor (1987) suggested that patterns of frequent injury occurrence should be regarded as possible evidence of poor family functioning. However, few studies have considered childhood injury in combination with both parental and family characteristics (Matheny, 1987). Consequently, little is known about how family functioning relates to parenting and childhood injury (Aagran, Winn, Anderson, & Del Valle, 1998; Gable & Peterson, 1998; Gallagher, Hunter & Guyer, 1985; Hu, Wesson, & Kenney, 1993; Peterson & Saldana, 1996; Peterson & Stern, 1997).

1.2.1 Family Functioning, Maternal Health and Childhood Injury

Family dysfunction can influence child behaviour. A study by Campbell, March, Pierce, Ewing, and Szumowski (1991) highlights the potential roles that family dysfunction and negative maternal control may have in the occurrence of behavioural problems in young children. Campbell et al. (1991) compared preschool boys who were identified by their teachers as being active, inattentive, and impulsive (N = 42) with matched classroom controls (N = 43) and with parent-identified problem-boys (N = 27) on measures of family functioning. The teacher-identified problem-boys and the parent-identified problem-boys did not differ on measures of their family adversity. Both groups came from less well-functioning families than the comparison boys. In addition, mothers who were feeling more depressed and overwhelmed were likely to report more health and behaviour problems in their children (Campbell et al., 1991). In a compliance test, the mothers of the problem-boys were observed to be more negative and controlling toward their sons than the mothers of the comparison boys were to their sons. A follow-up on the problem-boys and their families a year later verified the predicted behavioural problems in the boys. The adverse behaviours developed in response to the presence of maternal depression and negative maternal control within the family unit. The authors concluded that maternal depression, family change and instability may place children at risk of behavioural problems because these stresses make parents less available to meet their young children's developmental needs (Campbell et al., 1991).

Impairments in family functioning are seldom due to only one factor. A combination of factors such as maternal depression, poverty, inadequate housing, and single parenthood can upset the balance of family functioning and, as a result, can hinder child development and increase the risk of childhood injury (Zayas, 1995). A study by Backett and Johnston (1997) showed that maternal illness and stress strongly influenced the rate of childhood injury occurrence. An example of the influence of parental depression on childhood injury can be shown with a study by Weissman et al. (1986). Using a sample from the Yale Family Study of Major Depression, Weissman et al. (1986) studied sixty-five couples and their children (N=153). One or both parents had been treated for major depression. A control group with comparable sociodemographic backgrounds consisted of 26 couples and their children (N=67). The data from both groups were collected through blinded interviews. The final sample of

children included 105 boys and 115 girls, aged 6 to 23 years. The analyses showed that children from families with at least one depressed parent suffered more head injuries, adverse perinatal events, retarded development, convulsions, surgical operations, suicide attempts and depressions than children who had healthy parents (Weissman et al., 1986). The results of this study may be a reflection of stress and dysfunction in ill families. They may also reflect inadequate parenting skills among ill mothers, and may not be specific to maternal depression.

1.2.2 Parenting and Childhood Injury

Parenting skills involve the creation and application (via praise and punishment) of verbally based parental rules, which have only a gradual influence on child's behaviour over time (Kendall & Wilcox, 1979; Peterson, Mori, & Scissors, 1986; Zettle & Hayes, 1983). Research indicates that parents do not necessarily have a correct appreciation of their child's competence and ability to judge risks (Klein, 1980). Level of education is likely to influence the parent's perception of risk as well as parenting behaviours (Glik, Kronenfeld, & Jackson, 1993). Parents often overestimate their child's knowledge and ability to make decisions about safety (Dunne, Asher & Rivara, 1992; Yarmey & Rosenstein, 1988). For example, parents of children over two years of age tend to be less vigilant about preventing their children from exposure to hazards, even though these children are still at risk for making poor safety judgments. Furthermore, parents may confuse their child's verbal ability with cognitive development and expect the child to understand verbal commands to avoid risks (Christoffel, 1993). In general, the literature suggests that families with poor parenting skills are likely to have higher rates of injury occurrence among their children. Some studies suggest that parents may be less likely to supervise boys than girls when they are playing, resulting in boys reporting more injuries (for which an adult was not present) than girls (Block, 1983; Saegart & Hart, 1976).

Studies indicate that parenting can be disrupted by economic hardship and that parents of low SES are more apt to use harsh, authoritarian parenting practices (Simons, Johnson, Beaman, Conger, & Whitbeck, 1996). Focusing on low-income, inner-city families, Zayas (1995) reviewed the literature on the influence of culture on parenting behaviours towards young children. He also reviewed the impact of poverty, urban stresses, parental psychopathology, and family social support networks on parental

behaviour and early childhood development. Zayas's review suggests that poverty is associated with negative parenting practices such as the use of physical punishment; the issuance of commands without explanation or consultation with the child; and the neglect to reward the child for desirable behaviours.

1.2.3 Family Socioeconomic Status and Childhood Injury

There is evidence that children living in low-income families are more likely to die from injury than children from higher income families are (Nersesian, et al., 1985). Alwash and McCarthy (1988) found that social disadvantage increased the risk of childhood injury in the home. Characteristics associated with low socioeconomic status (SES) such as single marital status, poor maternal health, inadequate education, and poverty have been linked to the occurrence of childhood injuries (Parker et al., 1991; Nersesian, et al., 1985). A review of studies associated with child-pedestrian injuries revealed that the mothers of injured children were more likely to be young, poorly educated, and single (Wazana, Krueger, Raina et al., 1997).

Poor maternal physical and mental health, low social class and marital discord have been identified as risk factors for injuries in young children. These family characteristics have also been determined to be risk factors for aggressiveness and hyperactivity in the child (Bijur, Stewart-Brown, & Butler, 1986). In a study by Bijur, Golding, Haslum, and Kurzon (1988), 10,394 children from a birth cohort were interviewed on their injury experiences at their fifth and tenth birthdays. Significant linear trends indicated higher levels of aggressiveness and hyperactivity in children of low-income families living in crowded and deteriorated housing. Similar results were observed for children whose mothers were distressed and unhappy, and for children whose families moved frequently. The association of aggressiveness and the occurrence of injuries remained even after control for socioeconomic factors. Hyperactivity continued to be significant in boys, but not girls. However, the results of this study do not apply to children from ethnic and racial minorities in Great Britain.

It is likely that SES and maternal perceptions of risk, stress, coping, and parenting behaviours influence the presence of hazards in a home. Safety practices such as knowing how to perform the Heimlich maneuver, covering electrical outlets with safety plugs, and using car seats are more prevalent in high SES households where the parents are also more likely to be well-educated (Kramer, Allen, & Gergen,

1995). Low SES can also contribute to the occurrence of injuries through its influence on the cognitive development of the child. Results from a United States national cohort of 2,531 children of ages 6 to 16 years show that low SES is inversely related to a child's cognitive development. Thus, children from low-SES families are more likely to have difficulty with perceiving and managing injury hazards (Kramer, Allen, & Gergen, 1995).

In summary, research suggests that family can influence the occurrence of childhood injury, and that family's influence varies according to child's age. For toddlers, the pattern includes the influence of parental, home, and child temperament and behaviour, while among older children, child's behaviour seem to predominate. Risk factors for childhood injuries in the home include the developmental status of young children and their inability to perceive risk, impairments in family functioning and the quality of parenting. The family measures most associated with increased risk of injury appear to be indexes of poverty, social disadvantage, family stress, and family dysfunction. In turn, family dysfunction is rarely due to only one factor. Factors such as parental depression and ill health, single parenthood, poverty and inadequate housing upset the balance in family functioning and consequently may affect parenting behaviours, children's behaviour and increase the risk of injury.

1.3 Neighbourhood Characteristics and Childhood Injury

Research suggests that neighbourhood and community characteristics have important influences on child health and childhood injury (Bronfenbrenner, 1986; Diez-Roux, 1998; Jencks & Mayer, 1990; Kupersmidt, Griesler, DeRosier, Patterson & Davis, 1995; Malmstrom, Sundquist, & Johansson, 1999; Wazana, Kreuger, Raina et al., 1997). In general, studies show that children who live in disorganized environments or low socioeconomic neighbourhoods are at increased risk of injury (Jolly, Moller, & Volkmer, 1993; Matheny, 1986, 1987; Nersesian, et al., 1985; Valsiner & Lighfoot, 1987). Children living in low socioeconomic environments are more likely to die from a motor vehicle crash, from drowning or from fire (Dowswell et al., 1996; Nersesian, et al., 1985). Child pedestrian injuries for example, have been associated with living in communities characterized by household and neighbourhood crowding in which numerous families live below the poverty level (Durkin, Davidson, Kuhn, O'Connor, & Barlow, 1994; King & Palmissano, 1992; Rivara & Barber, 1985). Adverse environmental and demographic conditions of crowded urban neighbourhoods can interact with social

and personal factors to increase the risk of pedestrian injuries among children from poor families (Bagley, 1992). Child pedestrian injuries have also been attributed to living in poor neighbourhoods with houses in close proximity to busy streets and restricted access to play space. Pless, Verreault, Aresenault, Frappier, and Stulginkas (1987) showed that in Montreal, children of all ages and of both genders from low-income areas had higher rates of traffic and pedestrian injuries compared to children from middle- and upper income areas of the city.

1.3.1 Neighbourhood Disadvantage and Childhood Injury

Reading, Langford, Haynes, and Lovett (1999) found an independent effect of socioeconomic deprivation at the area level, with much higher injury rates in deprived urban neighbourhoods than in affluent areas. A multi-level analysis showed that variations in the occurrence of childhood injury could be explained by factors such as the gender of the child, the age of the mother, and whether the child had older siblings. The characteristics of disadvantaged neighbourhoods had a small, but noticeable effect on the rate of childhood injury: a higher number of severe injuries were reported from the most disadvantaged neighbourhoods. However, socioeconomic differences at the neighbourhood level are not limited to the most severe types of injury, and the reasons for the associations between neighbourhood socioeconomic status and injury remain unclear (Reading et al., 1999). Studies suggest that not only the absolute amount of income is important for health, but also the relative disparity of income distribution in a population (Kaplan, Pamuk, Lynch, Cohen, & Balfour, 1996; Kennedy, Kawachi, Prothrow-Stith, 1996; Wilkinson, 1996). A study conducted by Lynch et al. (1998) showed that high-income inequality was associated with a higher frequency of injury occurrence and with all-cause mortality rates. In studies that relate neighbourhood socioeconomic status (a combination of level of income, education and occupation) to variations in injury rates, the level of income and the inequalities of income appear to be the most strongly related to injury. The main explanations focus on lack of material resources and inability to protect children from injury (Black, Morris, Smith, & Townsend, 1982).

A Canadian population study of pedestrians and bicyclists involved in motor vehicle collisions found higher rates of death among children from census tracts that had the highest percentage of low-income

families (Dougherty, Pless & Wilkins, 1990). Dougherty, Pless and Wilkins (1990) examined motor vehicle traffic deaths and injuries to pedestrians and bicyclists aged birth to 14 years by their income quintile of residence. The injury rate of children living in the poorest neighbourhoods was four times greater than that of children living in the richer neighbourhoods. In census tracts of Northern Manhattan, Durkin et al. (1994) investigated the relationship between several socioeconomic factors and the occurrence of severe childhood injury. Their report included injury data from motor vehicle collisions, pedestrian injuries, falls, gunshot wounds, and burns. The census tract percentage of low-income households was the single most important predictor for the occurrence of all types of injuries. Children living in areas with predominantly low-income households were twice as likely to be injured from all causes than were children living in areas with few low-income households. Similarly, two studies conducted in Australia (Jolly, Moller, & Volkmer, 1993) and the United States (Nersesian, et al., 1985; Mierley & Baker, 1983) examined patterns of fatal and non-fatal injury among children and adolescents. These studies found significant relationships between injury rates and low-income neighbourhoods. Both of these studies showed that the risk of injury for low-income neighbourhoods was nearly three times greater than that of the highest income neighbourhoods.

