

## **Bicycle-related injuries: a survey in a pediatric emergency department**

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The number of bicycle-related injuries has risen significantly with the increased popularity of bicycle riding in Canada. The risk of injury is highest among children. To assess the magnitude of the problem and to identify the contributing factors we used a questionnaire, injury reports and patient charts to survey bicycle-related injuries among children brought to the emergency department of the Children's Hospital of Eastern Ontario, Ottawa, between May 1 and Sept. 30, 1988. The questionnaire was completed for 517 (91%) of the 568 children; 70% were boys, and the mean age was 9.4 years. Only 2% of the patients had been wearing a helmet at the time of injury, although 13% claimed to own one for cycling. Over 60% of the accidents were attributable to carelessness or poor bicycle control; mechanical failure and environmental hazards were minor factors. Over 80% of the injuries occurred within a kilometre of the child's home. Of the 97 children admitted to hospital 49% had head and skull injuries and 40% had limb fractures. Bicycle-related injuries represented 14.8% of all nonwinter (Apr. 1 to Oct. 31) trauma admissions among children 5 years or older. Our results further document bicycle-related injuries as an important childhood problem and underscore the need for improved safety measures.

La popularité croissante de la bicyclette au Canada a amené une augmentation significative du nombre des blessures qui y sont reliées. C'est pour les enfants que le risque est le plus grand. Afin d'en déterminer l'importance et les facteurs prédisposants, nous l'étudions à partir d'un questionnaire, des rapports de traumatismes et des dossiers hospitaliers pour tous les enfants blessés à bicyclette s'étant présentés aux urgences de l'hôpital pour enfants de l'est de l'Ontario, à Ottawa, du 1 mai au 30 sept. 1988. Il s'agit de 568 enfants, pour 517 (91%) desquels on répond au questionnaire. De ceux-ci, 70% sont des garçons; l'âge moyen est de 9,4 ans. Seuls 2% des enfants portaient un casque au moment de l'accident, mais 13% disent en posséder un pour aller à bicyclette. On attribue plus de 60% des accidents à l'imprudence ou au maniement fautif de la bicyclette; les difficultés mécaniques et les risques extérieurs comptent pour peu. Plus de 80% des accidents surviennent à moins d'un kilomètre de la maison. On hospitalise 97 enfants dont 49% sont blessés à la tête et 40% ont subi des fractures des membres. Du 1 avr. au 31 oct., parmi les hospitalisations d'enfants âgés d'au moins 5 ans motivées par un traumatisme, il s'agit dans 14,8% des cas d'un accident de bicyclette. Nous avons ajouté à notre connaissance de cette importante question et souligné le besoin d'améliorer les mesures de sécurité.

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**A** significant rise in the number of bicycle-related injuries has accompanied the increasing popularity of bicycle riding in the urban areas of Canada. In Ontario 55 people died of such injuries in 1988, as compared with 35 in 1987 (*Ottawa Citizen*, July 9, 1989: B7). Head injuries are the principal cause of death in 70% to 80% of accidents involving bicycles.<sup>1</sup>

Although bicycling is popular among people of all ages the risk of injury is highest among children. In the United States 63% of deaths from bicycle-related injuries in 1988 occurred among cyclists less than 19 years of age.<sup>2</sup> In Quebec during 1986-87 almost half of all bicycle-related deaths involved children aged 5 to 14 years.<sup>3</sup> In a 2-year study at the Children's Hospital of Eastern Ontario (CHEO), Ottawa, bicycle accidents were identified as the single most important cause of serious head injury in childhood.<sup>4</sup>

The purpose of this study was to assess the magnitude of the problem (the number of children involved and the types of injuries) and to identify contributing factors, including patient demographics, type and condition of the bicycles, circumstances surrounding the accident and rider safety practices. The study drew on similar research carried out in the United States and Australia.<sup>5,6</sup>

## Methods

We conducted a survey of bicycle-related injuries among children brought to the emergency department of CHEO between May 1 and Sept. 30, 1988. This facility was chosen because it is busy (56 000 patient visits per year) and it receives most children involved in accidents in the Ottawa-Carleton region as well as most children with major trauma in eastern Ontario and western Quebec.

