FAMILY FUNCTION AND BEHAVIOUR IN CHILDREN AFTER TRAUMA

THE ASSOCIATION BETWEEN FAMILY FUNCTION AND CHILD BEHAVIOUR AND ITS RELATIONSHIP WITH EXPENDITURES FOR USE OF HEALTH AND SOCIAL SERVICES AMONG CHILDREN/YOUTH WHO SURVIVE TRAUMA

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Abstract

To date most research on long-term outcomes of childhood trauma has focused on traumatic brain injuries, but less is known about traumatic injuries not involving the brain. Since traumatic brain injuries can have persistent effects on child behaviour, I investigated whether other types of traumatic injuries could also affect child behaviour in the long term. Currently, limited information is available on possible associations between family function and child behaviour after child trauma; knowledge of the long-term costs of pediatric trauma is also lacking. The main goal of this study was to determine whether family function was associated with behaviour in children who experienced a traumatic injury eight to ten years ago. Additional goals were to determine current expenditures and use of health and social services by child trauma victims and their parents. Pediatric trauma victims were selected from a trauma database at a tertiary care hospital in the Hamilton-Wentworth region. The parents of these children were interviewed to obtain children's current behaviours and the family's use of health and social services. The results showed that injury severity was not associated with child behaviour, but associated with family functioning. No relationship was found between health and social service expenditures for children and their injury severity, but there was a relationship between parent health and social service expenditures and child injury severity. The results do not support an association between child behaviour and injury severity following trauma, but they do suggest that expenditures and use of services by injured children and their families are

affected long-term. The results suggest that future health and social service uses of injured children and their families may be better understood and planned for by recognizing the continuing effects of trauma. This information could help making appropriate health and social service programs more available to this population.

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I would like to thank my supervisor Dr. Gina Browne for all her valuable direction and support throughout the many phases of my thesis development. Thank you to Maria Wong for her assistance with coding the scripts for analyzing the data. And to my committee members, Dr. Linda O'Mara and Dr. Lehana Thabane for their encouragement and constructive comments that helped me develop and refine my thesis. Thank you also to Dr. Olive Wahoush for her willingness to serve as my external examiner. Finally, I would like to thank Michael Drescher for his invaluable guidance and encouragement in helping me to pursue my academic goals.

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List of Abbreviations and Symbols

AIS – Abbreviated Injury Scale

FAD – Family Assessment Device

HRQL – Health-Related Quality of Life

ISS – Injury Severity Score

LOS – Length of Stay

MMFF – McMaster Model of Family Functioning

MVC – Motor Vehicle Collision

NIS – Nationwide Inpatient Sample

QALY – Quality Adjusted Life Year

QOL – Quality of Life

Responder – Parent or Most Responsible Caregiver

PTSD – Post-Traumatic Stress Disorder

TBI – Traumatic Brain Injury

Declaration of Academic Achievement

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Chapter 1 - Introduction

To date the majority of research on outcomes of childhood trauma has focused on those with traumatic brain injuries (TBI). TBI, according to Winthrop (2010), is the most common cause of short and long-term impairment in pediatric trauma. However, severe traumatic injuries can also frequently occur in other areas of the body. Better comprehension of outcomes in the entire pediatric trauma population (TBI and non-TBI) can help direct healthcare resource utilization and provide evidence for screening tools designed to detect disabilities related to traumatic injury in children and youth.

Furthermore, there is limited knowledge about the association between current family function and behaviour problems among children and youth who sustained traumatic injury eight to ten years ago. Wade et al., (2004) found that support from family and friends was associated with decreased psychological distress and that there was a decrease in injury-related stress over time for the families of children with severe traumatic brain injuries (TBI) if they had high psychosocial support. However, studies such as this on the association between family function and injury related stress are rare.

To date, studies looking at the generalized long-term effects of trauma in the pediatric population and associated cost factors are lacking. Instead, most studies focus on the adult population. For example, Marwitz, Cifu, Englander & High (2001) studied the causes and incidence of re-hospitalization one to five years after adults incurred a TBI. They found that re-hospitalization rates up to

five years after TBI in their study population were as high as 17 % and amounted to almost half of the total health services costs related to the traumatic injuries. It is important to know if similar results can be found in the pediatric population where developmental milestones play an important role in service use. Assessment of costs associated with the long-term effects of trauma in children will help inform policy makers and increase the knowledge of how money is spent on patients once the acute phase of trauma has passed.

Research Goals and Objectives

This study had one primary objective and two secondary objectives, namely:

Primary Objective: The primary objective of the study was to determine whether current family function was associated with various dimensions of current behaviour in children/youth that experienced a traumatic injury eight to ten years previously.

Secondary Objective: (1) The first secondary objective was to determine the level of recent expenditures for use of health and social services in children/youth that experienced traumatic injury eight to ten years earlier. (2) The second secondary objective was to explore the factors that could explain recent behaviour and use of health and social services in children/youth that experienced traumatic injury eight to ten years earlier.

Hypotheses

Three null hypotheses based on the research objectives were tested in this study.

(1) There would be no relationship between current family function and current child behaviour eight to ten years following traumatic injury.

(2) There would be no relationship between current expenditures for use of health and social services and level of traumatic injury experienced by children eight to ten years ago.

(3) There would be no relationship between use of health and social services following a traumatic injury experienced by children eight to ten years ago and a combination of other explanatory factors.

Chapter 2 - Literature Review

Review Articles

A comprehensive search of the relevant literature was performed using both review and original articles (Appendix A). In the beginning of my review I focused on the review articles. Subsequently I dealt with the review of original articles. Review articles were systematically located using the databases: Medline, Web of Science and the Cumulative Index to Nursing and Allied Health Literature (CINAHL). The following search terms were applied: family function, trauma outcomes and children. Limits were used to focus the search to articles, which were review articles, and written in English. Articles from all years covered by the scope of the databases were included in the search (Medline: 1890's onwards, Web of Science: 1976 onwards, CINAHL: 1961 onwards). A total of 56 articles were located. A further 8 articles were found by review of the reference lists of the previously identified articles. The main findings of this review are as follows.

A review of pediatric trauma rehabilitation by Jaffe (2008) highlighted the need for studies that specifically focus on the pediatric population. This is important for providing pediatric trauma patients with standardized, effective and evidence-based care obtained in the pediatric population. The current study provides evidence of how children and their families cope with a variety of traumatic injury types and severities in the long term. Recent use of health services was quantified as expenditures or costs incurred by this population.

Several articles assessed outcomes and predictors of long-term function in children; however, the results were not always in agreement with one another. For example, Catroppa, Anderson, Godfrey & Rosenfeld (2011) studied children who had sustained a brain injury prior to starting school and evaluated them ten years post-injury to assess attentional deficits. Socio-economic status and family factors were inconsistent predictors of attentional ability in study participants (Catroppa et al., 2011). Earlier work by Taylor, Yeates, Wade, Drotar, Stancin and Burant (2001), however, suggested that poor family functioning can negatively impact child behaviour following traumatic brain injury (TBI) and vice versa. The inconsistency of these results illustrated the need for more work to clarify potential relationships between traumatic injury, family functioning and long-term child behaviour.

These studies also highlighted a strong bias in past research: The majority of studies focused on TBI while other severe traumatic injuries received much less attention. For example, Osmond, Brennan-Barnes and Shepard (2002) conducted a four-year retrospective chart review of pediatric trauma patients. They identified areas of prevention research and programming that are needed in this population. One of their findings was that in 65% of cases the most severe injury was to the head and neck region. TBI could have lasting effects on child development, however it is also important to study the other 35% of severe traumatic injuries as well. Injuries aside from brain injuries may also have had significant physical, psychological and possibly behavioural ramifications for

children. Studying all types of traumatic injury would enable a more complete understanding of the repercussions that traumatic injuries may have on children and their families from a socio-psychological and service use perspective.

Other studies not only explored outcomes of TBI, but also other injury types such as acquired brain injuries and burn injuries (Catroppa, Anderson, Morse, Haritou & Rosenfeld, 2007; Mangeot, Armstrong, Colvin, Yeates & Taylor, 2002; Yeates, Taylor, Wade, Drotar, Stancin & Minich, 2002; Yeates, Taylor, Walz, Stancin & Wade, 2010). However, the focus of these studies on specific injury types means that the findings cannot be broadly used for a general assessment of traumatic injury consequences and demand for services. Including a variety of types and severities of injury in this study sample provides for a better understanding of all the factors that influence child behaviour, family function, and use of health and social services in the long term.

A number of other review articles investigated issues around post-traumatic stress related to traumatic injury in children. The review of Spates, Waller, Samaraweera & Plaisier (2003) looked at the psychological and behavioural ramifications of traumatic injury in children. They found that trauma can cause short-term effects on child behaviour as well as lasting detrimental effects that can limit child behaviour development. They noted that all family members were at risk of developing acute and long-term functional difficulties, indicating that education on the effects of trauma and recognition of post-traumatic stress disorder (PTSD) is needed. They identified a number of

screening instruments for PTSD in children and adolescents and recommended short-term, periodic reassessment of the child and family members following the injury to ensure that psychosocial function was optimal (Spates et al., 2003). Olofsson, Bunketorp and Andersson (2008) explored the psychological repercussions for children and adolescents injured in traffic accidents. They found that practical guidelines regarding post-traumatic stress in children and their families were needed to identify those children and families who could benefit from further care to cope with potential psychosocial problems. Understanding the determinants of post-traumatic stress following traumatic injury can help direct health resources towards children in need. For example, Yehuda, Flory, Pratchett, Buxbaum, Ising and Holsboer (2010) suggested that posttraumatic stress disorder develops as a result of an interaction between an early life stressor and a genetic predisposition. They argued that in addition to improving the health system response to post traumatic stress in children, increased knowledge regarding these determinants could raise awareness and understanding among family members of the potentially significant symptoms that may develop in children following traumatic injury. If family members were aware of the possible psychosocial ramifications of trauma in children, they might be more likely to seek medical help early on thereby reducing the long term costs to the child, family and health system.

These studies have helped us recognize some of the effects of traumatic injury in children on their psychological health and that of their family members.

However, they tended to focus on short-term or intermediate-term effects. Little is known about the longer term effects of trauma on children's behaviour, family functioning and health and social service use. Long-term health effects of traumatic injury may place a significant burden on the health and social service system in the long run and this should be quantified if possible. Unfortunately, to date there is a paucity of this information. For example, the systematic review conducted by Dougherty, Forrest, Miller and Scott (2003) found that while the number of pediatric outcomes research articles increased twofold between 1994 and 1999, there were limited studies that assessed the health consequences of preventive, long-term management or therapeutic interventions given to children and adolescents. Another improvement to previous studies would be to investigate whether there may be a bidirectional interaction between the effects of traumatic injury on child behaviour development and family functioning. Previous studies tended to focus on the negative psychological consequences of trauma outcomes on behaviour and family functioning. They did not investigate whether positive behaviour and good family functioning can follow trauma.. Helping families to achieve positive family functioning might be another way for them to cope with negative psychological consequences of trauma in children, something that is not yet clear from the current research evidence.

Winthrop (2010) conducted a review of research on health-related quality of life (HRQL) of children and their families following traumatic injury. The goal of her research was to identify outcome predictors that could then be used to

guide the development of interventions and resources to optimize injury recovery. She found that although many children recovered from injury with little long-term ramifications, others continued to have long-term deficits that contributed to caregiver stress and family burden of injury. This review highlighted the importance of assessing HRQL as part of the standards of care and the need to develop evidence-based resources to improve long-term care outcomes (Winthrop, 2010). Therefore, another goal of this study was to identify the services most often used by injured children and their families to gain a better understanding of the resources important to the trauma population in the long term. Furthermore, simultaneous assessment of current behaviour and current family function following traumatic injury was done to provide evidence about issues that might arise in this population over time.

Original Articles

A further search for original research articles addressing the topics of family function, outcomes, pediatric trauma and costs was made including all years searchable by the respective databases (Medline: since 1894, Web of Science: since 1976 and CINAHL: since 1961). (For individual search terms and combinations of terms please see Appendix A). A total of 47 articles were located and assessed for their relevance to the current research question. The articles were grouped according to the themes “Family Functioning”, “Long-term Effects of Trauma” and “Costs of Trauma”. These themes will be used to discuss my findings.

Family Functioning.

The effects of traumatic injury can result in both physical limitations and psychological distress. These psychological effects in the injured child can impact the entire family and become a significant burden for the psychological health of the family of the victim. However, studies that investigate how family structure and functioning could make families resilient against psychological distress following traumatic injury are rare.