Occupational structure, from blue collar to professional positions, can also explain variations in health and injury (Lantz, House, Lepkowski, et al., 1998; Lynch, et al., 1998; Durkin, et al., 1994; Emerick, Foster, Campbell, 1986; Beautrais, Fergusson, & Shannon, 1982). Communities with higher levels of occupations and smaller differences between occupational classes are likely to have more resources for promoting healthy lifestyles and lower levels of stressful and alienating social conditions (Sclar, 1980). Studies show large differences in mortality by occupational class for many causes of death (Hertzman, Frank, & Evans, 1994), and among children, unintentional injury shows the steepest gradient of social class disadvantage (Black, Morris, Smith, & Townsend, 1982).

Although empirical evidence is sparse, neighbourhood disadvantage may have an effect on childhood injuries through its impact on children's behaviour. Child pedestrian injuries significantly co-vary with child's behavioural problems such as over-activity, conduct disorder, and delinquency (Roberts, 1994; Roberts, Norton, & Jackson, 1995). In turn, delinquency reflects a variety of neighbourhood and ecological factors such as family poverty and dysfunction (Bagley, 1992). Limited available data suggest

that the adverse effects of socioeconomic disadvantage on child behaviour are mostly attributable to family level measures (Boyle & Lipman, 1998). A study of 673 five- to six-year olds from the United States examined the influence of selected neighbourhood characteristics on a child's problem behaviour. The impact of neighbourhood on child I.Q. results and reading scores was high, yet it had very little impact on child problem behaviour (Chase-Lansdale & Gordon, 1996). In a representative sample of Canadian children aged 4 to 11 years, Boyle and Lipman (1998) tested a multi-level model of the interrelationships between neighbourhood, family, and child problem behaviour. This model could predict approximately 25 percent of the variance in child problem behaviour. Six to seven percent of the variance was due to differences between enumeration areas, and the remaining 18 percent were due to family socioeconomic status. However, in Boyle and Lipman's study, the nature of the influence of neighbourhood was not entirely clear as there were no measures of the social influence of neighbourhood such as level of neighbourhood cohesion or prevalence of neighbourhood problems.

1.3.2 Social Influence of Neighbourhood on Childhood Injury

The concept of social influence on health and injury includes the influence of social factors such as social cohesion and community stress. Either jointly or independently, these factors can influence injury rates among children and youth (Corin, 1994). The term "community stress" refers to the proportion of the population that is considered at social risk and includes people on social assistance, unemployment insurance, or in shelters for the homeless or abused (FCM, 1998). Evidence suggests that people who live in communities that have high proportions of individuals who are at social risk, have more stressful and less healthy lives (Rosengren, Orth-Gomer, Wedel, & Wilhelmsen, 1993; Rubin, 1976). Social cohesion on the other hand is defined as a sense of social unity and cooperation among community members built on egalitarian standards, and aimed at promoting some common good (Wilkinson, 1996).

A number of population-based studies have examined social cohesion as a factor that is related to a population's health (Fullilove, 1998; Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997; Putnam, 1994; Wilkinson, 1996). Putnam (1994) demonstrated a high correlation between a stronger social cohesion, a lower infant death rate, and a longer life expectancy in females. Putnam (1994) also noted a highly significant correlation of a narrower income distribution with an index including the percentage of

voters in referenda, newspaper readership, and number of associations for voluntary activities per capita. However, few studies have examined the relationship between the occurrence of injuries and social cohesion. Sampson, Raudenbush, & Earls (1997) conducted a survey on injury occurrence in 343 neighbourhoods in Illinois. The authors tested the hypothesis that cohesion among neighbours, combined with their willingness to intervene on behalf of the common good, is linked to reduced neighbourhood violence. Neighbourhood cohesion yielded high between-neighbourhood reliability and was negatively associated with violence.

In general, the translation of social and neighbourhood factors into processes that can explain the occurrence of injuries is complex. This translation may involve mechanisms that may act differently for various types of injuries and have different effects at distinct stages in life (Goodman, 1999). For example, studies suggest that neighbourhood conditions may have a stronger impact on adolescent behaviour than on child behaviour. This may be due to increased independence during adolescence accompanied with the lessening of family influence and the ascendancy of peer influences (Boyle & Lipman, 1998; Williams, Currie, Wright, Elton, & Beattie, 1996). Another mechanism is family disruption such as separation or divorce, which lead to single parenthood. Such disruptions increase a child's anxiety level, which in turn increases the occurrence of injuries (Manheimer and Melinger, 1997). Children in single parent families are generally disadvantaged with respect to housing and income as compared to children whose parents are both present. Platt and Pharoah (1996) conducted a review of statistics on child health in the UK. In 1993, 23 percent of all families with dependent children were lone parents, and 21 percent of them were lone mothers. Lone parent families with dependent children were more likely to live in overcrowded, rented accommodation without central heating. Only 53 percent of lone mothers with children over five years old were employed, while 74 percent of married mothers were employed. In the United States, neighbourhoods with a higher than average proportion of single parents, disadvantaged ethnic minorities, household crowding, and low income have significantly higher rates of injury involving young pedestrians (Rivara & Barber, 1985).

In summary, children who live in disorganized environments and low-income neighbourhoods are at increased risk for injury. There is an increasing social disadvantage gradient in mortality for childhood injuries, but socioeconomic differences at the neighbourhood level are not limited to the most severe

forms of injury. Neighbourhood disadvantage may have an effect on childhood injuries through its impact on the behaviour of the child. However, studies suggest that neighbourhood conditions may have a stronger impact on adolescent behaviour than on child behaviour, and the adverse effects of socioeconomic disadvantage on child behaviour seem mostly attributable to family level measures. Family disruption that leads to single parenthood may also be associated with increased risk of childhood injuries. Children in lone parent families are generally disadvantaged with respect to housing and income as compared with children from families with two parents. Neighbourhoods with a higher than average proportion of single parents tend to have significantly higher rates of childhood injuries.

1.4 Critical Remarks on the Literature

In the studies that we have reviewed, the consistency of the results seems to vary according to the type of injuries considered and to the type of research design, i.e. prospective versus cross-sectional. For example, in cross-sectional studies, hyperactivity in children appears to be related to injury while in prospective studies, hyperactivity does not predict the occurrence of injury. In contrast, aggressive behaviour remains a strong correlate of injury in both types of designs. Other studies show that aggressive behaviour is consistently related to the occurrence of injuries in general, but not to pedestrian injuries.

Study results also seem to vary according to the source of measurement. Researchers often report that there is an association between the frequency of childhood injury occurrence and maternal reports of child activity levels. However, in studies where the teachers report the activity levels of the children, the association does not remain significant. Finally, not all studies account for socioeconomic factors, and some studies cannot be generalized because they were conducted with small samples or in experimental settings (e.g. observation in simulated settings).

Few studies on the occurrence of injuries have included measures of social influence of neighbourhood such as level of neighbourhood problems or cohesion. Consequently, the translation of social and neighbourhood factors into processes that can explain the occurrence of childhood injury remains complex and poorly documented. The literature suggests an evolving pattern of influence of family and neighbourhood on injury that varies according to child age. Furthermore, multiple mechanisms may act

differently for various types of injury outcomes and have different effects at distinct stages during childhood. Few studies have considered these environmental influences across different age groups that cover the span of childhood.

The literature we have reviewed suggests that a complex model of relationships between child, family and neighbourhood factors may account for the variations in the occurrence of childhood injuries. In general, the factors that seem to be most associated with increased risk of childhood injury include social disadvantage at the neighbourhood or family level, parental illness and depression, and family stress and dysfunction. The neighbourhood and the social environments of the family can interact in various ways to increase (or decrease) the impact of stressful events on the health of family members, disrupt (or reinforce) family functioning and positive parenting and increase (or decrease) the occurrence of childhood injuries. Family functioning can affect the risk of injuries either directly or through child behaviour or parenting. In turn parenting can influence childhood injuries through verbal rules, which favor the development of safe behaviours in children. The literature also suggests that parenting can be disrupted by economic hardship. Low SES families tend to use fewer positive interactions with their children and more harsh and punitive parenting practices. Family dysfunction and economic hardship can also affect maternal health and depression, which in turn can affect parenting and/or child behaviour and ultimately increase the risk of injuries. It is also possible that family SES modifies the effect of parenting and/or child behaviour on the occurrence of injuries. At yet another level, neighbourhood disadvantage can affect childhood injuries either directly or through its influence on child behaviour. Furthermore, the influence of neighbourhood can also be modified by family SES or by social cohesion. In turn social cohesion can modify the effect of child problem behaviour and reduce the risk of injuries. Thus, there are a number of plausible pathways of influence of neighbourhood and family factors on childhood injury. However, the value of a model is not necessarily its complexity or completeness, but whether it suggests testable hypotheses for major factors that influence injuries and can be modified to prevent them or reduce their severity (Robertson, 1998). The next section presents the specific research questions that were addressed in the present study.

2. Research Questions

The present project used data from the National Longitudinal Survey of Children and Youth (NLSCY). The NLSCY includes one wave of assessment of neighbourhood characteristics (cycle 1) and two waves of assessments of family and child characteristics at a two-year interval (cycle 1 and 2). We took advantage of this population-based study of households to examine the influence of child, family and neighbourhood characteristics on childhood injuries across age groups and time. More specifically, this project addressed the following questions:

1. Are there any associations between family functioning and childhood injuries across different age groups? If yes, are these associations mediated by parenting or child behaviour? The first goal of this study was then to examine the association of family functioning with childhood injuries across different age groups, after adjusting for other family and neighbourhood characteristics, and to examine if this association is direct or mediated by parenting and/or child behaviour.

2. If parenting or child behaviour does not mediate the effect of family functioning, is it modified by these factors? Answers to these questions can have important policy implications given that family functioning is not easily amenable to a direct intervention. By identifying how family functioning can affect childhood injury, relevant targets for resource allocation towards injury prevention could be set.

3. To provide relevant guidelines for policy, it was also useful to examine the relative impact of family versus neighbourhood on childhood injuries. Which is more strongly related to childhood injuries, family SES or indicators of neighbourhood disadvantage? Do they interact with each other? It was also important to examine if these factors interact with family functioning, parenting or child behaviour in order to identify the relevant units for intervention: family, neighbourhood or both.

4. Finally, can the models developed based on the previous steps predict injuries two years later? The development of a predictive model can help assess the importance of the variables used for modeling and provides useful indications for the assessment of causation.

