Summary

Pediatric traffic injuries: consequences for the child and the parents

Injuries constitute an important health problem among children and adolescents, not only because they can be life threatening, but because they are a major cause of disability in the survivors as well. Despite a number of studies on the nonfatal outcomes of pediatric injuries, knowledge on the sequelae of childhood injuries is limited. To address some of the unresolved issues, this thesis focuses on the consequences of pediatric traffic injuries. Specifically, the thesis aims to provide insight into the outcomes of pediatric traffic victims in terms of their short-term and long-term health-related quality of life (HRQoL), and their own and their parents’ post-traumatic stress reactions. Furthermore, the outcome studies intend to investigate which sociodemographic, injury or accident-related factors are associated with adverse child and parent outcomes.

The introductory chapter reviews current knowledge on the nonfatal outcomes of childhood injuries and points to the gaps in knowledge that led to the objectives of this thesis. In Chapter 1 the characteristics of a cohort of injured children are reviewed. The main objectives are addressed in Chapters 2 through 5. These chapters report on the young traffic victims’ HRQoL, and the child and parental post-traumatic stress reactions after pediatric traffic injury. The study populations in these chapters concern hospitalized and nonhospitalized young traffic victims treated at the Department of Traumatology, University Hospital Groningen, the Netherlands. The HRQoL of these children was assessed with the TNO-AZL Children’s Quality of Life Questionnaire (TACQOL). This questionnaire includes seven domains: physical complaints, motor functioning, autonomy, cognition, social functioning, positive and negative emotions. In Chapter 6 this instrument was also used in a study on the accident details and consequences of bicycle-spoke injuries. In the final chapter, the main findings of the studies are discussed, general conclusions are drawn, and recommendations for future studies are made.
Chapter 1. Epidemiology pediatric injuries

To gain insight into the magnitude and severity of pediatric injuries, Chapter 1 presents an epidemiological overview of the characteristics of 5057 injured children aged 0-19 years treated at the Department of Traumatology, University Hospital Groningen, the Netherlands in 1996 and 1997. The data were obtained from a computerized trauma registration system, the ‘Registratie van Letsels en Ongevallen Groningen’ (RLOG), and medical records.

The results showed that the majority of children were injured in home and leisure accidents (53%). The youngest children, aged up to 12, sustained primarily home and leisure injuries, especially fall injuries. Children aged 14-16 years were predominantly injured in sports accidents. With respect to traffic-related injuries, pre-school children in particular incurred bicycle-spoke injuries, and many of the children over the age of four were injured in bicycle accidents, often single-bicycle accidents. These subgroups of children may be interesting for future prevention activities.

The majority of the children incurred minor injuries. Only 1% of the children were severely injured (Injury Severity Score (ISS) ≥16), 19 children were referred to a rehabilitation center, and 24 children died due to their injuries. Overall, 512 (10%) injured children required hospitalization. More than one-third (37%) of these children were hospitalized for one or two days. Among these children were those hospitalized for observation after anaesthetic treatment or minor head injuries. The standard hospitalization of this subgroup of children needs to be investigated in future studies to avoid unnecessary hospitalization.

The groups of hospitalized and nonhospitalized injured children were compared to identify predictors of hospitalization. Compared with nonhospitalized patients, the group of hospitalized patients was more severely injured, had sustained more injuries of the head/neck, spine, thorax and abdomen and was composed of more males and traffic victims. Nonhospitalized patients incurred proportionally more upper and lower extremity injuries. The ISS, the body region of most severe injury, and the injury cause (traffic accidents) turned out to be significant predictors of hospitalization. It may be questioned whether the children at highest risk of hospitalization are also at high risk of sustaining injury-related disabilities. This question could not be answered, as the study did not include an outcome assessment.
Chapter 2. Short-term HRQoL and impact on the parents/family

A prospective study was conducted to explore the young traffic victims’ short-term HRQoL, and the impact of the incident on the parents/family. For this purpose, 61 parents of young traffic victims completed the TACQOL and the parent/family scales of the Child Health Questionnaire (CHQ). The children were aged between 6-15 at the time of the traffic incident, and had been treated at the Department of Traumatology of University Hospital Groningen between April 2000 and April 2001. The parents participated shortly after the injury to assess pre-injury data, and also at two follow-up assessments to gather post-injury information, i.e., 3 months (T1) and 6 months (T2) after the accident.