Wade et al. (2004) explored how pre-injury interpersonal resources and stressors affected the family's ability to adapt to their child's traumatic brain injury (TBI). They collected data on three injury levels: those with severe TBI, those with moderate TBI and those who sustained an orthopedic injury. The Life Stressors and Social Resource Inventory - Adult Form and the Family Burden of Injury Interview were used to collect data on parental adaptation following their child's injury. Data were collected at six and 12 months post-injury as well as on average, four years post-injury (Wade et al., 2004). The findings indicated that support from family and friends were protective against psychological distress and that there was a decrease in injury-related stress over time for the families of the severe TBI group if they had high resources and high stressors. The findings also showed that inter-personal tension with spouses was initially more likely to lead to greater injury-related stress (Wade et al., 2004). This study highlights the importance of support systems in helping families cope with the ramifications of traumatic injury to their children.

Long-term Effects of Trauma.

Traumatic injuries may have effects on a range of aspects of the psychosocial and physiological health of children. While these effects may be most apparent immediately post-injury, it is possible that some reductions in health may persist for long periods of time. These effects may be significant in children because they may affect the children's development. To date, however, few studies have assessed the effects of trauma on children for longer than one year.

Ameratunga et al. (2006) conducted a population-based study on the medium-term effects of motor vehicle collisions (MVC's) in New Zealand. They followed drivers involved in serious car crashes (defined as crashes leading to at least one occupant being admitted to hospital) and interviewed them about their pre-crash health as well as about their health at five and 18 months post-crash. Their findings indicated that the risk of decreased health 18 months post-crash relative to pre-crash was ten-fold higher for hospitalized crash drivers compared to those not hospitalized. Even more striking was the finding that even in non-hospitalized crash drivers the risk of decreased health was 3-fold higher compared to the control group of auto drivers not involved in accidents. And while physical function improved in all crash drivers from five to 18 months post-crash, general health, vitality, and mental health continued to decline. This study highlights the importance of conducting studies on health and use of health and social services following traumatic injury beyond the hospitalization and

immediate recovery phases. It also illustrates the need to understand how trauma affects victims who experience seemingly less severe injuries. What may initially appear to be a minor injury may still have long-term consequences, which is of particular relevance to the pediatric population where development may be impeded due to traumatic injury.

Samplis et al. (2006) explored the functional status and quality of life (QOL) of adult trauma survivors up to a year after their injury. They reported that MVC survivors experienced significant psychosocial impairment while those hurt in falls had decreased scores for physical function and mental health (Samplis et al., 2006). These results emphasize the fact that ramifications to psychosocial health may not be realized until an appreciable amount of time has passed since the injury. They also point to the need for similar studies in the pediatric population. To date, however, there have been few studies that have assessed the long-term social adjustment and functioning of pediatric patients following traumatic injury. Winthrop et al. (2005) assessed the quality of life post-injury in the pediatric population. However, their post-injury observations occurred at one, six months, and 12 months with information published only on the initial two time points. They concluded that both quality of life and physical function was below that of age-matched norms at six months after injury (Winthrop et al., 2005). This study highlights the need for longer-term follow-up in this population in order to better understand the process of recovery. The authors also noted that economic, social and personal strain was experienced by family members of the

injured children (Winthrop et al., 2005). This latter finding emphasizes the need to understand the impact of pediatric trauma on the psychosocial function of the child as well as of the whole family. Better comprehension of how families are affected by traumatic injury in children may mean that more effective services and screening tools could be developed to assess those who may be at risk of developing dysfunction.

Costs of Trauma.

To date there have been limited studies examining the costs associated with long-term traumatic injury in children. Costs can be quantified in numerous ways, however for the purpose of this study I was interested in the continuing long-term financial cost occurring to the health system as a result of the child and family experiencing a traumatic injury.

Marwitz, Cifu, Englander & High (2001) studied the causes and incidence of re-hospitalization one to five years after adults incurred a TBI. They found that re-hospitalization rates up to five years after TBI in their study population (n = 799) were as high as 17 % due to seizures, psychiatric issues and general health problems. They concluded that the cost associated with re-hospitalization must be taken into account when assessing the long-term consequences of injury (Marwitz et al., 2001). While this study was focused on TBI in adults, I believe that there could also be significant costs associated with traumatic injury (not necessarily brain injury) in children. Although children may appear to be functioning well in the short-term, over longer periods of time, such as several

years post-injury, possible additional long-term consequences and costs of traumatic injury may surface.

A number of other studies examined costs associated with TBI. Shi et al. (2009) used data from the 2006 Healthcare Cost and Utilization Project Kids' Inpatient Database (KID) to assess the characteristics and costs associated with TBI in US children under 20 years of age. They determined that in 2006, $2.56 billion was spent on hospital costs of an estimated 58,000 US children who incurred a TBI (implying an average cost of > $44,000 per child). Of those injuries, 39% were due to motor vehicle collisions (MVCs) and 21% were due to falls, with a higher distribution of falls occurring in children < 1 year and a significantly greater proportion of MVCs occurring in children > 15 years of age. The authors also used predictive mortality likelihood level, a disease staging measure, as a tool to estimate costs associated with hospitalization for TBI (Shi et al., 2009). They found that discharge status was routine for 94% of falls but only for 76% of MVCs. This means that a much greater proportion of the MVC victims were discharged to a long-term care facility or with a need for home health care (Shi et al., 2009). While hospital expenses are an enormous cost to the health service system, I believe that the costs associated with long-term care both in facilities and at home might also be great. For example, when care is provided in the home, costs associated with loss of income for the parent or caregiver must also be taken into account. Having accurate estimates of these

long-term care costs, which are so far unavailable, could provide a clearer picture of the total cost of childhood injury to society and their families.

Support for my proposal to improve assessment of long-term costs related to trauma came also from work done by Vangel, Rapport, Hanks and Black (2005). They explored costs associated with TBI in adults finding that disability and improvement during inpatient rehabilitation were better predictors of cost than the initial severity of the brain injury. They also found that during the 19-month duration of the study, residential care, home health care and state case management accounted for nearly half of the total health care costs and accounted for 27% of all Medicaid payments (Vangel et al., 2005). These costs reflected expense for services provided outside the acute care hospital setting, and were immense considering that only a third of the original patient sample required these services (Vangel et al., 2005). These findings highlight the importance of obtaining knowledge of the characteristics of children and families with high costs for use of services after discharge from hospital for traumatic injury. This knowledge could be used to target high cost patients and their needs.

Tilford, Aitken, Goodman & Adelson (2007) used cost-effectiveness to study how technological change in the treatment of TBI can affect the cost per quality-adjusted life year (QALY) in children. The study was conducted in the US and used Nationwide Inpatient Sample (NIS) databases to assess costs associated with inpatient stays and those associated with use of rehabilitation

services. Using repeated calculation of rehabilitation measures and incremental cost effectiveness ratios over the short term, they concluded that technological improvements in the care for children with TBI are worth the cost if children live at least five years following their injury (Tilford et al., 2007). While this study furthers our knowledge regarding the advancement of technology in pediatrics, it does not help us understand what long-term costs are incurred as an outcome of a broad spectrum of pediatric trauma injuries. Furthering this knowledge base can lead to better assessments of which technological advancements may be most efficiently used to care for the pediatric trauma population.

Chapter 3 - Methods

Study Design

This study was a historic cohort study of prognosis that used a cross-sectional approach to quantify the association between recent family function and child behaviour. The same design was used to quantify the current use and expenditures on health and social services by children/youth who experienced traumatic injury eight to ten years ago and their families.

Trauma Database Description

In order for pediatric trauma cases to be seen by a trauma team of physicians and nurse at Hamilton Health Sciences tertiary care hospitals, they must have an Injury Severity Score (ISS) of greater than 12 in which case they are automatically entered into the pediatric trauma database. The ISS is an anatomical scoring system that creates one score for multiple injuries to six different body regions and can have values ranging from 0 to 75 with higher scores indicating more severe injury (Baker, O'Neill, Haddon, & Long, 1974). The scoring system used for the individual regions is the Abbreviated Injury Scale (AIS). Injuries are ranked from 1 to 6 with 1 being a minor injury and 6 meaning not possible to survive (Copes, Sacco, Champion, & Bain, 1990). The top three scores of the regions are squared and then summed to reach the ISS.

Data Sources

The initial database consisted of six baseline variables: 1) ISS, 2) age of child at the time of injury, 3) length of stay (LOS) at Hamilton Health Science

tertiary care hospital, 4) the abbreviated injury scale for the head, 5) gender and 6) cause of injury. Baseline data for both responders and non-responders was available from January 2001 – December 2003 and was included in the analysis of the current study.

Participant Selection and Contact Process

The current study involved selecting children who experienced a traumatic injury between January 1, 2001 and December 31, 2003, which required the services of a trauma team and hospital admission at a tertiary care hospital in the Hamilton-Wentworth region. Service from a trauma team at the chosen hospital was contingent upon having an Injury Severity Score of greater than twelve (ISS > 12). Children that succumbed to their injuries and died during their hospital stay were excluded from the dataset. The most responsible caregiver of each child that meets the inclusion criteria (specified below) was recruited for the study.

The most responsible caregiver of each child was contacted via a letter from a pediatric trauma surgeon explaining the study and requesting their participation in answering three questionnaires to be administered over the phone.

If the caregivers contacted via letter did not wish to participate in the study, they were able to call a phone number and be removed from the list of study participants. Others were contacted by telephone for their verbal agreement to participate in the study. The questionnaires used were: the

National Longitudinal Study of Children and Youth (Statistics Canada, & Social Development Canada, 1994-2006), the McMaster Family Assessment Device (Byles, Byrne & Offord, 1988) and the Health and Social Services Utilization Questionnaire (Browne, Gafni & Roberts, 2006). Administration of the questionnaires by phone took approximately 20 to 45 minutes. The majority of questions were about the child/youth except for the final section on use of health and social services, which applies to both the child/youth and the caregiver (see Appendix B, C, D & E). A respondent could to decline to answer any question or withdraw from the study at any time.

Inclusion and Exclusion Criteria

Inclusion Criteria: The most responsible caregivers of those children who were between the ages of 0-18 years between January 2001 and December 2003 and received the services of a trauma team while inpatients at a tertiary trauma centre in Hamilton, ON were eligible to participate in the study. The children must have had an ISS>12 at the time of injury.

Exclusion Criteria: Sixteen subjects and their families who met the above criteria but succumbed to their injuries were not eligible to participate. Those subjects whose children had an ISS<12 were not be eligible.

Ethical Considerations

Research ethics board approval was sought from the Hamilton Health Sciences (HHS)/McMaster University Ethics board. This process included gaining ethics approval to use the data contained in the trauma database of all

subjects captured by the specified study years: January 2001- December 2003. Potential study subjects and their families were mailed a letter from the chief of service explaining the purpose of the study and describing the expectations of study subjects should they decide to participate. The questionnaires were administered to the most responsible caregiver of the child/youth identified in the pediatric trauma database. If the recipients did not wish to participate in the study, they called a number and their name was removed from the database of potential subjects. There were no further attempts to reach them at a later date. Three weeks after the study letters were mailed, the potential subjects were contacted by phone to request their participation in the study. At that time they could decline to participate or they could agree at which point the questionnaires were administered via phone. Their agreement to participate was taken as implied consent.

The information imparted by the study participants was maintained in a confidential manner. Once they had completed the interview, the hard copy of their data was stored in a locked location. Any information stored on computer was identified by a numeric code and the computer was encrypted with password entry. Participation in this study in no way affected their access or interactions they may have had with healthcare professional(s). If at any point during completion of the study questionnaires the participant wished to withdraw from the study, they were able to do so and their records were destroyed. There were

no known physical safety risks to the participants involved in this study and the interviewer was careful to avoid discussion that may provoke emotional distress.