3. Methodology

3.1 Data Source

The data for this study come from cycle 1 and cycle 2 of the National Longitudinal Survey of Children and Youth (NLSCY). The NLSCY is a national prospective longitudinal survey designed to measure child well being, health and development. The first cycle was conducted by Statistics Canada on behalf of Human Resources and Development Canada in 1994-95. The second cycle of the survey was undertaken in 1996-97. A detailed description of the NLSCY methods is available elsewhere (Special Surveys Division, 1996). Briefly, the NLSCY is a random probability sample of Canadian residential households with children aged 0-11. Excluded households included those situated in remote areas, those on First Nations Peoples' reserves, and in institutional settings. In each eligible household, one child aged 0-11 was randomly selected. Information was obtained from the Person Most Knowledgeable about that child (PMK). Other children were then selected at random, to a maximum of four per household in cycle 1 and up to two in cycle 2. The PMK was asked to complete a general questionnaire, a parent questionnaire and a child questionnaire. The PMK provided basic demographic information about all household members, socioeconomic information about her/himself and her/his spouse, and extensive information about the selected children.

For cycle 1 of the study, completed interviews were obtained from 13,439 households, resulting in an overall response rate of 81.4 percent. The longitudinal sample represents the population of children living in Canada and aged 0 to 11 in 1994. In all, 10,261 longitudinal households (of the original cohort) answered the questionnaire of cycle 2 of the NLSCY. In these households, 15,468 children 2 to 13 years old were surveyed. The sample for cycle 2 of the NLSCY that was used in the present study consisted of the responding children drawn from the sample in cycle 1. To avoid clustering effect in the present study, one child per household was randomly selected from the available sample in the NLSCY. This selection resulted in 12, 661 children in the cross-sectional sample and 9796 children in the longitudinal sample that were included in the present analyses (Tables 1a and 1b).

Table 1a **Sociodemographics and 1996-census neighbourhood characteristics, unweighted sample**

	Cross-sectional Sample				Longitudinal Sample			
	N	**Mean**	**S.D.**	**Percent**	**N**	**Mean**	**S.D.**	**Percent**
Children								
Boys	12,661			50.8	9,796			50.4
Mean age	12,661	5.13	3.64		9,796	4.92	3.66	
PMK								
Female	12,661			91.4	9,796			88.3
Mean Age	12,661	33.11	6.35		9,336	32.94	6.29	
Families								
Number of persons in the household	12,661	3.99	1.13		9,336	3.98	1.12	
SES	12,555	-0.17	0.76		9,258	-0.17	0.75	
Single female families in neighbourhood*	12,647	10.13	6.58		9,331	9.96	6.12	
Household income under $20,000 in neighbourhood*	12,647	15.06	10.80		9,331	15.23	10.48	
Neighbourhood disadvantage*	12,661	0.01	0.76		9,336	0.03	0.74	

* Variables selected or derived from the 1996 census

Table 1b **Sociodemographic and 1996-census neighbourhood characteristics, population estimates**

	Cross-sectional Sample				Longitudinal Sample			
	N	**Mean**	**S.D.**	**Percent**	**N**	**Mean**	**S.D.**	**Percent**
Children								
Boys	2,836,028			51.1	2,917,059			50.2
Mean age	2,836,028	5.48	3.56		2,917,059	5.52	3.51	
PMK								
Female	2,836,028			89.8	3,065,782			87.3
Mean Age	2,836,028	34.22	6.38		2,917,059	34.24	6.27	
Families								
Number of persons in the household	2,836,028	3.97	1.16		2,917,059	4.08	1.24	
SES	2,818,252	0.08	0.77		2,893,430	0.09	0.78	
Single female families in neighbourhood*	2,834,479	10.71	6.81		2,916,549	10.57	6.33	
household income under $20,000 in neighbourhood*	2,834,479	13.58	10.27		2,916,549	13.74	9.86	
Neighbourhood disadvantage*	2,8360,28	-0.23	0.75		2,917,059	-0.21	0.73	

* Variables selected or derived from the 1996 Census

3.2 Variables and Measures

Selection of the variables from the survey included their relevance to this study as well as the psychometric properties of the scores that were developed by Statistics Canada (i.e., number of missing values and Cronbach Alpha of at least 0.60). Some new variables were created and necessary changes to the scale of some variables were done to avoid zero or missing cells. Table 2 specifies the range, the mean and standard deviations for all the variable scores.

Table 2 **Descriptive statistics for scales and variables from the NLSCY, cross-sectional sample**

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Socio-economic status	12,868	-3.25	2.82	.01	.78
Number of persons in the household	12,932	2	14	3.97	1.16
PMK depression	12,680	0	35	4.83	5.48
Neighbourhood cohesion	11,698	0	15	10.58	2.77
Neighbourhood problems	12,572	0	10	1.28	1.66
Neighbourhood disadvantage*	12,925	-2.43	3.85	.0004	.77
Female single female–headed families*	12,925	0	70	10.72	6.86
Families with income < $20,000*	12,925	0	81.08	13.60	10.33
Family functioning	12,703	0	35	8.03	5.21
Overall level of child difficulty, age 0-23 months	4,407	1	7	2.58	1.49
Positive interaction, age 0-23 months	2,297	0	20	17.55	2.90
Positive interaction, age 2-11 years	10,559	1	20	13.59	3.27
Consistency age, 2-11 years	10,453	0	20	14.65	3.46
Physical aggression & opposition, age 2-3 years	2,168	0	16	4.69	2.92
Prosocial behaviour, age 2-3 years	1,982	0	10	5.19	2.83
Prosocial behaviour, age 4-11 years	8,066	0	20	12.53	3.79
Hyperactivity-inattention, age 2-3 years	2,199	0	14	4.27	2.83
Hyperactivity-inattention, age 4-11 years	8,307	0	16	4.60	3.59

* Variables selected or derived from the 1996 census

3.2.1 Outcome Variable

Injury occurrence was assessed by PMK's answers to the question: Was your child injured during the last 12 months. The question was related to injuries that required contact with health care services. Response choices were Yes or No. Other questions, not used in this study, were related to the cause and type of injury, and the body part injured.

3.2.2 Neighbourhood Characteristics

Seven variables were selected from the 1996 census-linked database. The first two included *percentage of single-female headed households and percentage of families with an income less than $20,000.* Following a methodology proposed by Boyle and Lipman (1998), the remaining five variables were used to develop *a measure of neighbourhood disadvantage* including percentage of : income from government transfer payments; population aged 15 years and over without a secondary school certificate; population aged 15 years and over with a university degree (reverse coded); mean household income in 1000's of dollars (reverse coded); and percentage unemployed aged 15 years and over. Each of the five variables was z-standardized (mean of zero and a standard deviation of one). Missing values were excluded from the analyses. The final score was the sum of the unweighted average of the five standardized variables. The score varied from -2.43 to 3.85 with a high score indicating high disadvantage.

Additional neighbourhood characteristics included PMK's assessments of neighbourhood cohesion and problems. *Neighbourhood cohesion* measures the cohesion and support among neighbours. Items include "If there is a problem in the neighbourhood, the neighbours get together to deal with it; There are adults in the neighbourhood that children can look up to; When I'm away from home, I know that my neighbours will keep their eyes open for possible trouble". Response choices varied from strongly agree to strongly disagree. Total scores varied from 0 to 15 with a high score indicating high cohesion (Cronbach's alpha = 0.86).

Neighbourhood Problems score measures the prevalence of neighbourhood problems. Items include "How much of a problem is the following in this neighbourhood: Garbage, litter, or broken glass in the street or road, on the sidewalks, or in yards; Selling or using drugs; Groups of young people who cause trouble." Response choices were: a big problem, somewhat of a problem, no problem. Total score varied from 0 to 10 with a high score indicating high prevalence of problems (Cronbach's alpha = 0.70).

3.2.3 Family Characteristics

Family SES was derived by Statistics Canada from five variables: *Household income; level of education of the PMK and his/her spouse/partner; and prestige of the occupation of the PMK*

and his/her spouse/partner. The five variables were z-standardized and the final score was obtained as the unweighted sum of the standardized variables divided by the number of variables with no missing values. In two-parent families, four variables had to have completed information and in one-parent families, two variables had to have completed information. Otherwise, the derived variable was coded as missing. The score varied from -3.25 to 2.82 with a high score indicating high socioeconomic status.

Family functioning was assessed by a 12-item scale providing a global assessment of family dysfunction and an indication of the quality of the relationships between parents/partners such as problem solving, communications, roles, affective involvement and responsiveness. The family functioning scale was administered to either the PMK or spouse/partner and the unit of analysis for the scale was the family. Items include: “Planning family activities is difficult because we misunderstand each other; We cannot talk to each other about sadness we feel; We confide in each other”. Response choices varied from strongly agree to strongly disagree. The score varied from 0 to 35 with a high score representing high family dysfunction (Cronbach's alpha = 0.88).

Parenting examined the frequency of praise, punishment, rule creation and enforcement, and general interaction with the child. Statistics Canada developed specific scales for two age groups, less than 24 months and 2 to 11 years old. *Positive Parenting* was selected in this study for children less than 24 months old (Cronbach’s alpha =0.72). For children 2 to 11 years old, the scales included *Positive Parenting* (Cronbach’s alpha = 0.80), and *Consistency* (Cronbach’s alpha = 0.66). *Positive Parenting* items included: “How often do you praise (name) by saying something like "Good for you"; How often do you talk or play with each other, focusing attention on each other for five minutes or more, just for fun?”. *Consistency* items included: “If you tell (name) that he/she will get punished if he/she doesn't stop doing something, and he/she keeps doing it, how often will you punish him/her? When you give him/her a command or order to do something, what proportion of the time do you make sure that he/she does it?”. Response choices were: never, about once a week or less, a few times a week, many times each day. Total scores varied from 0 to 20 with a high value indicating high daily frequency.

3.2.4 Child Characteristics

Child Behaviour scales assessed overall difficulty, hyperactivity, physical aggression/opposition, and pro-social behaviour. *For children less than 24 months old*, the PMK rated on a scale from 1 to 7, the *Overall Difficulty* the child would present for the average parent. Response choices were from very easy, ordinary, some problems, to highly difficult to deal with. *For children 2 to 3 years old,* three scales were used including *Hyperactivity* (Cronbach's alpha = 0.80); *Pro-social Behaviour* (Cronbach's alpha = 0.85) and *Physical Aggression/Opposition* (Cronbach's alpha = 0.75). *For children 4 to 11 years old,* three similar scales were used: *Hyperactivity* (Cronbach's alpha = 0.84); *Pro-social Behaviour* (Cronbach's alpha = 0.82); *Physical Aggression/Opposition* (Cronbach's alpha = 0.77). Hyperactivity items included: "How often would you say that (name) can't sit still, is restless, or hyperactive? Is distractible, has trouble sticking to any activity?". Pro-social behaviour items included: "Offers to help other children (friend, brother or sister) who are having difficulty with a task? Comforts a child (friend, brother, or sister) who is crying or upset? Will invite bystanders to join in a game? Volunteers to help clear up a mess someone else has made?". Physical aggression/opposition items included: "Is defiant? Gets into many fights? Has temper tantrums or hot temper? Kicks, bites, hits other children?" And for older children: "Physically attacks people? Threatens people? Is cruel, bullies or is mean to others?". Responses were never or not true, sometimes or somewhat true, often or very true, do not know. Total scores varied from 0 to 20 with high scores indicating high frequency.

3.3 Other Covariates

Other covariates included *child's age, gender, number of persons in the household and PMK's restriction of activity and depression score. Restriction of activity* assessed the presence or absence of the PMK's activity limitation due to chronic illness. To measure symptoms of depression, the PMK was asked: "How often have you felt or behaved this way during the past week?: I felt that everything I did was an effort; I had crying spells; I felt that I could not shake off the blues even with help from my family or friends". Response choices were less than 1 day, 1-2, 3-4 and 5-7 days. Total scores varied from 0 to 36 with a high score indicating high level of depression (Cronbach's alpha= 0.82).