The data revealed that the traffic victims suffered a reduced HRQoL at T1. This seemed particularly the case for the children with an ISS ≥9, hospitalized children, children injured in a motor vehicle accident, and children with a lower extremity fracture. On the CHQ parent/family scales, the parents reported significantly increased emotional distress at T1. These adverse parent/family effects were associated with the severity of the child’s accident and injuries. At T2, the children’s mean HRQoL and the parental mean emotional scores were comparable to respective pre-injury values.

The results illustrate the extensive impact of pediatric traffic injuries on children and their parents. The adverse effects were of short duration as within six months the group of young traffic victims had regained their pre-injury HRQoL and the parent/family functioning was back to ‘normal’. Children and parents/families at risk of short-tem adverse effects can be identified by looking at the severity of the traffic accident and at the severity of the child’s injuries.

Chapter 3. Short-term HRQoL and post-traumatic stress

Fifty-one of the young traffic victims, aged 8 years and older, of the prospective study described in Chapter 2 also completed the TACQOL themselves shortly after the injury, 3 months (T1) and 6 months post-injury (T2). At the latter two follow-up measurements, the children and their parents also completed the Impact of Event Scale to measure post-traumatic stress reactions.

The children only reported short-term adverse changes in the motor functioning and autonomy HRQoL domains. The subgroups of hospitalized children and the children with lower extremity fractures had significantly lower scores in these domains compared with their counterparts. Furthermore,
children injured in a motor vehicle accident also indicated lower motor functioning compared with the children not injured in an incident with a motor vehicle. The T2 motor functioning and autonomy scores of the sample did not differ significantly from the respective pre-injury scores.

With respect to the post-traumatic stress reactions, 12% of the children and 16% of the parents in the study reported serious post-traumatic stress symptoms at T1. At T2, these percentages were 12% and 6%, respectively. Far larger percentages of parents and children reported mild through moderate stress symptoms at T1 or T2. Increased stress at T1 or throughout the follow-up was observed among hospitalized children, children with head injuries, and children injured in a motor vehicle accident. Parental stress was related to low socio-economic status and the seriousness of the child’s injury and accident.

In summary, we found that the children only reported temporary adverse effects in their motor functioning and autonomy, and that post-traumatic stress symptoms are common among both the children and their parents following pediatric traffic injury.

Chapter 4. Long-term HRQoL

To explore the long-term health-related quality of life (HRQoL) of young traffic victims, 320 parents of young traffic victims were asked to complete the TACQOL. The traffic victims, aged between 6-15 at follow-up in June 1999, had attended the Department of Traumatology of University Hospital Groningen between 1996 and 1997. Eventually, 211 parental questionnaires could be used for analyses. The mean follow-up time was 2.4 years. To examine the young traffic victims’ HRQoL, comparisons were made with the HRQoL of a reference group of children. Compared with these children, the overall group of young traffic victims experienced a lower HRQoL sumscore. Subgroups of hospitalized young traffic victims, traffic victims with serious injuries (ISS≥9), children who had experienced a stressful life event after the traffic accident, and children from low socioeconomic status (SES) parents, experienced a lower HRQoL sumscore compared with their respective counterparts.

A total of 48 parents (23%) attributed their child's reduced HRQoL specifically to the traffic accident. Specifically, children of low SES parents and severely injured children proved to be at particularly high risk of a reduced long-term HRQoL due to a traffic incident.
Chapter 5. Long-term HRQoL

To investigate the long-term HRQoL from the point of view of the young traffic victims themselves, those children aged 8 and older from the study population of Chapter 4 were also asked to complete the TACQOL. Furthermore, the parental reports were also included to address the child-parent agreement on the child's HRQoL.

The data of 157 child-parent pairs were available for analysis. The study population of young traffic victims reported a significantly lower HRQoL in the motor and autonomy scales compared with contemporaries in the reference group. Analyses indicated a low to moderate child-parent agreement with respect to the child’s HRQoL. The children were more negative regarding their physical complaints, motor, autonomy and positive-emotion HRQoL scales than their parents.