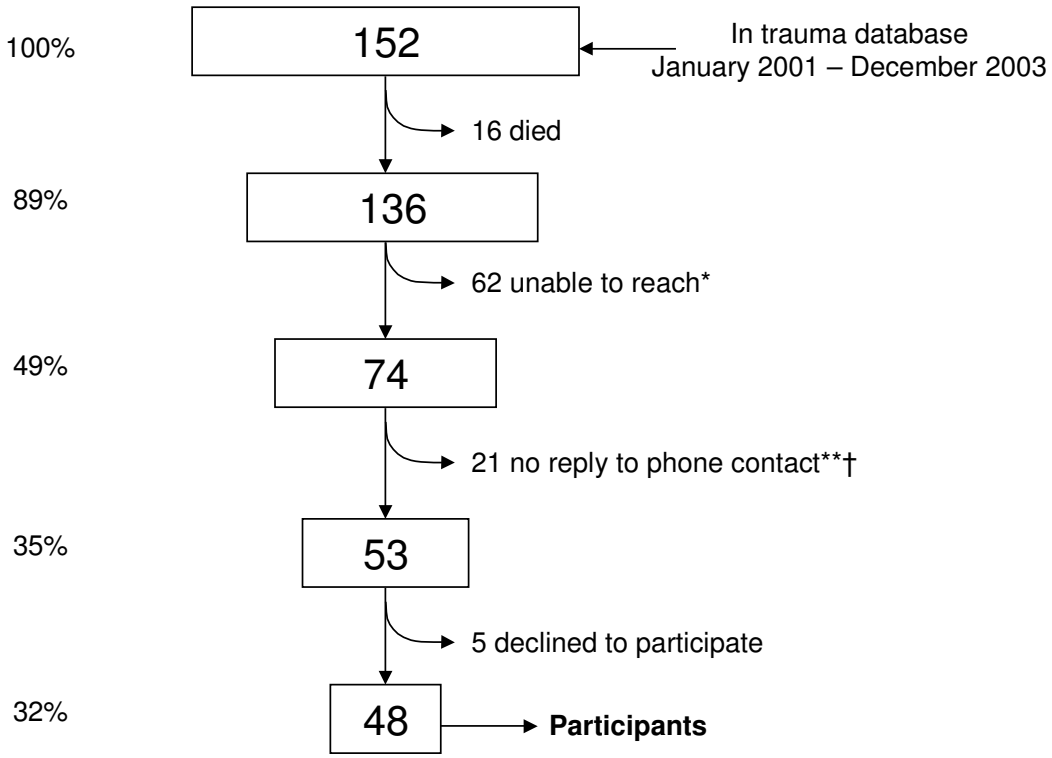

Figure 1.

Strobe Diagram of Recruitment Process of Children in Trauma Database (Injury Severity Score [ISS] greater than 12) between January 2001 and January 2004

Interview Description

The duration of the interviews was on average 30 minutes, ranging from 20 to 45 minutes during which time the three questionnaires: FAD, NLSCY and Health and Social Services Utilization Questionnaire were administered to the most knowledgeable caregiver of the study subjects via phone. It was acceptable for interview subjects to decline answers if they felt unable to respond or did not know the answer to the question.

Description of Survey Tools

Family Function.

In the absence of a clearly defined meaning of good family function, the following definition implemented by Access Economics Pty Limited (2010) for the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) in their final report on Positive Family Functioning, was used for the purposes of this study. Family functioning is made up of an interaction of six domains namely: emotional attributes, frameworks of family governance, engagement and cognitive development properties, physical health behaviour, intra-family relationships and social connectivity. When there is effective interaction between these attributes there will be clear expectations among the family members, emotional connectedness, engaging interactions, implementation of health promotion behaviours and quality relationships between family members and participation within the community (Access Economics Pty Limited, 2010). These attributes constitute good family functioning.

The McMaster Family Assessment Device (FAD) is a screening tool designed to obtain information on the functioning of the whole family in a brief and efficient way. The tool is implemented through direct questioning of individual family members yielding information on six dimensions of family functioning. The FAD arose from the McMaster Model of Family Functioning (MMFF), an extensive model that describes the structural and organizational aspects of the whole family and has been used to distinguish between healthy and unhealthy families (Epstein, Baldwin & Bishop, 1983). Arising from the field of psychiatry and based on systems theory, the model describes the family as a unit, whereby their organization and interactional patterns influence the family members' behaviour (Byles, Byrne, Boyle & Offord, 1988).

There are six dimensions of family functioning addressed by the FAD. These include: problem solving, communication, roles, affective responsiveness, affective involvement and behaviour control. These six dimensions originate from the MMFF, however, an additional dimension not included in the MMFF is that of general functioning, as assessment of the overall health and pathology of the family. For the purpose of this study, the 12-item General Functioning Scale (GF) of the FAD, plus a question on alcohol abuse, was used. Half of the items in this scale describe healthy family functioning and half describe unhealthy family functioning. The GF although focused on one scale, that of general functioning, encompasses aspects of the other scales. Scoring for the FAD can range from 0

to 36 with higher values indicating greater family dysfunction (Byles, Byrne, Boyle & Offord, 1988).

A study by Epstein, Baldwin and Bishop (1983) has validated the FAD showing that scores for clinical versus non-clinical families were significantly different in a discriminant analysis ($p < 0.001$). They also successfully used the FAD in a study of retirement adjustment and with regression analysis were able to predict 22% of the variance in the morale scores of husbands and 17% for the wives (Epstein, Baldwin & Bishop, 1983).

Each question on the 12-item McMaster Family Functioning Assessment consists of the following four possible answers: strongly agree, agree, disagree and strongly disagree (see Appendix B). The choice of answers to each question is numerically coded with the first being one and so forth up to four. For analysis, the questionnaires must be re-coded to reflect the lowest score possible being zero and to ensure the scoring accurately reflects the positivity or negativity of the response variable. Firstly, each answer was reduced by one value (for example, 1 becomes 0 and 2 becomes 1 and so on). Secondly, all odd items of the questionnaire were reverse scored. This means that items 1, 3, 5, 7, 9 and 11 are re-coded. Reverse scoring was achieved by subtracting the score for that item from 5. For example, if the answer to question 3 were given as 2, the reverse score would be 3 (5 - 2). After all odd items were re-coded the subject's family functioning score would be the sum of the 12 items in the questionnaire

with a possible score ranging from 0-36. A high score (>14) is indicative of poorer family function (Byles, Byrne, Boyle & Offord, 1988).

Health and Social Services Utilization Questionnaire.

The Health and Social Services Utilization Questionnaire (see Appendix E) was created to quantify the amounts and types of health and social services being used by families in Ontario (Browne, Gafni & Roberts, 2006). The origin of this device is the work of Browne, Byrne and Browne (1985) who developed a tool to assess health and social service use by making adjustments to Spitzer, Roberts and Delmore's (1976) work on the development of a health utilization index. In an attempt to validate the tool, clients' recollection of received lab services were compared with those record of lab services kept by the health clinic they had attended. The observed agreement between the values reported by clients and those on record at the lab were 0.72-0.99 with a Kappa statistic (adjusts for chance agreement) of between 0.48-0.89, thereby indicating that the tool was effective in capturing service use as measured by subject report of lab tests (Browne, Arpin, Corey, Fitch & Gafni, 1990). The original tool developed by Browne, Byrne and Browne (1985) has been updated to reflect changes in inflation and health costs with the current version being developed in 2006. Physician fees used in the tool were derived using as estimate from the Schedule of Benefits for Physician Services under the Health Insurance Act and the Ontario Health Insurance (OHIP) Schedule of Benefits and Fees website (Browne, Gafni & Roberts, 2006). Sources for the cost estimates of different services were

attained from varying geographical regions across the province to increase the representativeness for province wide costs. The questionnaire enables one to quantify the average health and social service costs across Ontario. The following services were included: community support services (paid and unpaid), medical procedures, blood tests, diagnostic tests, hospitals (day surgery), emergency services, hospices, medications (prescription and non-prescription), transportation costs and employment and income data (Browne, Gafni, & Roberts, 2006).

National Longitudinal Survey of Child and Youth (NLSCY).

The National Longitudinal Survey of Children and Youth (NLSCY) is a long-term study of children designed to follow the development of children into early adulthood conducted by Statistics Canada and Human Resources and Skills Development Canada. The survey used is designed to capture information on a variety of topics such as: physical development, learning and behaviour as well as on the social setting (Statistics Canada, 2010). For the purposes of this study the 42 question behavioural component (behavioural and aggressive behaviour) of the NLSCY for children aged 6-19 years was used as this focused on recent behaviour of the child. Consisting of 41 questions the behavioural component (see Appendix C) is further subdivided into six categories, which are then individually scored to reflect the child's behaviour in that component. For each question there are three possible answers: 'never or not true', 'sometimes or somewhat true' and 'often or very true'. They are coded numerically in

ascending order from 1 to 3. For the purposes of analysis these answers were re-coded by subtracting one (for example, 1 becomes 0 and 2 becomes 1) from each answer so that the lowest possible score would be zero on each component. Hyperactivity-inattention, the first component, consists of eight questions, the results of which were summed to give an indication of hyperactivity for a maximum of 14. A high score is indicative of hyperactive behaviour. Pro-social behaviour constitutes the second component, with ten questions, a maximum of 20 and a high score being indicative of positive behaviour. Emotional disorder-anxiety is the third component, with seven questions, a maximum of 14 and a high score indicating anxiety and emotional disorder. The fourth component is the conduct disorder-physical aggression score, of which there are six questions, a maximum of 12 points and a high score also indicating a conduct disorder and physical aggression. Indirect aggression, the fifth component, consists of five questions, a maximum of 10 points and a high score indicating indirectly aggressive behaviour. The final component is the property offenses score, made up of six questions, a maximum of 12 points and once again a high score indicative of a tendency to commit property offenses.

The internal consistency (correlation among individual questionnaire items) of the six behavioural components of the NLSCY has been assessed for children of 7 to 11 years old during the survey's using Cronbach's alpha. It was found that internal consistency varied from 0.64 to 0.84 (Ma, 2002), depending on the specific behaviour (Table 1).

Validation of the six behavioural components of the NLSCY depends on the availability of a reference value or "gold standard". For most of the six behavioural components no standardized criteria exist and validation of these behavioural components has therefore not occurred. The hyperactivity – inattention component is the only behavioural component of the NLSCY that has been validated (Charach, Lin & To, 2010). A clinical diagnosis of emotional disorder and methylphenidate prescription (for controlling symptoms of attention deficit hyperactivity disorder) were used to identify children for which health professionals and parents expressed therapeutic concern.

Table 1.
Internal Consistency of NLSCY Behavioural Components
(Ma, 2002)

Behavioural Component	Cronbach's Alpha
Hyperactivity – Inattention	0.84
Pro-social Behaviour	0.82
Emotional Disorder – Anxiety	0.79
Physical Aggression – Conduct Disorder	0.77
Indirect Aggression	0.78
Property Offence	0.64

Using an additional eighth questionnaire item for the hyperactivity – inattention component, which increases the maximum score for this component to 16, Charach, Lin & To (2010) found that a threshold of 14 was a highly specific

though not very sensitive indicator of clinical hyperactivity – inattention. General utility of the behavioural components of the NLSCY for psycho-social research is exemplified by a variety of studies that utilize these components. Various behavioural components have been used to conduct research in areas such as depression, attention deficit hyperactivity disorder and behavioural and emotional problems (Charach, Lin & To, 2010; Guerriere, Ungar, Corey, Croxford, Tranmer, Tullis & Coyte, 2006; Ma, 2002).

Aggressive Behaviour.

The NLSCY aggressive behaviour component, consisting of six questions was utilized in addition to the behaviour assessment to define current behaviour of children and youth in the study. These questions addressing issues such as school attendance, alcohol consumption, response to authority and involvement with the police could be answered by four possible responses: never, once, twice or more than twice in the past year (see Appendix D). They were numerically coded from one to four in the original questionnaire and for the purposes of the current study were re-coded to zero, one, two and three so that the lowest possible score would be zero.

Statistics

Descriptives:

The study population was initially analyzed using standard descriptive statistics such as mean, minimum and maximum and standard deviation age at accident, ISS, length of stay in hospital. Similar descriptive statistics were

calculated for family function, health and social services expenditure and health and social services use. At the same time, the frequencies of children's gender and type of accident were determined. Continuous variables were initially tested for Normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). If the statistical analyses required normality of data distribution and the variables of interest were not normally distributed, then these variables were log transformed prior to conducting the analyses. In cases where variable values were zero, I set them to one before log transforming them.

Possible differences in ISS between those who completed the survey of family functioning, behaviour and health and service utilization (responders) were compared with those who did not complete the survey (non-responders).

Nonparametric tests (Independent Samples Mann-Whitney U Test, Independent Samples Median Test) were used to analyze pooled responders and non-responders together for differences in frequencies of subjects by gender and accident type as well for differences in ISS between gender and accident type.

Hypothesis One:

The association of family function and child behaviour in those children who experienced a traumatic injury between 2001-2003 was explored using a multivariate multivariable linear regression analysis to identify any relationships between these factors. Multivariate regression was chosen to decrease the likelihood of type one errors that may have occurred by doing multiple univariate regressions.

Hypothesis Two:

Multivariate linear regression was used to determine whether there was an effect of ISS on health and social service costs for responder and child eight to ten years later. Cost was quantified by summing expenditures over similar service types (e.g., all general and specialist physician service costs). Because of non-normal distribution of the cost data, all cost variables were log transformed before analysis.

Hypothesis Three:

The effect of a variety of continuous and categorical variables were investigated on use of health and social services by both the responder and the child. Use was quantified by counts of the number of uses of the particular service type. Since count data tend not to be normally distributed, the Poisson loglinear regression model was used to analyze relationships. Since the available models for Poisson loglinear regression do not allow for multivariate analysis, multiple univariate analyses of use of health and social services was performed. All analyses were performed using SPSS 18 (Chicago, Illinois).