3.4 Data Analyses

All the analyses were stratified for the selected child age groups: less than 24 months, 2-3 years, and 4-11 years old. The analyses included two main phases: cross-sectional and longitudinal analyses. Analyses were weighted using the relevant sample weights provided with the cross-sectional and longitudinal samples.

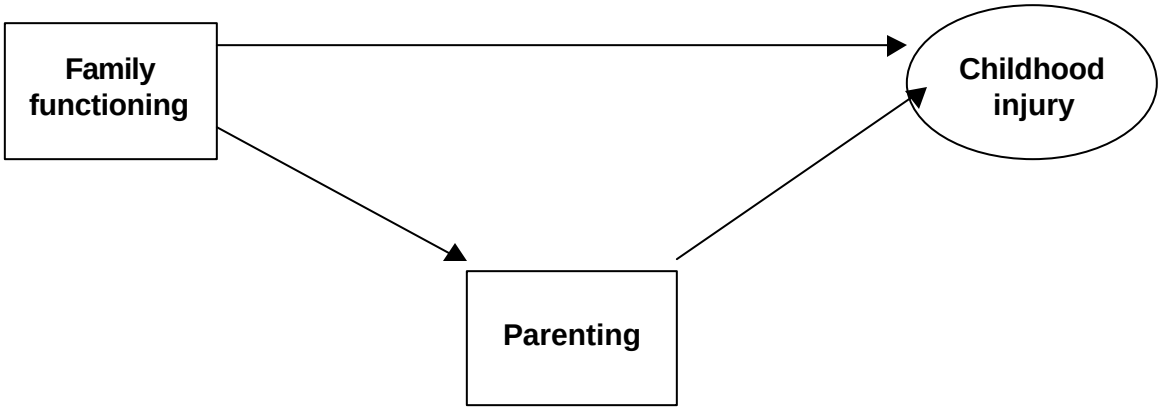
3.4.1 Cross-Sectional Analyses

The first objective of the analyses was to examine the relationships between family functioning, parenting, child behaviour and childhood injury while adjusting for child's gender, family SES, number of persons in the household, PMK depression and restriction of activity, and neighbourhood characteristics. This phase of the analyses included testing two potential models of the relationship between family functioning and childhood injuries: the mediated models and the interaction effect model.

Testing the Mediated Models

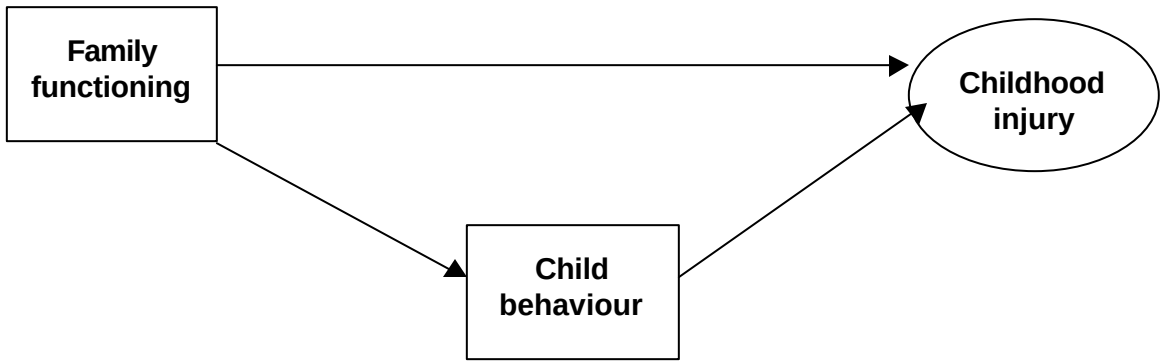
Figures 1 and 2 represent mediated models of the relationship between family functioning and childhood injuries. The models indicate that family functioning has both a direct and indirect effect on childhood injuries. The indirect effect in model 1 is mediated by parenting practices. The indirect effect in model 2 is mediated by child behaviour.

Figure 1
Testing the parenting mediated model of the relationship between family functioning and childhood injuries



Note: Controlling for covariates including child behaviour and neighbourhood characteristics

Figure 2
Testing the child behaviour mediated model of the relationship between family functioning and childhood injuries



Note: Controlling for covariates including parenting and neighbourhood characteristics

A third variable analysis was used to sort out the direct and indirect effects of family functioning using regression equations (Baron & Kenny, 1986; Susser, 1987). To illustrate this approach, we will use an example of the indirect influence of family functioning as an independent variable on injury as a dependent variable using parenting practices as a third variable. In this procedure, the following regression equations are estimated, while controlling for covariates:

Equation 1: Log (Odds of injury) = β_{01}+ β_{11} family functioning + β_{21} covariates

Equation 2: Parenting = β_{02} + β_{12} family functioning + β_{22} covariates + error$_2$

Equation 3: Log (Odds of injury) = β_{03} + β_{13} parenting practices + β_{23} family functioning + β_{33} covariates

One of the advantages of this approach is its flexibility. Associations between relevant variables can be examined using partial correlations, simple linear regressions or logistic regressions, depending on the nature of the dependent variable (Baron & Kenny, 1986). To establish indirect or mediated effect, all of the following criteria must hold. Failure to meet any of these criteria excludes the mediated model from further consideration:

1. The independent variable (family functioning) must be significantly related to the dependent variable (injury) in the first equation.

2. The independent variable (family functioning) must be significantly related to the third variable (parenting) in the second equation.

3. The third variable (parenting) must be significantly related to the dependent variable (injury) in the third equation.

4. When these criteria are met, the third equation must meet one last criterion: the introduction of the third variable (parenting) must reduce the direct relationship ($\beta_{23} < \beta_{11}$) between the independent (family functioning) and the dependent variable (injury). Perfect mediation holds if the independent variable (family functioning) has no effect ($\beta_{23} = 0$) on the dependent variable (injury) when the third variable (parenting) is in the equation.

To apply this approach to our first objective entailed the following analyses after controlling for child's gender, family SES, number of persons in the household, PMK depression and restriction of activity, and neighbourhood characteristics: (All regression analyses were conducted with SPSS 9.0. Failure to meet any of the criteria excluded the mediated models from further consideration.)

1. Examine associations between family functioning and childhood injuries (first criterion)

2. Examine associations between family functioning and parenting (second criterion)

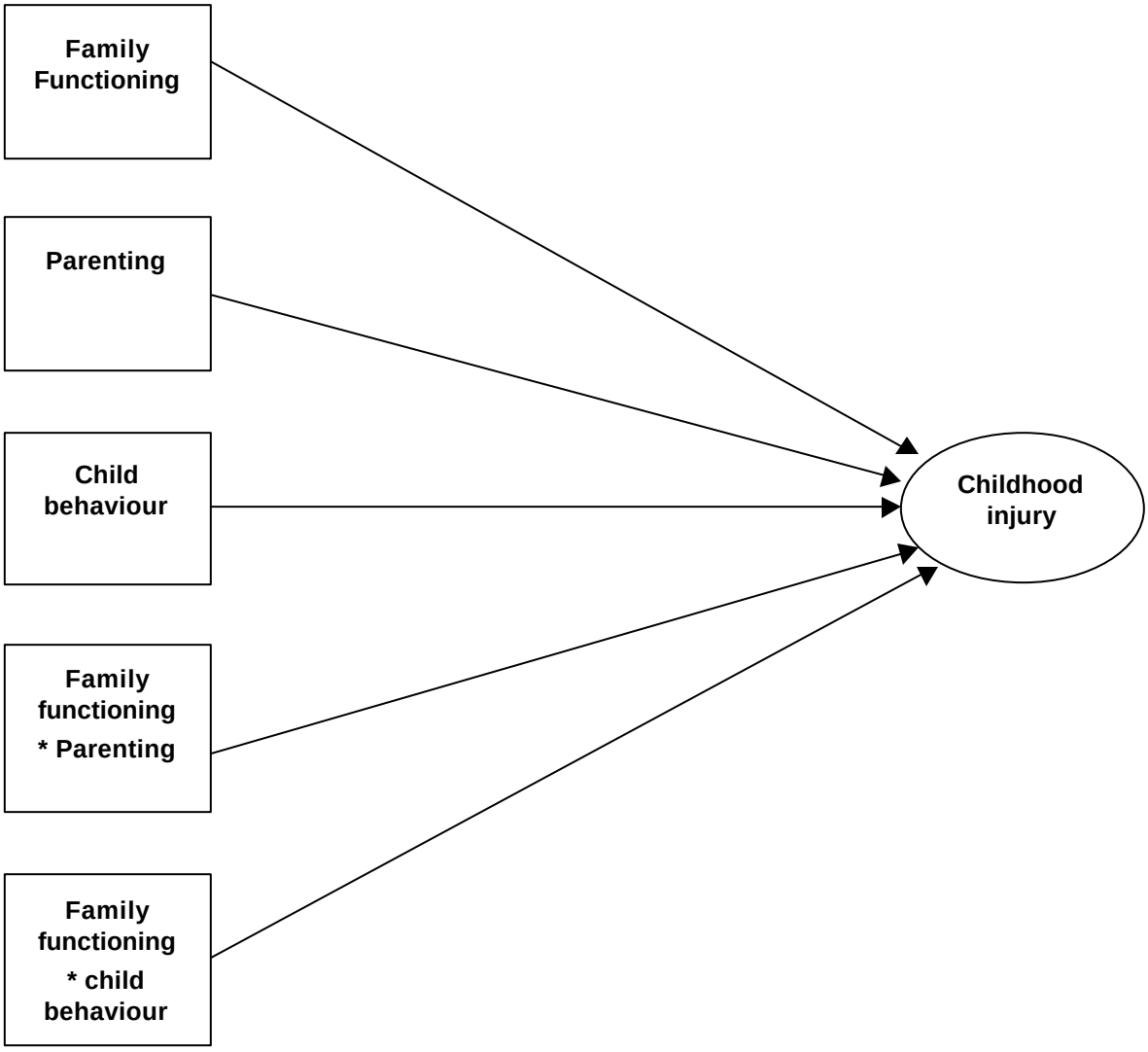
3. Examine associations between family functioning, parenting, and childhood injuries (third and fourth criterion)

4. The same steps from 1.1 to 1.3 were applied using child behaviour as a third variable.

Testing the Interaction Effects Model

Figure 3 represents an interaction effect model (independent effects and interaction terms) of the relationships between family functioning and childhood injuries.

Figure 3
Model of the main effects and interaction terms



Notes: 1. Interaction terms are entered in the model after the main effects
2. Other terms included in the model were child gender, family SES, number of persons in the household, PMK restriction of activity and depression, and neighbourhood characteristics.

With this model, we examined if parenting practices and child behaviour modify the relationship between family functioning and childhood injuries (Baron & Kenny, 1986). Logistic regression was used throughout the analyses with childhood injury as a dependent variable. Selection of the covariates followed a model building strategy suggested by Hosmer & Lemeshow (1989). Odds ratios were used to identify factors significantly related to the occurrence of childhood injury. Inclusion or exclusion of

variables at each step was based on the importance of the variables for the research questions as well as on statistical criteria ($p < 0.05$, 95% confidence intervals). The selection began with univariate analyses of each variable where individual odds ratios along with 95% confidence limits were examined. Variables of known importance based on the literature and variables whose univariate test had a p-value < 0.25 were considered for the multivariate model. Attention was given to the correlations among the measures (Table 4, 5, and 6). The choice between two variables that were highly collinear was made on the basis of their independent contribution to the model as well as their relevance to the research questions. Changes to the scale of some variables were done whenever necessary after verification of the assumption of linearity in the logit (Hosmer & Lemeshow, 1989). Once the variables were selected, the multivariate models were developed.