In general, the results revealed that the total group of young traffic victims reported a reasonably good long-term HRQoL. Few psychosocial problems emerged. Physicians who rely only on parental reports may overestimate the child's HRQoL, especially when assessing physical functioning. Until the reasons for child and parent disagreement are unraveled, the child's own reports need to be included to obtain a comprehensive picture of the child's HRQoL.

Chapter 6. Bicycle-spoke injuries: accident details and outcome

A questionnaire survey among the parents of children with bicycle-spoke injuries was performed to gain insight on the circumstances of bicycle-spoke accidents and to investigate whether these incidents affect the children’s physical and/or psychosocial functioning. The parents of children aged between 1-12 who arrived with bicycle-spoke injuries at the Department of Traumatology of University Hospital Groningen between January 1998 and October 1999 were asked to participate in the survey. The questionnaire asked about the accident details, the quality of life and the functional health status (behavior) of the injured child.

Fifty-nine parents filled out the questionnaire. The mean follow-up time was 13.2 months. The children had been transported on the carrier (66%), in a bicycle-seat on the carrier (25%) and on the crossbar of the bicycle (8%). Half of the children (51%) were seated on the carrier without any foot supports. Only 24% of the bicycles were equipped with intact coat-guards.

With respect to the impact of the incident on the child’s behavior, 14% of the parents attributed behavioral problems to the bicycle-spoke accident.
Regarding the child’s wellbeing, the younger children (1-5 years old) were found to have significantly lower motor functioning scores compared with a reference group.

Apparently, not all children had fully recovered one year after the bicycle-spoke accident. The sequelae included physical and behavioral aspects of functioning. Furthermore, in light of future prevention activities, it became clear that many of the bicycles lacked adequate protective features. The prevention efforts should include the further development and official adoption of standards for bicycle-seats and spoke-guards. Bicycle manufactures should supply bicycles already fitted with adequate spoke-guards.

**Discussion**

The final chapter discusses the main findings regarding in particular the central themes of the thesis, i.e. the HRQoL of young traffic victims and the post-traumatic stress of traffic-injured children and their parents.

**HRQoL**

The short-term studies revealed that adverse changes in HRQoL after pediatric traffic injury are short lived because the overall sample of young traffic victims was back at pre-injury HRQoL within six months. However, the long-term HRQoL results indicated that the young traffic victims had significantly lower scores on a number of the HRQoL domains compared with reference children. Yet, Cohen’s calculated effect sizes pointed out that these differences were small and of questionable clinical relevance. A future prospective study should include a long-term assessment, a number of years after the accident, to conclude whether the young traffic victims’ long-term HRQoL deviates from the short-term, e.g. six months, HRQoL reports.

The variables indicative of the severity of the child’s injuries, i.e., the need for hospitalization and the ISS, were most consistently related with the young traffic victims’ HRQoL. Furthermore, the association between the parents’ SES and the young traffic victims’ long-term HRQoL is a noteworthy finding. It might be that children of low SES parents have more difficulty in adjusting to the consequences of the traffic incident compared with their counterparts from higher SES parents.

Finally, we have some remarks with respect to the TACQOL HRQoL instrument applied in our outcome studies. Ideally, for clinical practice and future research on the HRQoL of injured children, a HRQoL instrument should be made available for which the minimal clinically important
Summary

difference is set, and that can be used for individual assessment. We advocate a generic instrument that is supplemented by injury-specific modules.

Post-traumatic stress reactions
Pediatric traffic injuries are associated with post-traumatic stress symptoms, not only in the children but in their parents as well. The child’s symptoms need to be detected and possibly treated as they can affect the child’s functioning and development, including school achievement. Moreover, the parental stress symptoms need to be watched because these can affect not only parental wellbeing, but influence the child’s symptoms and the parents’ capacity to support their child as well.
In view of the strong association between post-traumatic stress symptoms and the involvement of a motor vehicle in the accident (car, bus, truck), we suggest that the children injured in a motor vehicle accident, and their parents, need to be informed about the probable emergence of avoidance, intrusion and hyperarousal symptoms. Furthermore, at a follow-up visit, the children and their parents need to be asked about their symptoms to determine whether they are in need of treatment.