Chapter 4 - Results

Descriptive Statistics

The entire dataset consisted of 136 subjects who experienced a traumatic injury that required the services of a trauma team between January 2001 and December 2003. Children's age at accident ranged from zero (before their first birthday) to 17 years, their injury severity score (ISS) ranged from 13 to 43 and their length of stay in the hospital (LOS) ranged from 2 to 112 days (Table 2).

Table 2.
Descriptive Statistics for All Subjects in Database (n = 136)

Demographic Variable	Mean	Standard Deviation	Minimum	Maximum
Age at accident (Years)	9.4	5.0	0	17
Injury Severity Score (ISS)	20.3	6.9	13	43
Length of Stay (Days)	12.9	16.3	2	112

There were 50 girls and 86 boys in the database. I tested the frequencies of girls and boys with the null hypothesis that equal numbers of subjects were expected in each gender. A chi-squared test of differences between groups indicated that there were significantly more males than females represented in this dataset ($\chi^2 = 9.53$; degree of freedom =1; $p = 0.002$).

The type of accident preceding the subjects' traumatic injuries was explored by accidents into three types (MVC, fall, other: Table 3). The first group was 'motor vehicles collisions' (MVC) which included collisions with pedestrians and those involving motorcycles. The second group was 'falls', and included

those situations where the caregiver fell while holding the child. The third group called 'other' consisted of atypical injuries, for example, burns, abuse, and equestrian accidents. The null hypothesis was that equal numbers of subjects were expected in each of the accident types, i.e., about 45 subjects for each accident type. A Chi-square goodness of fit test of difference between groups showed a significant difference between the expected and observed subject distribution across accident types, χ^2 (2, N=136)= 25.47, p<0.001, meaning that the null hypothesis of equal counts between accident types was rejected. The actual counts were MVC 70, falls 44 and other 22, meaning that there were more subjects involved in MVC's than expected and less subjects involved in atypical injuries.

Table 3.
Accident Type – Observed & Expected

	Observed N	Expected N	Residual
MVC	70	45.3	24.7
Fall	44	45.3	-1.3
Other	22	45.3	-23.3
Total	136		

Note:
MVC: motor vehicle collision

Since ISS was a key variable for testing the study hypotheses, two tests of normal distribution (Kolmogorov-Smirnov and Shapiro-Wilk tests) were used to explore the ISS distribution across all subjects in the dataset. Both the

Kolmogorov-Smirnov and Shapiro-Wilk tests of normality were significant meaning that the null hypothesis of normal distribution for ISS was rejected. The ISS data was then log transformed to help achieve a normal distribution thereby making it possible to do further statistical tests such as correlation and regression which necessitate normally distributed data.

The log-transformed ISS data was then explored in relation to gender using the non-parametric Mann-Whitney Independent Samples test. The null hypothesis is that ISS does not differ between girls and boys. The results of the test showed that ISS did not differ significantly between gender (Test statistic = 0.34, p = 0.736). It was also found that median ISS was not significantly different among accident types (Test statistic = 3.81, p = 0.433).

I also compared responders to non-responders for differences in ISS, age at accident and LOS as well as for differences in the distribution of subjects by gender and accident type. Mann-Whitney's U Test indicated that responders and non-responders differed in ISS of their children (U = -2.89, N = 136, p = 0.004), with ISS of non-responders' children on average being approximately 4 units higher than ISS of responders' children. Neither age at accident nor LOS differed significantly between responders and non-responders (age at accident: U = 0.19, N = 136, p = 0.850, LOS: U = -1.28, N = 136, p = 0.199). Also the distributions of subjects between gender and among accident types did not differ between responders and non-responders (gender: χ^2 (1) = 0.02, p = 0.896, accident type: χ^2 (2) = 0.91, p = 0.636).

Hypothesis One - Relationship Between Family Functioning and Child Behaviour Following Traumatic Injury

The study's first hypothesis was that there would be no relationship between family function and child behaviour eight to ten years following traumatic injury. Initially, in order to test this hypothesis multivariate linear regression was used to explore the effects of family function on child behaviours as measured by the sub-group constructs of the NLSCY. Family function was the independent variable and the sub-group constructs of the NLSCY (Hyperactivity/inattention, pro-social, anxiety and emotional, conduct disorder/physical aggression, indirect aggression, property offence and aggressive behaviour) were the dependent variables. For

Table 4.

Behavioural Variables (NLSCY) (Dependent Variables) as Predicted by Family Function (Independent Variable) for Children that Experienced a Traumatic Injury Eight to Ten Years Earlier (N=48)

Behavioural Variable	*b*	*t*	df	*P*
Hyperactivity & Inattention	0.318	3.334	40	***0.002***
Pro-social	-0.400	-3.975	40	***<0.001***
Anxiety and Emotional Dysfunction	0.266	3.313	40	***0.002***
Conduct Disorder & Physical Aggression	0.207	4.357	40	***<0.001***
Indirect Aggression	0.082	1.799	40	0.079
Property Offence	0.167	3.527	40	***0.001***
Aggressive Behaviour	0.035	1.779	40	0.082

all constructs except indirect aggression, property offence and aggressive behaviour, family function was found to significantly explain child behaviour (Table 4 & 5).

Table 5.

Variance in Behavioural Variables (NLSCY) as Explained by Family Function for Children that Experienced a Traumatic Injury Eight to Ten Years Earlier (N=48)

Behavioural Variable	*SS*	*df*	*MS*	*F*	*P*	R^2
Hyperactivity & Inattention	131.45	1	131.45	11.12	***0.002***	0.202
Pro-social	207.09	1	207.09	15.80	***<0.001***	0.264
Anxiety and Emotional Dysfunction	91.87	1	91.87	10.98	***0.002***	0.200
Conduct Disorder & Physical Aggression	55.74	1	55.74	18.98	***<0.001***	0.301
Indirect Aggression	8.72	1	8.72	3.24	0.079	0.069
Property Offence	1.76	1	1.76	0.61	0.439	0.220
Aggressive Behaviour	2.51	1	2.51	5.07	***0.029***	0.067

The next step was to investigate how might ISS interact with family function to determine child behaviour. This necessitated using a multivariate and multivariable linear regression with three independent variables: family function, ISS and their interaction (multivariable regression). The dependent variables were the NLSCY behaviour measures. Tests of this multivariable regression model did not show any significant effect of either family function, ISS nor the

interaction family function with ISS on child behaviour 8 to 10 years following traumatic injury (Table 6).

Table 6.
Test of Multivariate and Multivariable Regression of Child Behaviours on Family Function, ISS and Family Function with ISS Using Pillai's Trace with 7, 36 Degrees of Freedom

Independent Variable	Pillai's Trace	F	P
Family Function	0.16	0.98	0.461
ISS	0.21	1.40	0.238
Family Function * ISS	0.21	1.36	0.251

Note:
ISS: injury severity score

This means that the interaction term of current family function with the historic ISS was not a significant factor affecting current child behaviour in children and youth who experienced traumatic injury 8 to 10 years ago. Subsequently the multivariable regression was run without the interaction term between family function and ISS. In this multivariable regression, ISS did not significantly explain the children's current behaviour (Table 7), suggesting that ISS does not affect current child behaviour in children and youth who experienced traumatic injury 8 to 10 years ago.

I further explored whether ISS and family function were in fact correlated and therefore a possible effect of ISS on child behaviour was absorbed by family function and led to a lack of significance in the results. But the correlation is not

significant, r = 0.10, n = 48, p = 0.944, indicating that there was no relationship between family functioning and ISS.

Table 7.
Test of Multivariable Regression of Child Behaviours on Family Function and ISS Using Pillai's Trace with 7, 37 Degrees of Freedom

Independent Variable	Pillai's Trace	F	P
Family Function	0.49	5.14	***<0.001***
ISS	0.07	0.40	0.898

Note:
ISS: injury severity score

To corroborate the findings of the multivariable regression analysis I performed multiple pairwise correlation analyses. All pairwise tests of NLSCY behaviour variables with family function indicate a significant positive relationship, $r \geq 0.361$, $n \geq 47$, $p \leq 0.013$, except for pro-social behaviour which showed a significant negative relationship, $r = -0.554$, $n = 48$, $p < 0.001$ and for indirect aggression, which is not significantly related to family function, $r = 0.261$, $n = 47$, $p = 0.076$. The results are similar for multiple pairwise correlations controlling for ISS (partial correlations), except that the strength of the relationship slightly weakened for all pairwise tests. Only for the relationship of hyperactivity and attention disorder, the strength of the relationship slightly increased from $r = 0.441$ to $r = 0.453$. This suggests that ISS was not a factor that mediated the influence of family function on children's behaviour in the long term after traumatic injury.

Hypothesis Two - Relationship Between Expenditures on Physicians, Health and Social Services and Traumatic Injury

Null hypothesis two states that there would no relationship between current expenditures for use of health and social services and level of traumatic injury experienced by children 8 to 10 years ago. However, health and social service expenditures can be assessed with a variety of measures and there was no presumption that any of these measures were more relevant than the others. Therefore I decided to investigate the relationship between service expenditure and level of traumatic injury for a range of cost variables. Initially the descriptive statistics were explored for the expenditures by children and their most responsible caregivers (responder) on health and social services (Table 8).

Next, a preliminary, visual exploration of these different cost variables was performed and suggested that most cost variables did not have a relationship with level of traumatic injury. For example, a plot of all system costs incurred by children on ISS did not suggest that a relationship between these variables existed (Figure 2).

An additional regression analysis of all system costs incurred by children on ISS was not significant, $R^2 = 0.01$, $F(1,46) = 0.42$, $p = 0.521$, confirming the result of the visual exploration.

A notable exception to the general lack of relationships between cost variables and ISS was the total cost for health and social services for the

respondent, which seemed to increase with the level of traumatic injury experienced by the child (Figure 3).

Table 8.
Expenditures by Children and Responders on Physicians, Health and Social Services (N = 48)

Total Costs	Maximum ($)	Mean ($)	Std Deviation
Responder			
General/Specialist Physician	597.24	58.97	101.86
Health & Social Services	1,436.00	167.73	250.42
Other Health Related Services	3,000.00	200.07	523.22
All Services	3,131.00	426.78	643.57
Child			
General/Specialist Physician	255.00	55.12	73.64
Health & Social Services	1,738.00	216.65	372.71
Other Health Related Services	3,553.00	199.53	601.42
All Services	4,631.00	471.30	854.25
Direct Cost to Family	4,010.00	293.50	925.54
Value Cheques Received	32,006.00	3,135.04	6,236.65
All Costs to System	32,407.00	4,326.62	6,269.97

Notes:
Health & Social Services: Allied health and social support services eg) physio, counselors, meals on wheels, community support
Other Health Related Services: eg) hospital admissions, aids and devices, medications, outpatient tests
Direct Cost to Family: eg) parking, household assistance, wages lost, travel
Value Cheques Received: All cheques received (government &/or private insurance)
All Costs to System: Costs to health system, respondent, private insurers, government

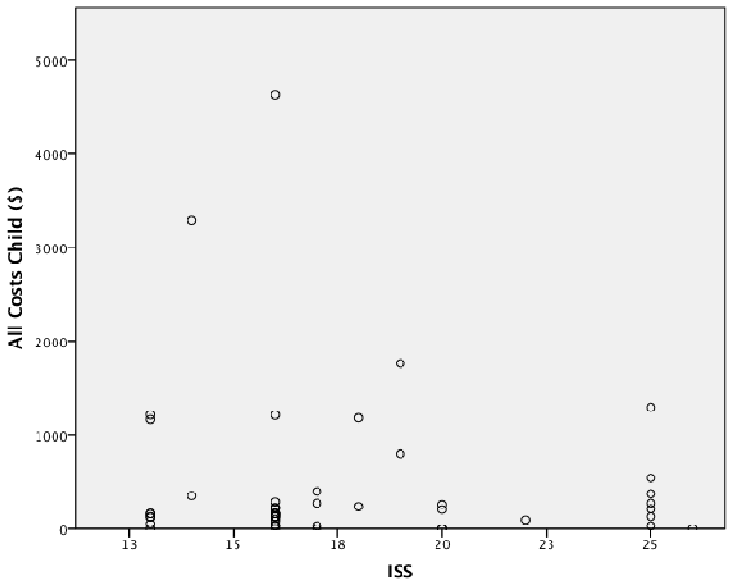

Figure 2.
All Health & Social Service Costs Incurred by Child in Past 6 Months Plotted by Injury Severity Score (ISS) at Time of Accident (8-10 years ago).