For each age group, the first variables that were entered in the multivariate model were child's gender, family SES, number of persons in the household, and PMK's restriction of activity and depression. Neighbourhood variables were entered in a second step. The other variables were then entered in three successive blocks: family functioning, parenting, and child behaviour. Once the main effects were examined, two-way interaction terms between family functioning and parenting, and between family functioning and child behaviour were entered in the model and tested. Other interaction terms included the following two-way interactions: family SES by neighbourhood variables, family SES by family functioning, family SES by parenting, and family SES by child behaviour. Similarly, two-way interactions between neighbourhood variables, family functioning, parenting and child behaviour were also tested.

The general strategy to evaluate interactions was based on the assessment of homogeneity of effects. This strategy involved the examination of the estimates of effect by stratum-specific values of the effect modifier (Szklo & Nieto, 2000). This strategy included the following steps:

1. Adopt as a reference category the absence of both factors in the case of dichotomous variables, and low levels in the case of continuous variables
2. Calculate the independent relative effects of each of the factors in the absence of the other or in the presence of low levels of the other variable for continuous variables
3. Identify crossover interactions: one factor has an opposite direction of effect according to the levels of the second factor, or when there is an association on one level but not the other.

Table 3 **Correlations among neighbourhood, family and child behaviour variables, children 0 to 23 months old**

	1	2	3	4	5	6	7	8
1. Neighbourhood disadvantage	1							
2. Household income < $20,000	.62#	1						
3.Single-female-headed families in neighbourhood	.38#	.55#	1					
4. Neighbourhood cohesion	-.17#	-.21#	-.31#	1				
5. Neighbourhood problems	.21#	.21#	.31#	-.31#	1			
6. Family functioning	.12#	.12#	.13#	-.30#	.05*	1		
7. Positive parenting	.03	-.01	-.02	.06*	.01	-.11#	1	
8. Child difficulty	.02	-.01	.02	-.05*	.06*	.13#	-.08#	1

* p < .05; p< .01; # p < .001

Table 4 **Correlations among neighbourhood, family and child behaviour variables, children 2 to 3 years old**

	1	2	3	4	5	6	7	8	9	10	11
1. Neighbourhood disadvantage	1										
2. Household income < $20,000	.61#	1									
3. Single-female-headed families	.39#	.60#	1								
4. Neighbourhood cohesion	-.20#	-.19#	-.24#	1							
5. Neighbourhood problems	.16#	.16#	.26#	-.32#	1						
6. Family functioning	.12#	.11#	.10#	-.32#	.15#	1					
7. Positive parenting	-.02	.01	.01	.07+	.03	-.16#	1				
8. Consistency (parenting)	-.14#	-.12#	-.14#	.08#	-.07+	-.16#	.06+	1			
9. Hyperactivity	.09#	.05*	.02	-.14#	.04*	.13#	-.12#	-.15#	1		
10. Prosocial behaviour	-.04	-.05*	-.08#	.16#	-.03	-.08#	.15#	.10#	.04	1	
11. Physical aggression/opposition	-.01	-.01	.02	-.10#	.11#	.10#	-.13#	-.19#	.55#	.07+	1

* p < .05; p< .01; # p < .001

Table 5 **Correlations among neighbourhood, family and child behaviour variables, children 4 to 11 years old**

	1	2	3	4	5	6	7	8	9	10	11
1. Neighbourhood disadvantage	1										
2. Household income < $20,000	.63#	1									
3. Single-female-headed families	.33#	.54#	1								
4. Neighbourhood cohesion	-.12#	-.16#	-.22#	1							
5. Neighbourhood problems	.13#	.19#	.26#	-.26#	1						
6. Family functioning	.10#	.08#	.06#	-.30#	.07#	1					
7. Positive parenting	.01	.04#	.02*	.11#	-.04+	-.20#	1				
8. Consistency (parenting)	-.14#	-.11#	-.07#	.13#	-.04+	-.20#	.09#	1			
9. Hyperactivity	.08#	.03+	.04#	-.12#	.11#	.16#	-.10#	-.20#	1		
10.Prosocial behaviour	-.01	-.01	.02	.13#	.02	-.17#	.18#	.17#	-.15#	1	
11.Physical aggression/opposition	.05#	.03*	.03*	-.09#	.14#	.15#	-.08#	-.14#	.46#	-.19#	1

* p < .05; + p< .01; # p < .001

After the three main groups of factors (neighbourhood, family and child behaviour) were examined, those variables within each group that made a significant contribution (main effects and interaction terms) to the models were entered into summary regression models for each age group. All the final models adjusted for child gender, family SES, number of persons in the household, and PMK's depression and activity restriction. Results were expressed as odds ratios with their 95 percent confidence intervals. The standard errors were calculated for each interaction term using the variance-covariance matrix of the coefficients. Likelihood ratios and Chi-square goodness of fit were used to assess each regression model (Hosmer & Lemeshow, 1989).

3.4.2 Longitudinal Analyses

The second objective of the analyses was to examine predictive associations of neighbourhood, family and child characteristics assessed at baseline (cycle 1) with childhood injuries at follow-up (cycle 2). Using the models that were developed at the baseline, associations between predictor variables and the occurrence of injury two years later were examined with logistic regressions using the same approach described in the cross-sectional analyses. Additional covariates included injury status in cycle 1 and variable scores that showed a significant difference between baseline and follow-up. Relevant predictors with their significant interaction terms were then included in the final models in one of the three groups of predictor variables: neighbourhood, family and child behaviour.

4. Results

4.1 Analyses at Baseline

4.1.1 Testing the Mediated Models

Table 6 presents the odds ratios and 95% confidence intervals for the first equation of the mediated models relating family functioning to childhood injury (first criterion). For all age groups, family functioning was not related to injury after adjusting for child's gender, family SES, number of persons in the household, PMK depression and restriction of activity, neighbourhood cohesion, neighbourhood problems, neighbourhood disadvantage, percentage of single female households, and percentage of families with income less than $20,000. Since the first criterion was not met, the mediated models were excluded from further analyses. In the remainder of this section, we will examine models with interaction effects, which seemed more plausible based on this study.

Table 6 **Testing the first equation of the mediation model: Effect of family functioning on childhood injury, cycle 1, odds ratios and 95% confidence intervals**

	0 to 23 months	2 to 3 years	4 to 11 years
Child's gender[!]	1.52[#]	.75	.79[#]
	(1.00-2.31)	(.57-1.0)	(.68-.92)
Family SES**			
1st quartile	.68	1.63+	.70+
	(.36-1.27)	(1.04-2.96)	(.57-.87)
2nd quartile	.32*	1.64+	.72+
	(.15-.67)	(1.10-2.49)	(.58-.88)
3rd quartile	.92	1.47	.78+
	(.54-1.56)	(.97-2.23)	(.64-.95)
Number of persons in household	1.06	.89	.95
	(.87-1.27)	(.78-1.03)	(.89-1.01)
PMK restriction of activity	1.12	.68	.52[#]
	(.51-2.46)	(.43-1.09)	(.43-.64)
PMK depression	.98	1.0	1.01
	(.94-1.03)	(.98-1.03)	(.99-1.02)
Neighbours cohesion	.89[#]	1.01	1.03
	(.83-.96)	(.96-1.07)	(.99-1.05)
Neighbourhood problems	1.15+	1.11+	1.07+
	(1.04-1.27)	(1.03-1.20)	(1.03-1.12)
Neighbourhood disadvantage	.79	.64*	.99
	(.58-1.07)	(.49-.83)	(.87-1.15)
Single-female-headed families	.95[#]	.97	1.00
	(.93-.98)	(.95-1.00)	(.98-1.01)
Families with income < $20,000	1.02*	1.01	1.01+
	(1.00-1.05)	(.99-1.03)	(1.00-1.03)
Family functioning	1.03	.99	.99
	(.99-1.10)	(.97-1.02)	(.98-1.01)

! Boys are the reference category.
* p < .05; + p< .01; # p < .001
** The highest quartile is the reference category.

4.1.2 Final Models

For children less than 2 years old, neighbourhood problems were significantly associated with higher odds of injury. There was a significant interaction between neighbourhood cohesion and overall difficulty of the child (Tables 7a, 7b).

Table 7a Odds ratios and 95% confidence intervals from logistic regression for children less than 2 years old, cross-sectional model

	Main Effects Model**		Interaction Effects Model***	
Variable	**Odds Ratio**	**95%CI**	**Odds Ratio**	**95%CI**
Neighbours cohesion	.89+	.83 - .96	1.06	.93 - 1.21
Neighbourhood problems	1.16+	1.05 - 1.29	1.17#	1.05 - 1.30
Difficulty of the child	1.34#	1.18 - 1.53	2.31#	1.60 - 3.33
Neighbours cohesion by difficulty of the child			.94+	.90- .97

p < .05; + p< .01; # p < .001
Note: Model adjusted for child gender, family SES, number of persons in the household, PMK restriction of activity, depression, neighbourhood disadvantage, family functioning, and positive parenting
** -2 Log Likelihood: 712.43; χ^2 Goodness of fit: 7.23, df=6, p =.29
***-2 Log Likelihood: 702.14; χ^2 Goodness of fit: 3.80, df=6, p =.70

Table 7b **Values of the estimated odds ratios and 95% confidence intervals for high and low values of neighbourhood cohesion and overall difficulty of the child, children less than 2 years old, cross-sectional model**

Effect	Among	Odds Ratio	95% CI
High neighbours cohesion	Low overall difficulty of children	.45	.16-1.33
High neighbours cohesion	High overall difficulty of children	.04	.01-.19
High overall difficulty	Low neighbours cohesion	17.49	4.20-72.66
High overall difficulty	High neighbours cohesion	1.14	.49-2.70

Notes: 1. High and low values of neighbourhood cohesion were in standard deviations above/below the average score (12 to 15 and 0 to 7). In this numerical example the values 13 and 2 were used for high and low values respectively.
2. High and low values of difficuly of the child were in standard deviations above/below the average score (4 to 7 and 1 to 2). In this numerical example the values 5 and 2 were used for high and low values respectively.

As shown in Table 7b, high neighbourhood cohesion is a significant protective factor among difficult children. Among low difficulty children, the odds ratio for neighbourhood cohesion is relatively higher, but not statistically significant. Within less cohesive neighbourhoods, the odds ratio for child difficulty is high with a positively skewed confidence interval, which suggests that difficulty of the child is an important risk factor for injury. However, the large width of the confidence intervals indicates that there is a notable uncertainty in the estimates. Similarly, in highly cohesive neighbourhood, the odds ratio for difficulty of the child, although less impressive, shows a positively skewed confidence interval which suggests a similar effect of child difficulty in this group. Child difficulty and neighbourhood cohesion

seem to operate in opposite directions, with high cohesion generally protective and high difficulty a risk factor for injury. Thus, the difference in the odds ratio for difficulty of the child among cohesive as compared to less cohesive neighbourhoods may result from a negative interaction between difficulty of the child and neighbourhood cohesion.