The survey consisted of a questionnaire and injury reports. The questionnaire was distributed by the triage nurse; seriously injured patients as well as young children not accompanied by a parent were excluded. Short information sheets describing the injury and the treatment were completed for all patients, including those not surveyed, by the attending physician. The research assistant reviewed the charts of all children admitted to hospital.

Information was obtained on the age, sex and medical history, including previous bicycle accidents, of the children, the type of bicycle, including its road worthiness, the frequency of maintenance, the safety features, whether the child had ever received instructions for safe bicycle riding and the circumstances of the accident. The circumstances allowed some judgement to be made of the relative importance to the accident of rider error, mechanical failure and environmental hazard. In addition, the

children and their parents were asked whether they used protective headgear and, if not, their attitude toward the possibility of using a helmet in the future.

## Results

A total of 568 children involved in bicycle-related accidents presented to the emergency department of CHEO during the study period. The questionnaire was completed in 517 (91%) of the cases, by a parent (in 76%), the rider (in 15%), the rider and his or her parent (in 5%) and someone else (in 4%). Only rarely did the patient or parent decline to respond, and in most cases the nonparticipants were deliberately excluded because they were seriously injured or were young children unaccompanied by a parent. Injury reports were completed for all 568 patients, and the charts of 97 children admitted to hospital were reviewed.

### *Patient profile*

Boys accounted for 363 (70%) of the patients; this represents a pattern typical of childhood injuries. The ages were from 1 to 17 (mean 9.4) years; 132 (26%) were less than 7 years and 250 (48%) less than 10. The largest group consisted of children 5 years of age. A total of 198 children (38%) had 3 or fewer years of experience riding a bicycle. In 99 cases (19%) this was not the first bicycle-related injury. At the time of injury 512 (99%) were healthy.

### *The bicycles*

Of the bicycles 202 (39%) were standard 1-speed models, 165 (32%) had 10 or more speeds, 73 (14%) were BMX-style bicycles, 41 (8%) were mountain bikes, 20 (4%) had 3 or 5 speeds, and 16 (3%) were tricycles or bicycles with training wheels. In 326 (63%) of the cases the bicycles were less than 2 years old. A total of 383 bicycles (74%) had been repaired at home or in a shop the same year as the accident.

### *Circumstances*

Of the accidents 235 (45%) occurred before July 1. There was an equal distribution of accidents throughout the week. A total of 245 (47%) occurred in the afternoon and 211 (41%) in the evening; for the accidents in the evening the light did not appear to have been a factor, since only nine (2%) of the respondents reported poorly lit or foggy conditions.

Weather and road conditions were not major causative factors in the accidents; for example, it was raining or slippery in only 39 (8%) of the cases, and there was sand or gravel on the road in only 72 (14%). The locations of the accidents, in decreasing

order, were as follows: sidestreets (218 [42%]), a highway or major street (48 [9%]) and intersections (29 [6%]); 429 (83%) of the accidents occurred less than a kilometre from the victim's home.

In 343 (66%) of the cases the rider was alone or with friends; only 68 (13%) of the riders were accompanied by a parent. Most of the accidents (416 [80%]) occurred when the cyclist was riding for recreation or visiting a friend; only 52 (10%) happened when the cyclist was on an errand or riding to or from school. Poor riding skills or reckless or careless behaviour that led to loss of control caused 321 (62%) of the accidents (Table 1). Mechanical failure was reported in 57 (11%) of the cases and environmental hazards in 47 (9%). In 38 cases (7%) the cyclist reported being hit by a car and in 34 (6%) by another cyclist.

### Safety practices and equipment

Of the children 135 (26%) had attended a bicycle safety course; 43 (32%) had enrolled the same year as the accident and 35 (26%) the previous year. The courses were offered by the police, schools and cub scout or girl guide organizations.