Again, an additional regression analysis of the health and social service costs incurred by the responder on ISS confirmed the result of the visual exploration, which suggested a significant relationship, $R^2 = 0.38$, $F(1,46) = 7.53$, $p = 0.009$. However, in order for a linear regression to be valid, the cost data must be normally distributed. In order to assess this, the distribution of the total health and social service costs was tested for normality using the Kolmogorov-Smirnov and Shapiro-Wilk tests of normality. The results for both tests were significant indicating that the health and social service costs were not normally distributed ($p < 0.001$ for both tests). To compensate for this non-normal distribution, the health and social service costs were log transformed to achieve a

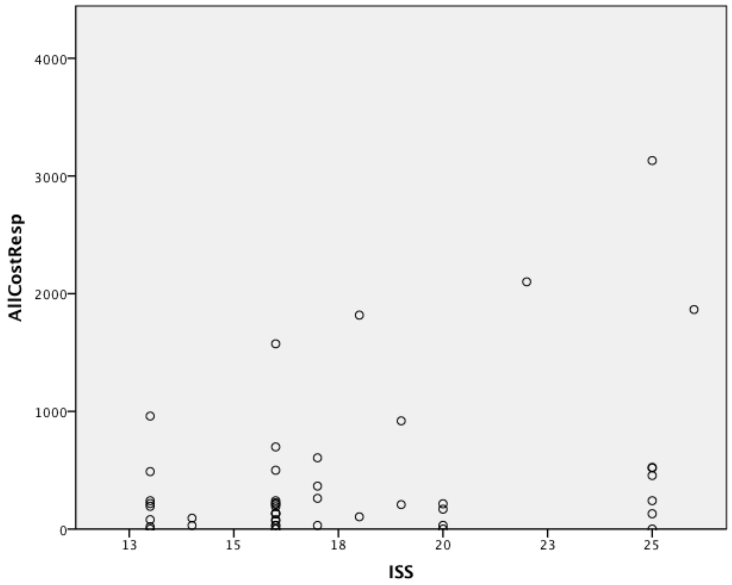

Figure 3.
All Health & Social Service Costs Incurred by Responder in Past 6 Months Plotted by Injury Severity Score (ISS) of Child at Time of Accident (8-10 years ago).

more normal distribution. While the distribution of the data improved, it also led to a number of outliers due to values which were originally zero and were given value "1" in order to log transform them. The regression was re-run with the log transformed data resulting in a non-significant effect of ISS on responder health and social service costs, $R^2 = 0.036$, $F(1,46) = 1.727$, $p = 0.195$. But looking at the scatter plot there appeared to be a trend in the data (Figure 4). It appeared that the zero-cost values that I assigned cost "1" and that were converted to zero by the log transformation, resulted in outliers that may have been skewing the data in favour of these low values. To test this hypothesis, the outliers were removed and the regression recomputed (Figure 5). In this instance the result

was significant with higher ISS being a predictor of increased health and social service costs for the responders, $R^2 = 0.154$, $F(1,46) = 7.465$, $p = 0.009$.

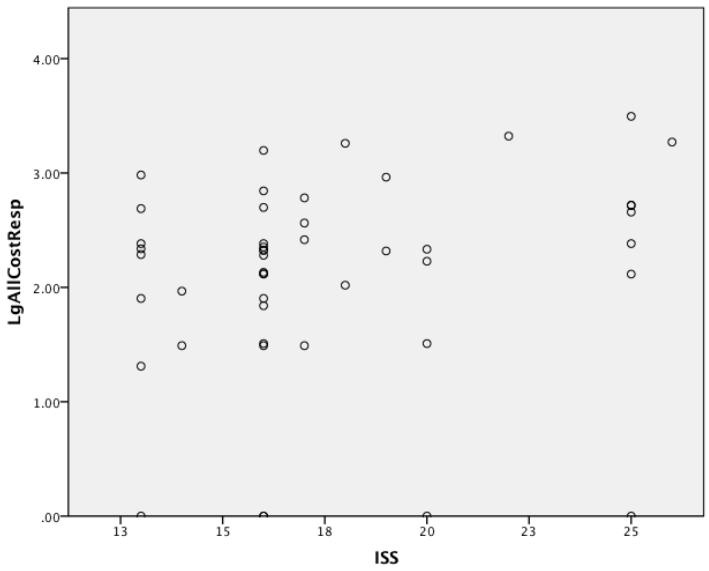

Figure 4.
Log of All System Costs Respondent in Past 6 Months Plotted by Injury Severity Score (ISS) of Child at Time of Accident (8-10 years ago) with Outliers.

Next a multivariate linear regression was done to explore the effect of ISS on all of the health system costs (all health and social service costs) incurred by children and their caregivers in the past six months. A multivariate linear regression was chosen because using multiple univariate regressions would have increased the likelihood of experiencing a type one error that could erroneously suggest any significant effects. Because the visual inspection of the data suggested that the data was not normally distributed, all cost data was log

transformed in an effort to achieve a normal distribution prior to running the regression.

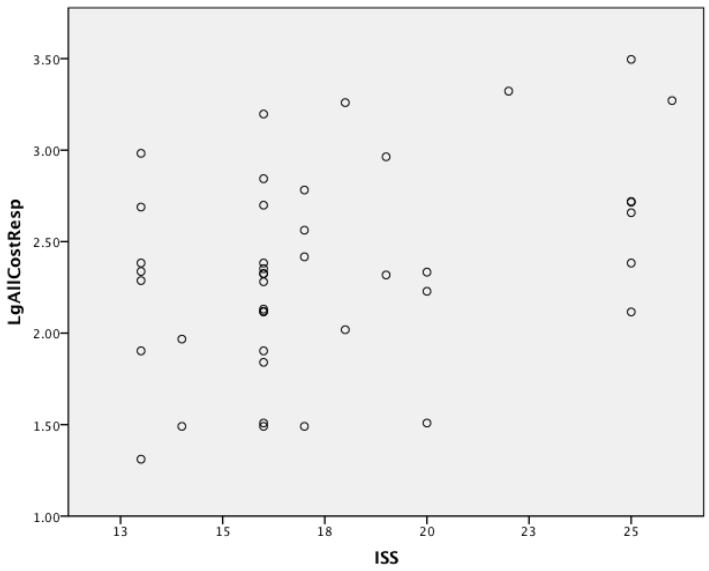

Figure 5.
Log of All System Costs Respondent in Past 6 Months Plotted by Injury Severity Score (ISS) of Child at Time of Accident (8-10 years ago) without Outliers.

The result of this multivariate analysis was not significant, Pillai's Trace = 0.257, F = 1.103, df = 11, 35, p = 0.388, meaning that the null hypothesis of no relationship between current expenditures for use of physicians, health and social services and traumatic injury experienced by children 8 to 10 years ago could not be rejected for any of the cost variables (Table 9).

When the outliers that skewed the responder health and social service costs in previous analyses were removed from the data set and the multivariable regression re-run, the overall multivariable regression model was not significant, Pillai's Trace = 0.341, F = 1.461, df = 11, 31, p = 0.196. However, a number of

the individual cost variables for the responder showed significant relationships with child ISS (Table 10). Total current costs incurred by the responder for all services (physicians, health and social) was significantly related to the child's

Table 9.

Multivariate Linear Regression of the effect of Injury Severity Score (ISS) (Independent Variables) on Logs of Expenditures on Physicians, Health and Social Services (Dependent Variables) (N =48)

Log Transformed Costs	*SS*	*df*	*MS*	*F*	*P*	R^2
Responder						
General/Specialist Physician	0.20	1	0.20	0.24	0.624	0.01
Health & Social Services	3.03	1	3.03	2.21	0.144	0.05
Other Health Related Services	3.74	1	3.74	2.83	0.100	0.06
All Services	0.64	1	0.64	0.90	0.347	0.02
Child						
General/Specialist Physician	0.07	1	0.07	0.08	0.780	<0.01
Health & Social Services	0.01	1	0.01	0.01	0.940	<0.01
Other Health Related Services	0.17	1	0.17	0.13	0.720	<0.01
All Services	0.31	1	0.31	0.34	0.564	0.01
Direct Cost to Family	1.12	1	1.12	0.83	0.366	0.02
Value Cheques Received	0.05	1	0.05	0.02	0.878	<0.01
All Costs to System	0.55	1	0.55	0.91	0.345	0.02

Notes:

Health & Social Services: eg) physio, counselors, meals on wheels, community support

Other Health Related Services: eg) hospital admissions, aids, devices, medications, tests

Direct Cost to Family: eg) parking, household assistance, wages lost, travel

Value Cheques Received: All cheques received (government &/or private insurance)

All Costs to System: Costs to health system, respondent, private insurers, government

historic ISS at time of accident. Also, the cost for other health related services

Table 10.

Multivariate Linear Regression of the Effect of Injury Severity Score (ISS) (Independent Variable) on the Logs of Expenditures on Physicians, Health and Social Services on (Dependent Variables) Without Outliers (N = 48)

Log Transformed Costs	*SS*	*df*	*MS*	*F*	*P*	R^2
Responder						
General/Specialist Physician	0.58	1	0.58	0.78	0.383	0.02
Health & Social Services	4.72	1	4.72	3.77	0.059	0.08
Other Health Related Services	5.31	1	5.31	4.14	***0.048***	0.09
All Services	1.91	1	1.91	7.47	***0.009***	0.15
Child						
General/Specialist Physician	0.25	1	0.25	0.27	0.607	0.01
Health & Social Services	0.24	1	0.24	0.17	0.684	<0.01
Other Health Related Services	0.35	1	0.35	0.25	0.618	0.01
All Services	0.56	1	0.56	0.75	0.393	0.02
Direct Cost to Family	0.30	1	0.30	0.22	0.643	0.01
Value Cheques Received	0.20	1	0.20	0.09	0.767	<0.01
All Costs to System	0.26	1	0.26	0.70	0.409	0.02

Notes:

Health & Social Services: eg) physio, counselors, meals on wheels, community support

Other Health Related Services: eg) hospital admissions, aids, devices, medications, tests

Direct Cost to Family: eg) parking, household assistance, wages lost, travel

Value Cheques Received: All cheques received (government &/or private insurance)

All Costs to System: Costs to health system, respondent, private insurers, government

incurred by the responder was significantly related to the child's ISS at time of accident. Additionally, health and social services costs showed a non-significant trend in their relationship to child ISS.

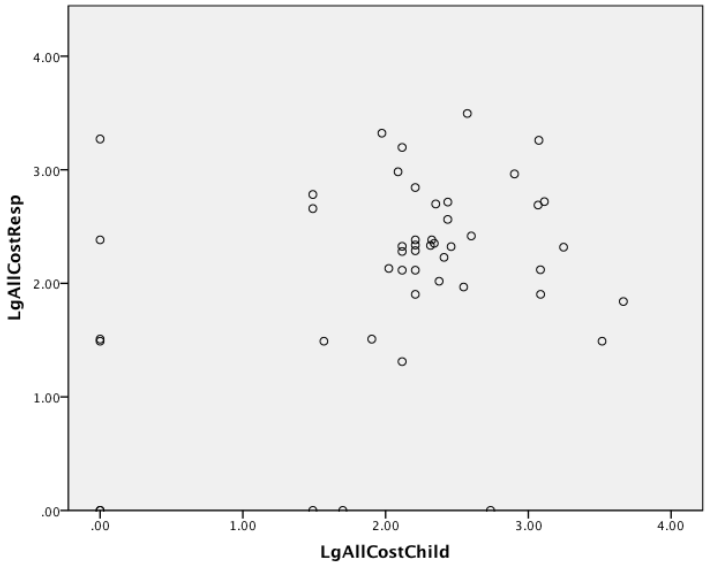

Figure 6.
Plot of Log of Total Cost Responder Against Log of Total Cost Child

A final investigation of total costs incurred by responder and child was made by first plotting the total costs for each in a scatter plot (Figure 6). There appeared to be no significant relationship in the data but this was further tested using Pearson's correlation test and Spearman's correlation test for non-normally distributed data. While Pearson's test suggested a significant positive correlation between the log transformed total cost of the responder with that of the child, $r = 0.31$, $n = 48$, $p = 0.033$, Spearman's test did not, $r = 0.17$, $n = 48$, $p = 0.250$. As done in the previous analysis, the outliers were removed from the dataset and the correlation analyses recomputed. In this case, both the

Pearson's and Spearman's tests were not significant (Pearson's: r = 0.08, n = 48, p = 0.633, Spearman's: r = 0.02, n = 48, r = 0.882) indicating that there was no significant relationship between the total cost incurred by the child and that incurred by the responder

Hypothesis Three - Exploration of Factors Relating to the Use of Health and Social Services Following Traumatic Injury

Null hypothesis three states that there would be no relationship between use of health and social services following a traumatic injury 8 to 10 years ago and other explanatory factors. As for the case of the analysis of expenditures on services, use of services can be quantified in a variety of ways. Accordingly, in order to test hypothesis three, a number of exploratory analyses were done. Using univariate-multivariable Poisson loglinear regressions, the responder and child health and social service use data in the past six months were analyzed (Table 11) using a number of categorical and continuous independent variables. The categorical independent variables included in the regression were: gender of child, body part most affected by injury and accident type. The continuous independent variables included were: ISS, length of stay (LOS) of child in hospital at time of injury, age of child at accident and time since accident.