Among children 2 to 3 years old, neighbourhood disadvantage was associated with lower odds of injury while neighbourhood problems were associated with increased odds of injury. Similarly, positive parenting and physical aggression/opposition seemed to be independently associated with higher odds of injury. Finally, significant interactions were found between family dysfunction and child's pro-social behaviour (Tables 8a, 8b).

Table 8a **Odds ratios and 95% confidence intervals from logistic regression for children 2-3 years old, cross-sectional model**

	Main Effects Model**		Interaction Effects Model***	
Variable	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Neighbourhood problems	1.09^{+}	1.02 - 1.18	1.10^{+}	1.02 – 1.18
Neighbourhood disadvantage	.68$^{\#}$	.53 - .88	.70$^{\#}$	.54 – .91
Family functioning	.99	.97 - 1.02	1.08^{+}	1.02 – 1.14
Positive parenting	1.07^{+}	1.01 - 1.13	1.07^{+}	1.01 – 1.13
Pro-social behaviour	1.02	.97 – 1.08	1.17^{+}	1.07 – 1.29
Physical aggression/opposition	1.08^{+}	1.03 – 1.13	1.07^{+}	1.01 – 1.13
Family functioning by pro-social behaviour			.98^{+}	.97- .99

Note: 1. Model adjusted for child gender, number of persons in the household, family SES, PMK restriction of activity and depression, percent of single female households, and percent of families below $20,000 of income
2. -2 Log Likelihood: 1456.19; χ^2 Goodness of fit: 15.82, df=8, p =.04
3. -2 Log Likelihood: 1445.53; χ^2 Goodness of fit: 6.72, df=8, p =.57
p< .05, $^{+}$ p< .01; $^{\#}$ p < .001

Table 8b **Values of the estimated odds ratios and 95% confidence intervals for high and low values of family functioning and pro-social behaviour of the child, children 2-3 years old, cross-sectional model**

Effect	Among	Odds Ratio	95% CI
High family functioning	Low pro-social behaviour of children	5.93	1.52-23.17
High family functioning	High pro-social behaviour of children	.01	.00- .19
High pro-social behaviour	Low family functioning	7.28	2.12-25.01
High pro-social behaviour	High family functioning	.02	.00-.37

Notes: 1. High and low values of family functioning (measured as family dysfunction) were defined in standard deviations above and below the average score (14 to 35 and 0 to 3). In this numerical example the values 28 and 3 were used for high and low values respectively.
2. High and low values of pro-social behaviour of the child were in standard deviations above and below the average score (17 to 20 and 0 to 8). In this numerical example the values 17 and 1 were used for high and low values respectively.

Table 8b shows a typical crossover interaction between family dysfunction and child pro-social behaviour. High family dysfunction seems to be a significant risk factor among children with low pro-social behaviour, but it seems to operate as a protective factor among children with high pro-social behaviour. In turn, pro-social behaviour seems to be a significant risk factor among children from families with low levels of dysfunction. Among children from dysfunctional families, pro-social behaviour appears as a significant protective factor.

Among children 4 to 11 years old, being a girl was associated with low odds of injury (Table 9a). Compared to the highest quartile of family SES, children from the lowest quartile of SES seem to have lower odds of injury. High odds of injury were observed for children living in neighbourhoods with high prevalence of problems, as well as children who were described as physically aggressive. There was a small but significant interaction between family dysfunction and child's pro-social behaviour (Table 9b).

Table 9a **Odds ratios and 95% confidence intervals from logistic regression for children 4-11 years old, cross-sectional model**

	Main Effects Model**		Interaction Effects Model***	
Variable	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Child gender				
Girl	.79#	.68 - .92	.80#	.69 - .93
Boy	Ref.			
Family SES				
1st quartile (low)	.71+	.57 - .87	.70+	.57 – .88
2nd quartile	.72+	.59 - .88	.71+	.58 –.88
3rd quartile	.78+	.64 - .95	.77+	.63 –.94
4th quartile (high)	Ref.			
Neighbourhood problems	1.08#	1.03 – 1.13	1.03#	1.03 – 1.13
Family functioning	.99	.98 – 1.01	.91+	.87 - .96
Pro-social behaviour	1.02	.99 – 1.04	.96+	.93 - .99
Physical aggression/opposition	1.11+	1.07 – 1.15	1.11+	1.07 – 1.16
Family functioning by pro-social behaviour			1.00*	1.00 – 1.01

Note: Model adjusted for number of persons in the household, PMK restriction of activity, depression, neighbourhood cohesion, % of single female households, and positive parenting.

* $p < .05$; + $p < .01$; # $p < .001$

** -2 Log Likelihood: 5214.96; χ^2 Goodness of fit: 20.25, df=8, p =.009

***-2 Log Likelihood: 5199.72; χ^2 Goodness of fit: 5.57, df=8, p =.69

Table 9b **Values of the estimated odds ratios and 95% confidence intervals for high and low values of family functioning and pro-social behaviour of the child, children 4-11 years old, cross-sectional model**

Effect	Among	Odds Ratio	95% CI
High family functioning	Low pro-social behaviour of children	.10	.03-.33
High family functioning	High pro-social behaviour of children	2.28	1.28-4.10
High pro-social behaviour	Low family functioning	.72	.46-1.14
High pro-social behaviour	High family functioning	14.75	4.22-51.50

Notes: 1. High and low values of family functioning (measured as family dysfunction) were in standard deviations above and below the average score (14 to 35 and 0 to 3). In this numerical example the values 28 and 3 were used for high and low values respectively.
2. High and low values of pro-social behaviour of the child were in standard deviations above and below the average score (17 to 20 and 0 to 8). In this numerical example the values 17 and 1 were used for high and low values respectively.

Table 9b shows a crossover interaction between family dysfunction and child pro-social behaviour. High family dysfunction seems to be a significant protective factor among children with low pro-social behaviour. Conversely, high family dysfunction seems to operate as a risk factor among children with high pro-social behaviour. Although not statistically significant, pro-social behaviour seems to be associated with low odds of injury among children living in families with low-family dysfunction. However, pro-social behaviour, with a significant and positively skewed confidence interval, seems to be a significant risk factor among children living in dysfunctional families.

4.2 Longitudinal Analyses

Among children less than 2 years old, girls had a lower risk of injury than boys. Children from families in the lowest quartile of SES seemed to have lower risk of injury compared to the highest quartile of SES. A small but significant protective effect was found for percentage of single female-headed families in the neighbourhood. Percentage of families with less than $20,000 income seemed to be associated with higher odds of injury in this age group. As expected, prevalence of neighbourhood problems was linked to higher odds of injury. Finally, there was a significant interaction between neighbourhood cohesion and difficulty of the child (Table 10a). Table 10b presents stratum-specific values for neighbourhood cohesion and child difficulty using a numerical example of high and low values for each.

Table 10a **Odds ratios from logistic regression for children less than 2 years old, longitudinal model**

	Main Effects Model**		Interaction Effects Model***	
Variable	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Child gender				
Girl	.61#	.44 - .85	.61#	.44 - .85
Boy	Ref.			
Family SES				
1st quartile (low)	.64	.38 – 1.05	.59*	.35 - .99
2nd quartile	.89	.56 – 1.43	.86	.54 - 1.38
3rd quartile	.72	.45 – 1.15	.68	.43 - 1.09
4th quartile (high)				
Neighbours cohesion	.90*	.85 - .96	1.02	.92 – 1.14
Neighbourhood problems	1.10	1.01 – 1.20	1.09*	1.01 – 1.19
Single female	.96+	.93 - .98	.96+	.93 - .99
Families with income < $20,000	1.03	1.00 – 1.05	1.02*	1.00 – 1.04
Difficulty of the child	1.02	.91 – 1.14	1.75+	1.19 – 2.55
Neighbours cohesion by difficulty of the child			.94+	.91 - .98

Note: Model adjusted for number of persons in the household, PMK restriction of activity, depression, injury status in cycle 1, neighbourhood disadvantage, family functioning, and parenting.
** -2 Log likelihood: 1062.40; χ^2 Goodness of fit: 7.13, df=6, p =.30
***-2 Log likelihood: 1053.83; χ^2 Goodness of fit: 4.71, df=6, p =.58
* p < .05; + p< .01; # p < .001

Table 10b **Values of the estimated odds ratios and 95% confidence intervals for high and low values of neighbourhood cohesion and overall difficulty of the child, children less than 2 years old, longitudinal model**

Effect	Among	Odds Ratio	95% CI
High neighbourhood cohesion	Low overall difficulty of children	.29	.12-.69
High neighbourhood cohesion	High overall difficulty of children	.03	.01-.17
High overall difficulty	Low neighbourhood cohesion	5.90	1.35-25.73
High overall difficulty	High neighbourhood cohesion	.38	.10-1.74

Notes: 1. High and low values of neighbourhood cohesion were in standard deviations above the average score (12 to 15 and 0 to 6). In this numerical example the values 13 and 2 were used for high and low values respectively.
2. High and low values of difficuly of the child were in standard deviations above the average score (4 to 7 and 1 to 2). In this numerical example the values 5 and 2 were used for high and low values respectively.

As shown in Table 10b, high neighbourhood cohesion is a significant protective factor regardless of the level of difficulty of the child. Among less cohesive neighbourhoods, the odds ratio is high with a positively skewed confidence interval, which suggests that difficulty of the child, may be an important risk factor for injury. Among cohesive neighbours, the odds ratio for difficulty of the child, while much lower, is within a positively skewed confidence interval, which suggests that difficulty of the child is also

a risk factor in this group. Both factors seem to operate in opposite directions, with neighbourhood cohesion generally protective and child difficulty a risk factor for injury.

Among children 2-3 years old, significant protective effects were found for girls, for positive parenting and for having been injured two years earlier. Increase in the percentage of single female headed households in the neighbourhood was predictive of a small but significantly lower risk of injury two years later (Table 11a). Finally, there was a significant interaction between neighbourhood disadvantage and child's physical aggression/opposition (Table 11b).

Table 11a **Odds ratios and 95% confidence intervals from logistic regression for children 2-3 years old, longitudinal model**

	Main Effects Model**		Interaction Effects Model***	
Variable	**Exp (B)**	**95% CI**	**Exp (B)**	**95% CI**
Child gender				
Girl	.42#	.27 - .63	.41#	.27 - .62
Boy	Ref.			
Injury in cycle 1	.57*	.35 - .92	.57*	.35 - .94
Neighbourhood disadvantage	.93	.65 – 1.32	.60	.36 - 1.00
Single female	.96*	.92 - .99	.95*	.92 - .99
Positive parenting	.88#	.81 - .95	.88#	.81 - .95
Physical aggression/opposition	1.06	.98 – 1.14	1.05	.97 – 1.14
Neighbourhood disadvantage by physical aggression/opposition			1.08+	1.01 – 1.16

Note: Model adjusted for family SES, number of persons in the household, PMK restriction of activity, depression, percent of families below $20k of income, family functioning, consistent parenting, prosocial behaviour, hyperactivity.
* $p < .05$; + $p < .01$; # $p < .001$
** -2 Log Likelihood: 807.33; χ^2 Goodness of fit: 15.91, df=8, p =.04
***-2 Log Likelihood: 802.16; χ^2 Goodness of fit: 8.5018, df=8, p =.38

Table 11b **Values of the estimated odds ratios and 95% confidence intervals for high and low values of neighbourhood disadvantage and physical aggression/opposition of the child, children 2-3 years old, longitudinal model**

Effect	Among	Odds Ratio	95% CI
High neighbourhood disadvantage	Low physical aggression/opposition	.51	.43-2.29
High neighbourhood disadvantage	High physical aggression/opposition	2.21	.75-6.50
High physical aggression/opposition	Low neighbourhood disadvantage	.71	.22-2.30
High physical aggression/opposition	High neighbourhood disadvantage	4.29	1.42-13.03

Notes: 1. High and low values of neighbourhood disadvantage were defined in standard deviations above and below the average score (1 to 2 and -2 to -1). In this numerical example the values 1 and -1 were used for high and low values respectively.
2. High and low values of the child's physical aggression and opposition were in standard deviations above the average score (8 to 16 and 0 to 4). In this numerical example the values 11 and 2 were used for high and low values respectively.