Initially a likelihood ratio Chi-square test of the univariate Poisson loglinear regression model of health uses by the responder was done using the above-mentioned independent variables. The results suggested that the full model is significant, i.e., it explains more variation of the data than an intercept-only

model, χ^2 (8, N = 48) = 20.51, p = 0.009. A more detailed investigation shows that two variables, accident type and ISS, were significant (accident type: χ^2 (2, N = 48) = 6.53, p = 0.038, ISS: χ^2 (1, N = 48) = 13.86, p < 0.001), suggesting that these variables might be related to responder use of health services in the past

Table 11.
Uses of Physicians, Health and Social Services by Children and Responders (N = 48)

Total Uses	Maximum	Mean	Std Deviation
Responder			
General/Specialist Physician	12	1.5	2.2
Health & Social Services	7	1.3	1.7
Child			
General/Specialist Physician	42	4.1	6.6
Health & Social Services	31	3.1	6.2

Notes:
Health & Social Services: Allied health and social support services eg) physio, counsellors, meals on wheels, community support

six months (Table 12). The responder made significantly more use of health services when the child's trauma was caused by MVC than when it was caused by falls. In the case of ISS, there was a positive relationship between ISS and use of health services.

Next, a likelihood ratio Chi-square test of the univariate Poisson loglinear regression model of social service use in the past six months by the responder was done using the same variables as in the previous analysis. The model was

significant with, χ^2 (8, N = 48) = 127.26, p < 0.001. The more detailed investigation suggests that four variables, accident type, ISS and LOS, are significant (accident type: χ^2 (2, N = 48) = 28.96, p < 0.001, ISS: χ^2 (1, N = 48) = 66.89, p < 0.001 and LOS: χ^2 (1, N = 48) = 8.37, p = 0.004), suggesting that

Table 12.

Tests of Parameter Estimates of Poisson Loglinear Regression Model of Responder Health Use (N = 48)

Independent Variable	*b*	χ^2	df	*P*
Categorical				
Gender (Male vs. Female)	-0.09	0.10	1	0.748
Body Part (Head vs. Non-head)	-0.47	3.44	1	0.064
Accident Type: (MVC vs. Other)	0.39	0.86	1	0.353
Accident Type: (Fall vs. Other)	-0.37	0.67	1	0.415
Accident Type: (MVC vs. Fall)	0.76	6.42	1	***0.011***
Continuous				
ISS	0.12	13.86	1	***<0.001***
LOS	-0.01	1.01	1	0.316
Age at Accident	0.00	0.01	1	0.928
Time since Accident	0.03	0.03	1	0.857

Notes:

MVC: motor vehicle collision, ISS: injury severity score, LOS: length of stay

these variables might be related to responder use of social services (Table 13). The responder made significantly more use of social services when the child's trauma was caused by MVC than when it was caused by falls or other (atypical accidents). There was also a positive relationship between child's ISS and

responder use of social services and a negative relationship between child's LOS and responder use of social services.

After testing health and social service uses by the responder, similar

Table 13.

Tests of Parameter Estimates of Poisson Loglinear Regression Model of Responder Social Service Use (N = 48)

Independent Variable	*b*	χ^2	df	*P*
Categorical				
Gender (Male vs. Female)	0.362	6.38	1	0.121
Body Part (Head vs. Non-head)	-0.58	2.40	1	0.785
Accident Type: (MVC vs. Other)	2.09	12.07	1	***0.001***
Accident Type: (Fall vs. Other)	1.12	3.32	1	0.068
Accident Type: (MVC vs. Fall)	0.97	20.17	1	***<0.001***
Continuous				
ISS	0.161	66.89	1	***<0.001***
LOS	-0.35	8.37	1	***0.004***
Age at Accident	-0.037	2.24	1	0.135
Time since Accident	0.012	0.01	1	0.925

Note:

MVC: motor vehicle collision, ISS: injury severity score, LOS: length of stay

analyses were applied to the child's use of health and social services. Once again univariate Poisson loglinear regressions were used to explore child health and social service use. The categorical independent variables included in the regression again were: gender of child, body part most affected by injury and accident type. The continuous independent variables included were: ISS, length

of stay (LOS) of child in hospital at time of injury, age of child at accident and time since accident.

To begin this step of the analysis, a likelihood ratio Chi-square test of the univariate Poisson loglinear regression model of health service use by the child was done. The results indicate that the full model was significant, χ^2 (8, N = 48) = 22.518, p = 0.004. Exploring the data in more depth suggested that two variables, gender and time since accident, were significantly related with health

Table 14.

Tests of Parameter Estimates of Poisson Loglinear Regression Model of Child Health Service Use (N = 48)

Independent Variable	*b*	χ^2	df	*P*
Categorical				
Gender (Male vs. Female)	-0.95	12.53	1	***<0.001***
Body Part (Head vs. Non-head)	-0.17	0.35	1	0.552
Accident Type: (MVC vs. Other)	0.45	1.10	1	0.294
Accident Type: (Fall vs. Other)	0.21	0.22	1	0.642
Accident Type: (MVC vs. Fall)	0.23	0.60	1	0.450
Continuous				
ISS	-0.02	0.32	1	0.571
LOS	-0.01	1.13	1	0.288
Age at Accident	0.027	0.70	1	0.413
Time since Accident	-0.36	4.80	1	***0.029***

Note:

MVC: motor vehicle collision, ISS: injury severity score, LOS: length of stay

service use (gender: χ^2 (1, N = 48) = 12.53, p < 0.001 and time since accident: χ^2 (1, N = 48) = 4.80, p = 0.029). The results indicated that females used more health services than males following traumatic injury and that there was a negative relationship between children's use of health services and time since accident (Table 14).

The final exploratory analysis looked at children's use of social services as depending on the previously mentioned explanatory variables. In this case the likelihood ratio Chi-square test of the univariate Poisson loglinear regression model of social service uses by the child also was significant, χ^2 (8, N = 48) = 104.11, p < 0.001. The in depth exploration revealed that six variables were significant: gender, accident type, ISS, LOS, age at accident and time since accident (Table 15).

Table 15.
Tests of Model Effects for Analysis of Child Health Service Use (N = 48)

Independent Variable	χ^2	*df*	*P*
Categorical			
Gender	49.30	1	***<0.001***
Accident Type	21.92	2	***<0.001***
Continuous			
ISS	4.98	1	***0.026***
LOS	7.90	1	***0.005***
Age at Accident	13.02	1	***<0.001***
Time sine Accident	6.29	1	***0.012***

Note:
ISS: injury severity score, LOS: length of stay

The univariate Poisson loglinear regression suggested that female children and youth made more use of social services in the past six months than males. Also, children who experienced atypical accidents (other) made more use of social services than those who experienced MVC's or falls. Use of social services showed a significant positive relationship with ISS, age at accident and time since accident. On the other hand, use of social services was negatively related to LOS (Table 16).

Table 16.

Tests of Parameter Estimates of Poisson Loglinear Regression Model of Child Social Service Use (N = 48)

Independent Variable	*b*	χ^2	df	*P*
Categorical				
Gender (Male vs. Female)	-1.47	49.30	1	***<0.001***
Body Part (Head vs. Non-head)	-0.11	0.30	1	0.591
Accident Type: (MVC vs. Other)	-0.94	16.70	1	***<0.001***
Accident Type: (Fall vs. Other)	-1.12	18.04	1	***<0.001***
Accident Type: (MVC vs. Fall)	0.18	0.61	1	1.433
Continuous				
ISS	0.06	4.98	1	***0.026***
LOS	-0.03	7.90	1	***0.005***
Age at Accident	0.08	13.02	1	***<0.001***
Time since Accident	0.30	6.30	1	***0.012***

Note:

MVC: motor vehicle collision, ISS: injury severity score, LOS: length of stay

Chapter 5 – Discussion

The purpose of this study was twofold: First, I wanted to determine whether family function was associated with child behaviour from a psychosocial perspective eight to ten years after the children experienced a traumatic injury. Second, in order to explore the burden of traumatic injury in children on the health system, I investigated whether health and social service expenditure and use by children and their families was related to injury severity. To date few studies have explored long-term health and social service utilization in the pediatric trauma population, particularly more than three years after the original trauma took place.

An initial analysis of responders and non-responders found that children's ISS differed significantly between the groups with non-responders being four units higher than responders. There are a number of possible explanations for this variation. Firstly, this was a retrospective cohort study, so the contact information for respondents came from a trauma database kept at the tertiary care hospital where the children were originally treated. This meant that I was not able to obtain updated contact information for those families who may have relocated in the years post-accident. The families of the more severely injured children may have had greater need to relocate to a different residence, for example, if their child required rehabilitation in an alternative facility or access to particular services in the community. A further explanation is that families were reluctant to discuss personal attributes such as family function, child behaviour

and the possible negative emotions associated with the child's injury. Similar traumatic experiences have led to increased non-response rates in survivors of a tsunami disaster and survivors of domestic violence against women (Hussain, Weisaeth & Heir, 2009; Ruiz-Perez, Plazaola-Castano & Vives-Cases, 2007). This disparity in response rates between the children by ISS is unfortunate because those children with higher ISS and their families may have benefited most from a better understanding of the long-term ramifications of traumatic injury in children.

The initial analysis of the entire database (pooled responders and non-responders) showed that girls were involved in fewer accidents of all types than boys. However, when they were injured, their ISS paralleled that of the boys. This disparity may be related to the risk taking behaviour of boys, who are known to engage more readily in risky behaviours than girls as pedestrians as well as in other situations (Granie, 2007; Ginsberg & Miller, 1982).

The next key finding was that MVC's caused the highest number of accidents that the children were involved in. Possible explanations may include the generally high rate of serious injuries and fatalities due to MVC's, which in this age group (0 – 18 years), was 30,219 in 2009 for the whole of Canada (most recent data released by Transport Canada) (Transport Canada, 2009). Also, MVC's are the leading cause of injuries in young adults (20 – 34 years) in Ontario, in line with my finding that MVCs are a major source of injuries (Canadian Institute for Health Information, 2011).

Relationship Between Family Functioning and Child Behaviour Following Traumatic Injury

In line with the first hypothesis I set out to analyze family function and ISS, as well as their interaction, and their effects on child behaviour. The results showed that ISS did not interact with family function to explain child behaviour; neither did ISS in itself explain child behaviour. There may be a number of possible reasons for this apparent absence of relationship between child behaviour and ISS. For example, the relatively long time since accident (eight to ten years) may mean that any negative psychosocial effects of the trauma no longer trouble the children. Gallo, Barton and Parry-Jones (1997) suggest that while traffic accidents may cause moderate to severe posttraumatic stress symptoms in children, the effects may be most acute immediately following the accident and tail off relatively quickly with passing time. Another reason may be that children are relatively plastic and have adapted to any lasting effects of the trauma within a shorter timeframe than is captured in the current study. Alternatively, the injury itself nor family function are predictors of child behaviour. Rather another possible hypothesis is that troubled child behaviour is associated with family dysfunction, leads to risk taking activities, resulting in increased likelihood of traumatic injuries and continuation of troubled behaviour post-injury (Byrne et al., 2004). A prospective study, which identified youth exhibiting troubled behaviour and its relationship to family function and then followed them

over time to explore the incidence of risk taking behaviour resulting in traumatic injury could be used to test this hypothesis.

When I explored the effect of family function on child behaviour, there was a strong relationship between these variables indicating that current family function explained a significant amount of current child behaviour (hyperactivity & inattention, pro-social behaviour, anxiety and emotional disorder, conduct disorder & physical aggression, property offences). Generally, positive behaviour increased with good family functioning and negative behaviours decreased with good family functioning. These results are consistent with the tenets of Structural Family Therapy (Minuchin, 1974). The underpinnings of this therapy approach state that child behaviour problems arise from problematic family structures and behaviours. Conversely it may be concluded that positive family function promotes positive child behaviours. Two components of child behaviour were not explained by family function: indirect aggression and aggressive behaviour. However, while these behaviours were not significantly related with family functioning, they expressed the same direction of relationship and are in line with the patterns expressed by the other behavioural variables.

I found relationships between family functioning and child behavioural variables, however these might be expected for all families, whether children were involved in severe traumatic accidents or not. Despite my expectation of a negative effect of traumatic injury on child behaviour, my data do not indicate that there is a relationship between ISS and child behaviour eight to ten years after a

traumatic accident. Overall there is no conclusive evidence to suggest an association between traumatic injury and long-term negative behavioural consequences in children.

Relationship Between Expenditures on Health and Social Services and Traumatic Injury

A further goal of the analysis was to determine if relationships existed between costs incurred by the child and caregiver (responder) in the past six months and the child's level of trauma as measured by ISS. While I found no relationship between current expenditures on health and social service for children and ISS, there appeared to be a relationship between responder health and social service costs and child ISS. In particular, there was a significant relationship between costs incurred for social services (non-physician services) by the responders. This may suggest that the ramification of child trauma may in fact be more lasting, particularly from a psychosocial perspective, for the caregiver rather than the child. The results relate to a study by Ghosh Ippen, Harris, Van Horn & Lieberman (2011). This study, which focused on the efficacy of child-caregiver psychotherapy for children suffering from stressful life events, highlighted that the parents of traumatized children may also suffer from depression and PTSD and subsequently may benefit from psychotherapy.

Interestingly, I did not find any relationship between health and social service costs incurred by the child and ISS. While it is perhaps surprising that there was no relationship between health service costs incurred by children and

ISS, it is easier to explain why there may not be a relationship between social service costs incurred by children and ISS. Many of the social services covered by the questionnaire are more likely to be accessed by adults than by children, such as employment retraining services, meals on wheels and financial support counselling. The services accessed by children may be better captured by a questionnaire tailored to their specific needs and service requirements.

Exploration of Factors Relating to the Use of Health and Social Services Following Traumatic Injury

The last goal of the study was to determine whether relationships existed between the use of health and social services by children and their caregivers (responders) and a variety of variables. This part of the study suggests a complex pattern of relationships between health and social service uses and variables that describe characteristics of the child victim, the accident and the time period following the accident. Again, as in the case of health and service expenditures, I found that service use by the responders to be related to the multiple factors of the child's accident. Interestingly, some of these relationships parallel those found for the children, while others differed between responders and children.

There was a consistent, positive relationship between use of various services (health as well as social services) for responders and children with ISS. Such a relationship was anticipated, because we expected that accidents that

caused more severe trauma in the children would have led to an increase in medical and support needs in both parents and children.

We also found a consistent, albeit unexpectedly negative relationship between social service use and LOS for responders and children. As a potential explanation I propose that when child injury necessitates a longer hospital stay, the child and their family may be more likely to receive supportive services such as counselling and social work while in hospital compared to those who are discharged home relatively quickly. Clearly, this explanation is purely speculative and would have to be investigated in detail with data about social service provided in the hospital and the community settings.

Health and social service uses consistently showed relationships with the type of accident, but the nature of this relationship depended on the type of service (health or social) and on the person receiving the service (responder or child). Health and social uses for responders were highest when child trauma was MVC-related and lower when trauma was related to falls or atypical accidents (other). For children, however, social service uses were highest for atypical accidents.

Despite girls and boys incurring traumatic injuries of similar severity, the results suggest that girls make more use of health as well as social services than boys. While it may be tempting to explain higher health use by girls with the well-known emphasis on having regular pelvic exams, a detailed investigation of the data did not support this suggestion. However, my results are in line with findings

such as by Green & Pope (1999), whose study about the factors determining the use of medical services, showed that gender contributes to explaining medical service use, with females making more use, even when removing the effects of gender-specific utilization.

Social service use by children was positively related to their age at the time of the accident as well as to the time that has passed since the accident occurred. A detailed investigation of the data reveals a non-significant correlation between age at accident and the severity of the accident (data not shown): Very young children tend not to incur very high ISS, but older children can incur both low and high ISS. This correlation may lead to higher social service use in older children. Also the increasing social service use with time since accident may be related to the age of the children. While very young children are less likely to make use of social services such as peer support or special education, older children may very well make use of such services. In contrast to social service uses by children, health service uses by children decreased with time since accident. A possible explanation for this relationship is an increasing likelihood that after several years the physical effects of the traumatic injury have waned.

Study Limitations

Limiting factors of this study include the small sample size of 48 participants, which may have affected the statistical reliability and validity of the results. The small sample size also meant that the results of the study are inconclusive regarding the ability to say there are no associations. There may

have been associations but the low power of the study may mean that they were not detected. A possible reason for the small sample size may be that the study was retrospective. Therefore I was not able to meet with the family or parent a priori and discuss the nature of the study with them before seeking their consent. Involvement in the study was dependent on their receiving a letter explaining the study, and then subsequently answering my phone call. This may have negatively influenced the response rate because people are inherently wary of being contacted for studies via phone (Tuckel & O'Neill, 2002). In future studies with this population it would be preferable to use a prospective design to increase the likelihood that those who consented to the study would continue to participate over time and notify the study coordinator if their address changed. In the current study, the contact information for potential subjects came from the trauma database located at Hamilton Health Sciences. This data was entered at the time of the children's injury and did not reflect any changes in address that may have occurred since their injury. A further point was that the study design does not lend itself to make conclusions about any directions of the associations found therefore no claims about causation can be made. Using a prospective study design with the use of a control group could help address this issue in a future study.

Another limitation of the study was the lack of broad variation in ISS scores (only ranging from 13 to 26 while maximum ISS is 75). This paucity of ISS at the high end of the spectrum may be because children with the highest

ISS scores succumbed to their injuries. Another reason for this lack of high ISS scores was that I was less successful in reaching and obtaining consent from those families with children who had high ISS scores. They may have been reluctant to discuss their child's injuries or the repercussions to their families. A further point is that children are generally fairly sheltered by their parents and therefore are expected to experience only relatively "minor" accidents that may not lead to very high ISS scores. Partially as a result of this the data showed a greater subject representation at the mid-range of ISS scores. While I found some relationships of health and social service use with ISS, many expected relationships were not significant. It is possible that more significant relationships involving ISS would have been found, if the range of ISS scores had been greater.

Finally, the non-normality of many of the variables in this study made the analyses more challenging. For example, the non-normal distribution of many of the cost variables made it necessary to log-transform them. Because some of the subjects incurred zero costs for several variables, these zero values had to be replaced with positive, non-zero values to allow log-transformation. This approach led to outliers in the log-transformed data, which affected the results of the analyses.

Clinical Applicability

The results of this study can be used to inform our knowledge of the long-term effects of traumatic injury in children on child behaviour, their families and

the health care and social service system. In particular, the information regarding caregiver health and social service use emphasizes the need for long-term assessment and possible delivery of services to the families of the injured children. While for the most part children seem to recover well from traumatic injury, the toll that motor vehicle accidents take on our juvenile population must not be underestimated. This points to the need for further programs focusing on reducing the incidence of motor vehicle accidents such as reducing traffic speeds and conducting spot checks for impaired driving.

Chapter 6 – Conclusions

This study investigated the relationship between child behaviour and family functioning eight to ten years following traumatic injury in children. Additionally, the study investigated the relationships of health and social service expenditures and use following traumatic injury with a range of variables describing characteristics of the injured child, the accident, and the period following the accident. The results indicated that child behaviour is not related to the severity of the injury incurred eight to ten years after a traumatic accident. However, they do suggest that health and social service expenditures and use by the injured children and their families are affected in the long-term. The results suggest that (i) current health and social service uses of children and their families may be better understood in the light of the long-term effects of child trauma, (ii) future health and social service uses of injured children may be better planned for by recognizing the long-term effects of trauma and (iii) making it easier for families to access health and social services in the long-term, may help alleviate the repercussions of child trauma.

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Appendix A

Search terms used for the purposes of the literature review in this proposal. Individual search terms within each theme were combined with a Boolean disjunction operator ("OR"), indicating that at least one term within each theme had to be included in the search. Individual search terms among all themes were combined with a Boolean conjunction operator ("AND"), indicating that at least one term from all themes had to be included in the search. Truncated search terms that are ending on an asterisk indicate a family of search terms, all starting with the same root. The search term that is surrounded by quotation marks indicates a combination of words that were searched for exactly as provided.

Theme	Search terms
Period	"long-term" OR persist* OR lasting
Traumatic event	injur* OR trauma OR impair* OR crash* OR accident*
Severity	sever* OR serious OR acute
Family members	child OR adolesc* OR pediatric* OR parent* OR caregiver*
Health dimensions	function* OR family OR social OR economic OR health
Health status measures	ability OR capacity OR limit* OR status OR outcome* OR predict*
Health system costs	financ* OR resourc* OR cost*

Appendix B

McMaster Family Assessment

1. Planning family activities is difficult because we misunderstand each other.

2. In times of crisis, we can turn to each other for support.

3. We cannot talk to each other about sadness we feel.

4. Individuals (in the family) are accepted for what they are.

5. We avoid discussing our fears or concerns.

6. We express feelings to each other.

7. There are lots of bad feelings in our family.

8. We feel accepted for what we are.

9. Making decisions is a problem for our family.

10. We are able to make decisions about how to solve problems.

11. We don't get along well together.

12. We confide in each other.

13. Drinking is a source of tension or disagreement in our family.

Possible Answers

1 'Strongly agree'

2 'Agree'

3 'Disagree'

4 'Strongly disagree'

Appendix C

National Longitudinal Survey of Child and Youth (NLSCY) – Behaviour

a. Shows sympathy to someone who has made a mistake?

b. Can't sit still or is restless?

c. Destroys his/her own things?

d. Will try to help someone who has been hurt?

e. Steals at home?

f. Seems to be unhappy or sad?

g. Gets into many fights?

h. Offers to help clean up a mess someone else has made?

i. Is easily distracted, has trouble sticking to any activity?

j. When mad at someone, tries to get others to dislike that person?

k. Is not as happy as other children?

l. Destroys things belonging to his/her family, or other children?

m. If there is a quarrel or dispute, will try to stop it?

n. Can't concentrate, can't pay attention for long?

o. Is too fearful or nervous?

p. When mad at someone, becomes friends with another as revenge?

q. Is impulsive, acts without thinking?

r. Tells lies or cheats?

s. Offers to help other children (friend, brother or sister) who are having

difficulty with a task?

t. Is worried?

u. Has difficulty waiting for his/her turn in games or group activities?

v. When somebody accidentally hurts him/her, they react with anger and fighting?

w. When mad at someone, says bad things behind the other's back?

x. Physically attacks people?

y. Comforts a child (friend, brother or sister) who is crying or upset?

z. Cries a lot?

aa. Vandalizes?

bb. Threatens people?

cc. Spontaneously helps to pick up objects which somebody has dropped?

dd. Bullies or is mean to others?

ee. Cannot settle to anything for more than a few moments?

ff. When mad at someone, says to others let's not be with him/her?

gg. Is nervous, high-strung or tense?

hh. Kicks or hits other people his/her age?

ii. Will invite others to join in a game?

jj. Steals outside his/her home?

kk. Is inattentive?

ll. Has trouble enjoying himself/herself?

mm. Helps other kids his/her age who are feeling sick?

nn. When mad at someone, tells that person's secrets to a third person?

oo. Helps encourage those who do not do as well as he/she does?

Possible Answers

1 'Never or not true'

2 'Sometimes or Somewhat true'

3 'Often or very true'

Questions Included in Scoring for Sub-components of NLSCY

Hyperactivity - Inattention Score.

0-14, a high score indicating the presence of hyperactive/inattentive behaviour

b. Can't sit still or is restless

i. Is easily distracted, has trouble sticking to any activity

n. Can't concentrate, can't pay attention for long

q. Is impulsive, acts without thinking

u. Has difficulty waiting for his turn in games or groups

ee Can not settle on anything for more than a few moments

kk Is inattentive

Pro-social Behaviour Score.

(0 to 20) a high score indicating pro-social behaviour

a. Shows sympathy to someone who has made a mistake

d. Will try to help someone who has been hurt

h. Volunteers to help clear up a mess someone else has made

m. If there is a quarrel or dispute, will try to stop it

s. Offers to help other children (friend, brother or sister) who are having difficulty with a task

y. Comforts a child (friend, brother, or sister) who is crying or upset

cc. Spontaneously helps to pick up objects which somebody has dropped

ii. Will invite others to join in a game

mm. Helps other children (friends, brother or sister) who are feeling sick

oo. Helps encourage those who do not do as well as he/she does

Emotional Disorder-Anxiety Score.

(0 to 14) a high score indicating the presence of behaviours associated with anxiety and emotional disorder

f. Seems to be unhappy or sad

k. Is not as happy as other children

o. Is too fearful or nervous

t. Is worried

z. Cries a lot

gg. Is nervous, high strung or tense

ll. Has trouble enjoying himself

Conduct Disorder - Physical Aggression Score.

(0 to 12) a high score indicating behaviours associated with conduct disorder and physical aggression

g. Gets into many fights

v. When somebody accidentally hurts him, he reacts with anger and fighting

x. Physically attacks people

bb. Threatens people

dd. Bullies or is mean to others

hh. Kicks, bites or hits other children

Indirect Aggression Score.