As suggested by the positively skewed confidence interval, high neighbourhood disadvantage among children with low level of physical aggression/opposition may increase the risk of injury (Table 11b). Among children with high level of physical aggression/opposition, neighbourhood disadvantage seems to increase the risk of injury. Although not statistically significant, the confidence intervals are positively skewed, which suggests that neighbourhood disadvantage may be an important risk factor for injury, regardless of the level of child's physical aggression/opposition. In turn, high physical aggression/opposition among children living in disadvantaged neighbourhoods seems to increase the risk of injury. These results suggest a positive interaction (synergistic effect) between neighbourhood disadvantage and child's physical aggression/opposition.

Among children 4 to 11 years old, a lower risk of injury was found among girls compared to boys (Table 12), and having been injured two years earlier seemed to be predictive of a lower risk of injury. There was a small but significant increase in the risk of injury among children living in neighbourhoods with high percentage of families with less than $20,000 of income. Finally, inconsistent parenting was linked to a sizable and significant risk of injury.

Table 12 **Odds ratios and 95% confidence intervals from logistic regression for children 4-11 years old, longitudinal model**

	Main Effects Model**	
Variable	**Odds Ratio**	**95% CI**
Child gender	.64#	.54 - .74
Girl	Ref.	
Boy		
Injury in cycle 1	.49#	.41 - .59
Families' income < $20,000	1.02+	1.00 – 1.03
Consistency	1.43#	1.22 – 1.68
No	Ref.	
Yes		

Note: Model adjusted for family SES, number of persons in the household, PMK restriction of activity, depression, neighbourhood cohesion, neighbourhood problems, neighbourhood disadvantage, percent of single female families, family functioning, and positive parenting

** -2 Log Likelihood: 4640.65; χ^2 Goodness of fit: 10.1707, df=8, p =.25

+ p< .01; # p < .001

5. Discussion

5.1 Family, Child Behaviour and Childhood Injury

The initial research questions of this study addressed the nature of the relationship between family functioning and childhood injuries: is this relationship mediated by parenting or child behaviour? And if not, is it modified by any of these factors? According to this study, a non-mediated model can be used to describe the relationship between family functioning (measured as family dysfunction) and childhood injuries after controlling for child gender, family SES, PMK's activity restriction and depression, and neighbourhood variables. The cross-sectional analyses suggest that the relationship between family functioning and childhood injury may be modified by child's pro-social behaviour. Moreover, this effect modification may vary according to child's age. The reasons for these age differences are unclear based on this study. We can only speculate that the nature of the behaviour or the reasons for the child to be pro-social may be different, as the child grows older. It is also possible that the consequences of family dysfunction on child behaviour are different depending on family stages. Family dysfunction may reflect different patterns of parent's interactions with different contingent roles played by other family members including children (Ransom, 1986). The child, at different stages of development, may be acting out differently depending on age or may be reacting differently and for different reasons to family dysfunction. Further research is needed to replicate these results in other samples and to clarify the mechanisms through which family dysfunction may relate to child's pro-social behaviour.

Other significant behavioural factors that were associated with higher odds of injury included overall difficulty among toddlers, and aggressive behaviour among children 2-3 years and 4-11 years old in the cross-sectional sample. Aggressive behaviour was also a significant predictor of injuries among children 2-3 years old in the longitudinal sample. These results are consistent with other studies that report an increased risk of injuries among aggressive children (Davidson, 1987; Wazana, 1997). Moreover, the longitudinal analyses of this study suggest a positive interaction between child's aggressive behaviour and neighbourhood disadvantage among children 2-3 years old. Similar to other studies, we did not find any association between hyperactivity and the risk of injury and there was no interaction between hyperactivity and aggressive behaviour (Bijur, Stewart-Brown & Butler, 1986; Davidson, 1987, 1992).

Further refinements to the analyses of this study are needed to take into account the type of injuries involved, as some behavioural indicators may be related to general injuries but not to specific types of injuries (Wazana, 1997). For example, aggressive behaviour may increase risk-taking and expose a child to injuries such as falls or being struck by an object. By contrast pro-social behaviour may indicate "acting out" or a general outwardly behaviour of the child that increases exposure to injuries in general.

Quality of parenting was predictive of the occurrence of injury among children aged 2 to 11 years. In the longitudinal sample, among children 2-3 years old, positive parenting was linked to a lower risk of injury while inconsistent parenting was predictive of a higher risk of injury among children 4-11 years old. This observation indicates that improving parent-child interactions may reduce the rate of injury occurrence. With good interaction skills and effective parenting styles, parents can protect their children from the common environmental hazards (Finney & Cataldo, 1991). By having parents object if the child behaves in an unsafe manner or congratulate the child for behaving safely, both parents and children develop a better awareness and understanding of the relevant contingencies for appropriate and inappropriate behaviour (Peterson, Mori, & Scissors, 1986). As the child grows older, consistent parenting may be even more needed to reinforce the learning acquired in earlier stages.

5.2 Socioeconomic Disadvantage and Childhood Injury

This study also addressed the relative impact of family versus neighbourhood on childhood injury by examining which of family SES or indicators of neighbourhood disadvantage is more strongly related to childhood injury and if they interact with each other? It was also important to examine if these factors interact with family functioning, parenting or child behaviour in order to help identify the relevant units for intervention: family, neighbourhood or both.

In the cross-sectional analyses, family SES was positively related to the occurrence of childhood injury among children aged 2 to 11 years. This finding differs from other reports that show an inverse relationship (Nersesian, et al., 1985; Parker et al., 1991). Williams, Currie, Wright, et al. (1996) cite the severity of injuries as an important criterion in establishing evidence for socioeconomic gradients. With the exception of specific groups, such as pedestrian injuries and poisoning, the socioeconomic profile of non-fatal injuries is less clear-cut than for fatal injuries (Lyons, et al., 2000). Studies have been

more consistent in finding SES differences with mortality than morbidity, due to unintentional injuries (Williams, Currie, Wright, et al., 1996). Studies suggest that this inconsistency may be due to the social nature of the decision to attend an emergency department and the medical decision to admit the patient. Both seem to be influenced by the social class of the patient and his/her family (Towner et al., 1994; Walsh and Jarvis, 1992).

The reason for this discrepancy may also reside in the type of measures of family SES used. Some studies use the socioeconomic characteristics of the census tract of residence as a proxy for social class, whereas others use level of family income either in isolation or in various combinations with education and occupation. Moreover, studies have shown that the prestige of the occupation is a more refined indicator of social class than the type of occupation per se. For example, economic disadvantage seems to have a strong and consistent association with emotional and behavioural problems among children, whereas occupational prestige does not (Boyle & Lipman, 1998; McLoyd, 1998). In addition, not all the studies consider the level of education and occupation of both parents. The family measure of SES used in this study is comprehensive and includes not only family income, but also level of education and the prestige of the occupation of the parents. It is possible that this measure of family SES provides a more accurate reflection of the social status of the family and of its effect on injuries in general. However, results of this study may also be specific to our sample.*

After controlling for child and family variables, neighbourhood variables that were associated with childhood injury included both self-reported variables, as well as compositional descriptors of neighbourhood defined at the level of census enumeration area. Furthermore, the pattern of association between these variables and the occurrence of injury varied according to child age. Among children less than 2 years old, both the cross-sectional and longitudinal analyses revealed a protective effect of neighbourhood cohesion with probably a negative interaction with the level of difficulty of the child. Among children 2 to 3 years old, neighbourhood disadvantage was linked to lower odds of injury in the cross-sectional analyses. The longitudinal analyses suggest that neighbourhood disadvantage increased the risk of injury in this age group, with probably a synergistic effect with child's aggressive behaviour.

* About 67 percent of the injured children reported in the NLSCY were from families in the middle or upper middle levels of the income adequacy scale. An examination of the level of household income indicates that 61 percent of the injuries were reported by families with an income equal or higher than $40,000, whereas families with an income less than $10,000 reported only 1% of injuries. Moreover, families with an income equal or higher than $40,000 reported 78 percent of sports related injuries.

In both the cross-sectional and the longitudinal sample, prevalence of neighbourhood problems was consistently related to increased odds of injury. The longitudinal analyses suggest that increasing the percentage of single female-headed households may decrease the risk of injury among children 2-3 years old. Finally, among older children, increasing the percentage of families with low income may increase the risk of injuries.

While a number of studies highlight the importance of deprivation and inequality of income at the neighbourhood level, the present study indicates that other social mechanisms such as the level of neighbourhood cohesion are also important to consider. In other words, results of this study indicate that neighbourhood may exert its influence on the risk of injury through both structural and social effects (Simons, Johnson, Beaman, Conger, & Whitbeck, 1996). As indicated by the longitudinal analyses, a high proportion of single female-headed households in the neighbourhood can have a protective effect among children aged 2-3 years. In addition, neighbourhood characteristics seem to influence the risk of childhood injury through how the PMK perceives it (prevalence of neighbourhood problems and neighbourhood cohesion). To our knowledge, this type of effect has not been reported before. Proportion of single female-headed households, mostly used as an indicator of economic disadvantage, may act through a combination of mechanisms including collective socialization and parental perception of risk of injuries in disadvantaged settings (Jencks & Mayer, 1990; Platt and Pharoah, 1996). For younger children, collective responsibility for their safety may be reinforced in neighbourhoods with a high proportion of single female-headed households while parent's perception of risk of injuries may increase their awareness of the safety needs of their young children.

Similar to Boyle and Lipman's study of child problem behaviour (1998), we did not find any significant interaction between family SES and neighbourhood disadvantage. These two variables seem to influence the risk of injuries independently of each other and with varying effects according to child age. In a similar vein, we did not find interactions between neighbourhood disadvantage and family functioning. This result indicates that neighbourhood disadvantage and family functioning may have additive and independent effects. Furthermore, this study suggests that the effects of these variables may be modified by child's behaviour to different degrees and probably involving different mechanisms. Further research is needed to clarify these mechanisms. One general implication of this result may be that re-housing

policies or interventions addressed only towards neighbourhood may not be enough if dysfunctional family patterns and child's behavioural patterns continue to present a threat to children's safety.

5.3 Consistency of Effects

Finally, this study assessed if the models developed in the cross-sectional analyses can predict injuries two years later. Overall, results of this study indicate noticeable differences in the type and strength of associations of neighbourhood, family and child characteristics depending on child's age. The most consistent predictors seem to be within the family setting, were found for the younger age groups, and included parental perception of neighbourhood problems and cohesion, parenting and level of difficulty of the child. Child gender seems to be the strongest predictor of injuries with, as expected, a lower risk of injuries among girls. This result was found for all age groups in the longitudinal sample and in both the cross-sectional and longitudinal samples for older children (4-11 years). Numerous other studies have shown consistent gender differences in the occurrence of injuries among pre-school and school aged children (Baker, O'Neill, & Karpf, 1984; Canadian Institute of Child Health, 1994; Matheny, 1988; Rivara & Mueller, 1987). Finally, with the exception of children less than 2 years of age, the predictive models showed that children 2-3 years and 4-11 years old who were injured at baseline were less likely to be injured at follow-up. This result may indicate an increased parental awareness and supervision, or a learning effect among older children.

5.4 Strengths and Limitations

The findings and inferences of this study are to be considered in light of the strengths and weaknesses of the NLSCY database. The NLSCY results are unique in that they are based on a large representative sample of Canadian children, allowing for the calculation of estimates of risk and protective factors that are representative for Canadian children. Among the limitations of the data are the potential biases related to non-response (refusal or item non-response), biases associated with self-report questionnaires, and biases associated with recall (underestimation and privileged recall).

It is possible that recall of information about injuries in the preceding 12 months may be faulty. A review of the literature on parent recall sheds little light on this issue. However, one study suggests that injuries

requiring treatment are recalled accurately after a period of 2 years (Pless, Peckham, & Power, 1989). Poor recall has two components: non-systematic, e.g., simple forgetting, which should be random and could affect groups with and without any particular risk factor equally, and systematically biased reporting. With a random component, the result can be loss of statistical power and underestimation of true relative risks. Systematically biased reporting is more critical and the problem is to estimate the direction of bias. If parents feel guilty about the injury event and associate its occurrence with the presence of a risk factor, the most likely result is to distort reporting by minimizing the number of injuries reported (Pless, Peckham, & Power, 1989). Hundreds of parents reported more than two injuries during a 2-year period so such a bias is unlikely to be important.

Several other methodological issues require further consideration. First, the choice of variables and measures for this study was mainly based on the availability of the relevant measures in the NLSCY. There was no information on characteristics of the agent of injury, nor any specific measures of environmental hazards. Second, in our modeling, we did not examine reciprocal relationships between parenting and child behaviour. These variables are correlated and are likely to influence each other (Tables 3, 4 and 5). Third, the outcome variable used in this study was limited to the occurrence of any injury in the last 12 months prior to the survey. Results of the present study should be replicated in other samples and with specific injury outcomes to help assess their general validity. Fourth, in this study we have selected only one child per family in order to avoid clustering effects. More refined analyses using Hierarchical Linear Modeling would use the whole sample and would take into account the variations among children and across families.

With these limitations in mind, three strengths of this study are important to acknowledge. First, in the literature reviewed, consistency of the studies' results seems to vary according to type of design, i.e. prospective versus cross-sectional. In this study, a non-mediated model was tested and developed in the cross-sectional sample of the NLSCY, and was then used with the longitudinal data to allow for stronger statements of directionality of effects. Second, we have combined two different sources of measurement for socioeconomic disadvantage: one provided by the census linked data file, and one based on the report from the parents on family income, education and occupation. The two measures exhibit independent effects on injuries and indicate the need to consider them separately in studies of

socioeconomic disadvantage and injuries. Third, this study included measures of socioeconomic and neighbourhood disadvantage available in the census as well as indicators of social processes in the neighbourhood as they were perceived by the PMK. These measures included neighbourhood problems and cohesion, and suggest potential mechanisms of mediation of the effect of neighbourhood on childhood injuries that require further analyses. These analyses may provide further refinement to the findings in our literature review regarding the relative importance of indicators of neighbourhood disadvantage and family characteristics on injuries.

5.5 Implications for Research and Prevention

As social settings, neighbourhood and family must be examined as systems of interacting variables and processes (Corin, 1994). Such a systemic view of the social context of childhood injuries draws attention to the patterns of interdependence between different components of the family system and its environment (Soubhi & Potvin, 2000). Work by Valach, Young & Lynam (1996) suggests the need for health research to emphasize the social character of family members' interactions and health-related behaviours, and to conceive of them as family health promotion projects. Recent work by Fisher and Ransom (1995), Fisher et al., (1998), and Soubhi and Potvin (2000), shows that family members' interactions and transactions among themselves and with the external environment are related to family members' health and health promotion practices. In this view, families functioning and parenting are seen as child health-promoting interactions that are rooted and practiced within the social context of the family. Thus, parenting practices such as taking time to talk and play with the child, as well as child behaviour, are examined within the larger social unit of the family including the neighbourhood. Therefore, to relate childhood injuries to their social context amounts to taking into account the influence of the social environment of the home, including family patterns of interaction (e.g., family functioning, parenting practices), on the occurrence of childhood injuries. In addition, the influence of neighbourhood and how the parents perceive it must be taken into consideration.

Results of this study concur with this view. They suggest that families functioning and parenting, i.e., what family members do to relate to each other including their children, in addition to their socioeconomic category and the neighbourhood they live in, may affect the risk of childhood injury. This

study also indicates that the influence of family and neighbourhood varies depending on child's age and behaviour. In early childhood, this study suggests that community interventions may gain from an increased focus on neighbourhood processes of cohesion and collective socialization. For older children, concentration of income poverty and disadvantage in the neighbourhood may be more dominant factors in the risk of injuries. This finding indicates the potential to identify specific areas that deserve special attention in terms of resource allocation and planning, e.g., areas with high concentration of disadvantaged families. Indicators of social disadvantage are easily available in the Census and can be linked to specific geographical areas. Identification of these areas would also allow the development and testing of specific hypotheses for understanding the influence of neighbourhood on childhood injury. However, there is in general a need for action and research on the physical, the economic, the social and the educational sides of the equation. Improved targeting of resource allocation to deprived areas must be combined with educational and environmental strategies to increase the level of social cohesion and community involvement. As indicated by Zayas (1995), considering both the social and physical nature of the neighbourhood can provide a balanced assessment of neighborhood's impact on what parents will do with the child or how the child behaves. Restrictive parenting, for instance, may be very adaptive in a neighbourhood where the dangers to the child are immediate (Zayas, 1995).

Where should policy focus its efforts to reduce childhood injuries: on families or neighbourhoods? Results of this study suggest that family, neighbourhood and child behaviour are difficult to separate. Functional characteristics of the family system should be included in the design of studies that attempt to examine the environmental influences on childhood injuries. This study also suggests that indicators of neighbourhood and family SES should not be considered in isolation from parenting, i.e., from what parents may do to protect their children and reinforce safety rules among them. Strategies focusing only on improving the socioeconomic positioning of families, without attention to the patterns of parent-child interactions, would not lead to significant reductions of childhood injuries. Further research is needed to understand the determinants of effective parent-child interactions and the links between these patterns and other family processes.

On an operational level, experiences from various countries highlight the need to broaden safety interventions to strategies that combine both environmental and health gains (Dora & Racioppi, 2000).

Previous studies have shown that family members' patterns of interactions and transactions among themselves and with the external environment are related to family members' health and health promotion practices (Fisher & Ransom, 1995; Fisher et al., 1998; Soubhi & Potvin, 2000). In the present study, there are enough indications that similar patterns (e.g., family functioning, parenting, child behaviour, parental perceptions of neighbourhood) are linked to childhood injury. Community interventions should adopt an integrative approach and develop innovative ways to take into account the potential effects of family members' patterns of interaction among themselves and with their environment. Such family based strategies of injury prevention would be integrated with other strategies that address both environmental (physical and social) and health promotion goals and concerns. This approach calls for a complete rethinking of the role of community and social institutions in the day-to-day functioning of the family. Child-family dialectic would be the central target of such strategies and would be approached directly or through a number of community institutions. Three broadly defined strategies could guide such an integrative approach (Soubhi & Potvin, 2000):

1. Directly target family members within their homes, mostly through health education and information transfer aimed at increasing knowledge or improving practical health, parenting and safety skills. Programs of this type directly target behavior changes at the individual and interpersonal levels. Mass media campaigns and training sessions are examples of such programs.

2. Bring about changes in the social and community contexts which would in turn impact on the family, e.g. changes in influential decision-makers regarding social policies that have a bearing on family's health and safety. Programs of this type would be part of a social and structural strategy that seeks change in the social and community contexts. Health and safety promotion actions generated according to this strategy would be based on an ecological model of health promotion in which health and safety are in part determined by the components of the individual's ecosystem (family, community, culture, physical and social environment) (Epp, 1986).

3. Help create and/or strengthen the links between the family system and other social systems (school, day care, neighbourhood, worksite, etc.). These links would improve the family's access to necessary resources to promote and sustain health and safety of its members. Among these

resources, as suggested in this study, are various processes of collective socialization that can increase community involvement and level of cohesion among neighbours. Programs of this type involve networking, which we view as a strategy to create or reinforce the links between the family, and different systems that bear a direct or indirect influence on family members. This view parallels that of Bronfenbrenner (1986) on the influence of mesosystems, defined as links between different settings, relating the family to different social contexts such as the school or day care, the worksite, etc. These links may be represented by the social interactions between settings or by setting occupants' attitudes and expectations about each other. In an extensive review of research on the influence of external environments on family functioning, Bronfenbrenner (1986) stresses the importance of the nature and strength of the linkages between the family and its surrounding settings for child development. It has also been shown that the strength and diversity of the links between these different social contexts or microsystems increases their influence on the individuals involved (Bronfenbrenner, 1986; Tietjen, 1989). The links between microsystems provide adequate feedback, information and other resources to the family. These links would function as vehicles for the empowerment of families, increasing their capacity to extract and use the health and safety promoting resources in their environment.

6. Conclusion

In a representative sample of children aged from birth to 11 years living in Canada, this study has examined cross-sectional as well as longitudinal relationships between childhood injury and three sets of variables: neighbourhood, family and child characteristics. Neighbourhood measures that were mostly associated with risk of injuries included neighbourhood disadvantage, in particular among aggressive children 2-3 years old, and prevalence of neighbourhood problems. Protective factors included neighbourhood cohesion, in particular among difficult children less than 2 years old and percentage of single female-headed households among children 2-3 years old. The family measures mostly associated with risk of injury included inconsistent parenting among children 4-11 years old. Protective family factors included positive parenting. Among children aged 2-11 years, moderate but statistically significant interactions were found in the cross-sectional sample between level of family functioning, age and child's pro-social behaviour. Child characteristics included as risk factors being a boy, having a difficult temper for younger children, and being physically aggressive. Protective factors included being a girl, and having had an injury in the last 2 years especially among preschoolers and school-aged children.

Results of this study suggest that in early childhood, particular attention should be paid to neighbourhood processes of cohesion and collective socialization, while for older children, concentration of income poverty and disadvantage in the neighbourhood may be more important factors in increasing the risk of injuries. Improved targeting of resource allocation to deprived areas must be combined with educational and environmental strategies to increase the level of social cohesion and community involvement. Strategies focusing only on improving the socioeconomic positioning of families without attention to the patterns of family functioning and parent-child interactions would not lead to significant reductions in childhood injuries. Further research is needed to understand the determinants of effective patterns of family functioning and parent-child interactions and to clarify the links between these patterns and family's social and economic positioning as well as its interactions with the neighbourhood. Such avenues of research hold fruitful prospects for a better understanding of health and safety resource exchanges between different settings and their differential distribution among families.

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