0 to 10, a high score indicating behaviour associated with indirect aggression

j. When mad at someone, tries to get others to dislike that person

p. When mad at someone, becomes friends with another as revenge

w. When mad at someone, says bad things behind the other's back

ff. When mad at someone, says to others let's not be with him/her

nn. When mad at someone, tells that person's secrets to a third person

Property Offences Score.

(0 to 12) a high score indicating behaviour associated with property offences

c. Destroys his own things

e. Steals at home

l. Destroys things belonging to his family, or other

r. Tells lies or cheats

aa. Vandalizes

jj. Steals outside his home

Appendix D

National Longitudinal Survey of Children and Youth (NLSCY) – Aggressive Behaviour

a. Stayed out later than you said he/she should in the past year?

b. Stayed out all night without permission?

c. Skipped a day of school without permission?

d. Gotten drunk?

e. Been questioned by the police about anything they thought he/she might have done?

f. Ever run away from home?

Possible Answers

1 'Never'

2 'once'

3 'twice'

4 'more than twice'

Appendix E

Health and Social Service Provider Visits

HSSUQ

HS1: Health and Social Service Provider visits (Please record how many times you visited a provider (e.g., # of visits = 1/mos for 6 months would be recorded as 6 visits).

PART A

	Respondent	Child
HS1a. Have you and/or your child seen a doctor or physician specialist in the **last 6 months**? **(Note to interviewer: Do not include visits with specialists during hospitalizations or day surgeries.)**	❑₁ Yes ❑₂ No If NO → Go to HS1b **# of visits**	❑₁ Yes ❑₂ No If NO→ Go to HS1b **# of visits**
Primary Care Provider visits		
a. Family Physician/Walk-in Clinic (primary care)		
b. Emergency Room		
c. 911 calls		
d. Ambulance Service		
Any Specialist visits:	❑₁ Yes ❑₂ No If NO → Go to HS1b	❑₁ Yes ❑₂ No If NO→ Go to HS1B
e. Adolescent Medicine Allergist (allergy specialist)		
f. Cardiologist (heart specialist)		
g. Dermatologist (skin specialist)		
h. **Ears/Nose/Throat** Specialist		
i. Endocrinologist (hormonal disorders, diabetes specialist)		
j. Gastroentologist (stomach and bowel specialist)		
k. Gynaecologist/Obstetrician (women's reproductive care specialist)		
l. Infectious Disease/HIV Specialist		
m. Haematologist or Oncologist (blood disorders and cancer specialist)		
n. Nephrologist (kidney specialist)		
o. Neurosurgeon Orthopedics/**Neurologist** (brain/nervous system specialist)		
p. Ophthalmologist (eye specialist)		
q. **Pediatrician** (children/adolescent specialist)		
r. Psychiatrist (mental health specialist)		
s. Respirologist (lung/breathing specialist)		
t. Rheumatologist (arthritis specialist)		
u. Rehabilitation Doctor(stabilizes or improves physical/mental/social functioning)		
v. Surgeon (general, dental)		
w. Surgeon (orthopaedic)		
x. Surgeon (neurological)		
y. Others (specify)_____		
z. Others (specify) _____		

PART B

	Respondent	Child
HS1b. Have you or your child seen any other health and/or social service providers in the **last 6 months**? (Use list below for prompts, if necessary). **(Note to interviewer: Do not include visits with specialists during hospitalizations or day surgeries.)**	❑₁ **Yes** ❑₂ **No → Go to HS1C** **# of visits**	❑₁ **Yes** ❑₂ **No → Go to HS1C** **# of visits**
a. Physiotherapist		
b. Massage Therapist (Cost/hour: _____)	**Hours**	**Hours**
c. Occupational Therapist		
d. Speech Language Pathologist		
e. Chiropractor		
f. Psychologist		
g. Podiatrist/Chiropodist (foot/lower limb doctor)		
h. Nutritionist/Dietician		
i. Nurse Practitioner		
j. Visiting Nurses (Home Care/PHN/VON/SEN)		
k. Private Nurse (Cost/hour: _____)	**Hours**	**Hours**
l. Optometrist		
m. Dentist		
n. Social Worker		
o. Children's Aid Worker		
p. Adolescence/School Counsellor		
q. Family Counsellor		
r. Mental Health Counsellor		
s. Homemaker/Personal Support Worker (home care; routine household activities, menu planning meal preparation, shopping, light housekeeping)	**Hours**	**Hours**
t. Child/Daycare (cost/visit: _____)		
u. Subsidized Daycare (cost/visit: _____)		
v. Naturopath/Homeopath (cost/visit: _____)		
w. Complementary Therapy (cost/visit: _____)		
x. Employment Retraining Services		
y. Meals on Wheels (cost/meal: _____)	**Meals**	**Meals**
z. Emergency Food/Food Bank		
aa. Police		
bb. Probationary Services		
cc. Correction Facilities		
dd. Social and Recreation Programs (e.g., Scouts, sports, swimming, music, etc.)		

ee. Community Support Programs (i.e., Wellness House, Helping Hand)		
ff. Special Education Services		
gg. Other Special Education Supports (i.e. Tutors, in-class help)		
hh. Others Specify: _____		
Part C. Community Support Services: HS1c. Have you or your child used any other community support services in the **last 6 months**? (Use list below for prompts, if necessary).	**Respondent** ❑1 **Yes** ❑2 **No → Go to HS2**	**Child** ❑1 **Yes** ❑2 **No → Go to HS2**
a. Groups/Peer Support		
b. Community Health Education/Prevention Talks		
c. Transportation Services (e.g. community volunteer transportation services)		
d. Housing Services (e.g. Supportive Housing)		
e. Financial Support/Counselling ($ rec'd: _____)		
f. Other Community Support Services (specify): _____		
g. Other Community Support Services (specify): _____		
h. Other Health & Social Services Providers (specify): _____		
i. Other Health & Social Service Providers (specify): _____		

	Respondent	**Child**
HS2. Have you or your child had any hospital admission(s) in the **past 6 months**?	❑1 **Yes** ❑2 **No → Go to HS3**	❑1 **Yes** ❑2 **No → Go to HS3**
a. How many hospital admissions?		
b. Total number of days in the hospital		
HS3. Have you or your child had any day surgery(ies) done in the **past 6 months**?	❑1 **Yes** ❑2 **No → Go to HS4**	❑1 **Yes** ❑2 **No → Go to HS4**
a. How many day surgery(ies)?		
b. Specify the type(s) of day surgery(ies)	_____ _____	_____ _____

	Respondent	Child
HS4a Have you used any respite providers for your child?	❑₁ Yes ❑₂ No → Go to HS5	
b. If yes, Who provided the care and for how many hours	**# Hours**	**Cost/hour**
1._____	**1.** _____	**1.**_____
2._____	**2.** _____	**2.**_____

HS5. Have you or your child had any outpatient tests done in the **past 6 months**?	❑₁ Yes ❑₂ No → Go to HS6	❑₁ Yes ❑₂ No → Go to HS6
If yes, please tell me how many times for each of the following tests:		
	Respondent	**Child**
	# of times	**# of times**
a. Blood		
b. Specimens (i.e., urine, throat swab)		
c. Scopes (i.e., endoscopy, bronchoscopy, sigmoidoscopy)		
d. X-rays		
e. Scans (i.e., ultrasound, CT scan)		
f. Breathing tests (i.e., spirometry)		
g. ECG (heart monitoring)		
h. EEG (brain waves)		
i. EMG (muscles)		
j. Other tests (please specify) _____		
k. Other tests (please specify) _____		

HS6. Have you or your child taken any prescription medications in the **past 2 days** (other than those received while you were a patient in the hospital)?

Respondent

❑$_1$ **Yes** ❑$_2$ **No → Go to child below**

Medications taken in the past 2 days	Dose (mg)	# pills each time (pills per dose)	# times each day (doses per day)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Child

❑$_1$ **Yes** ❑$_2$ **No → Go to HS7**

Medications taken in the past 2 days	Dose (mg)	# pills each time (pills per dose)	# times each day (doses per day)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

HS7. Have you or your child received any special treatment(s) in the **past 6 months** (other than those received while you were a patient in the hospital)? (e.g., **IV** (chemotherapy, antibiotics, ganciclovir, foscarnet, anthericin, amphotericin B, pentamidine), **vaccinations**, aerosolized pentamidine, dressing change, **TPN** (total parenteral nutrition) adiotherapy (radiation), blood transfusions, **injections** (vitamin B12, steroids, neupogen (GCSF), GMCSF).

Respondent ❑1 Yes ❑2 No → Go to HS8		**Child** ❑1 Yes ❑2 No → Go to HS8	
If yes, please specify:	**# of times**	**If yes, please specify:**	**# of times**
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	

HS8. Have you and/or your child been provided/bought/rented/leased any supplies, aids or devices (i.e., wheelchairs, syringes, walkers, crutches, pillows, tissues, etc.) in the past 6 months (other than those you received while you were a patient in the hospital)?

Respondent ❑1 Yes ❑2 No → Go to HS9		**Child** ❑1 Yes ❑2 No → Go to HS9	
If yes, please specify:	**Cost to the nearest $**	**If yes, please specify:**	**Cost to the nearest $**
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	

HS9. Due to you and/or your child's health in the **past 6 months**, did you:

a) Receive household help (e.g., cleaning, grocery shopping, light housekeeping, etc.) (Not homemaking or personal support from CCAC)?

❑1 Yes → Hours: _____ Cost: _____

❑2 No

b) Receive help with babysitting?

❑1 Yes → Hours: _____ Cost: _____

❑2 No

HS10. In the **past 6 months**, did you:

a) Travel to receive health care or social services for you and/or your child (cost at $.37/km if by car, or cost if by bus, taxi, etc.)?

❑$_1$ Yes → Cost: _____

❑$_2$ No

b) Pay for parking while receiving services?

❑$_1$ Yes → Cost: _____

❑$_2$ No

HS11. a) In the **past 6 months**, was any time lost from work due to you and/or your child's illness or situation?

i) by you ❑$_1$ Yes → Number of lost hours _____
Amount of lost wages _____
❑$_2$ No

ii) by others, i.e., family ❑$_1$ Yes → Number of lost hours _____
Amount of lost wages _____
❑$_2$ No

b) In the **past 6 months**, was any time lost from work due to you and/or your child's treatment?

iii) by you ❑$_1$ Yes → Number of lost hours _____
Amount of lost wages _____
❑$_2$ No

iv) by others, i.e., family ❑$_1$ Yes → Number of lost hours _____
Amount of lost wages _____
❑$_2$ No

HS12. In the **past 6 months**, did your family receive any government cheques?
❑$_1$ Yes ❑$_2$ No → **go to HS13** ❑$_9$ Refusal

If yes, complete the following, specifying the type of cheque, number of cheques received and the amount of each cheque in **the past 6 months**.

			How many cheques?	Amount of each cheque
a) Worker's Compensation	❑$_1$ Yes	❑$_2$ No		
b) Old Age Security	❑$_1$ Yes	❑$_2$ No		
c) Disability Pension, private	❑$_1$ Yes	❑$_2$ No		
d) Ontario Disability Support Program (ODSP/ACSD)	❑$_1$ Yes	❑$_2$ No		
e) Canada Pension	❑$_1$ Yes	❑$_2$ No		
f) Canada Pension, disability	❑$_1$ Yes	❑$_2$ No		
g) Child Tax Benefit	❑$_1$ Yes	❑$_2$ No		
h) GAINS (Guaranteed Annual Income Supplement)	❑$_1$ Yes	❑$_2$ No		
i) Veteran's Pension	❑$_1$ Yes	❑$_2$ No		
j) Survivor's Benefits (CPP)	❑$_1$ Yes	❑$_2$ No		
k) Employment Insurance	❑$_1$ Yes	❑$_2$ No		
l) Welfare (Social Assistance, Ontario Works)	❑$_1$ Yes	❑$_2$ No		
m) Other Specify: _____	❑$_1$ Yes	❑$_2$ No		
n) Other Specify: _____	❑$_1$ Yes	❑$_2$ No		
o) Other Specify: _____	❑$_1$ Yes	❑$_2$ No		
p) Other Specify: _____	❑$_1$ Yes	❑$_2$ No		
q) Other Specify: _____	❑$_1$ Yes	❑$_2$ No		

HS13. Due to your health or your child's health in the **past 6 months**, did you receive any other cheques

		How many cheques?	Amount of each cheque
*from private insurance?	❑$_1$ Yes ❑$_2$ No		

* **Interviewer**: this refers to income from private insurance. It does not include insurance that compensates for costs, i.e., dental insurance, supplies for colostomies, etc.