In 403 (78%) of the cases the bicycle had reflectors, but in only 46 (9%) was there a light. Only 71 (14%) of the children reported having a helmet for cycling; 21 (4%) said they used the helmet regularly, and yet only 13 (2%) were wearing a helmet at the time of the accident.

Of the 71 children who reported having a helmet 49 (69%) had a bicycle helmet, 18 (25%) a hockey helmet and 4 (6%) some other type. Another family member wore a helmet in only 45 (9%) of the cases, and the parents wore a helmet in only 18 (3%). A total of 136 children (26%) reported wearing a helmet for skating.

When the parents of those who did not own a helmet were asked whether they would consider buying one for their child 80 (18%) said they would. The most common reason for having reservations about buying a helmet, given by 98 (22%) of the

respondents, was the belief that the child would not wear it. Much of the resistance among the children to wearing a helmet stemmed from peer pressure. Few people objected to the price of helmets, although it is uncertain whether all of the respondents were aware of the relatively high price, and few questioned their effectiveness.

### Types of injuries

For the 568 children involved in bicycle-related accidents 738 injuries were recorded (Table 2); 407 (55%) involved the extremities and 257 (35%) the head, neck and face. Most (439 [57%]) of the injuries were abrasions, contusions and soft-tissue injuries (Table 3). Lacerations accounted for 141 (18%), fractures for 111 (14%) and head injuries for 77 (10%); injuries to the internal organs accounted for only 5 (1%).

During the survey period 97 (17%) of the 568 children were admitted to hospital. The mean age was 10.5 years. Boys accounted for 71 (73%) of the

Table 1: Cause of bicycle accidents among 517 children seen at the emergency department of the Children's Hospital of Eastern Ontario, Ottawa, between May 1 and Sept. 30, 1988

Cause	No. (and %) of children
Loss of control	321 (62)
Mechanical failure	57 (11)
Environmental hazard	47 (9)
Collision with a car	38 (7)
Collision with another cyclist	34 (6)
Bicycle was stationary	2 (0.4)
Other	18 (3)

Table 2: Location of injuries\*

Location	No. (and %) of injuries
Arm	233 (32)
Leg	174 (24)
Head and neck	149 (20)
Face	108 (15)
Back and chest	28 (4)
Mouth	24 (3)
Abdomen	10 (1)
Genital area	7 (1)
Eye	3 (0.4)
Other	2 (0.3)
Total	738 (100)

\*Because of multiple injuries in some cases, the total number of injuries (738) is greater than the total number of children (517).

Table 3: Type of injury\*

Type	No. (and %) of injuries
Abrasion	216 (28)
Laceration	141 (18)
Contusion	112 (14)
Fracture	111 (14)
Soft-tissue injury	111 (14)
Head injury	77 (10)
Internal organ injury	5 (0.6)
Total	773 (100)

\*The total number for type of injury (773) is greater than the total number of injuries (738) because some areas had more than one type of injury.

admissions. The accident involved collision with a motor vehicle in 23 (24%) of the cases.

The most common reasons for hospital admission were head and skull injuries (in 48 cases [49%]), limb fractures (in 39 [40%]) and abdominal trauma (in 6 [6%]), which included ruptured spleen in 2 cases. Fifteen children (15%) suffered multiple injuries. Table 4 shows the profile of injuries for the 97 children admitted. The average length of stay in hospital was 9.4 days; the longest stay was 23 days. Over half of the patients had to stay only overnight. Surgery was required in 26 of the cases: orthopedic surgery in 21, neurosurgery in 2, abdominal surgery in 2 and oral surgery in 1. Eleven patients were admitted to the intensive care unit.

## Discussion

During the study period two young cyclists were killed in the Ottawa-Carleton region; however, neither was brought to CHEO. Although one cannot ignore the importance of injuries from bicycle accidents, the data have a number of limitations. CHEO is widely used as a community facility; however, an unidentified number of local children with minor injuries obviously sought care at other community hospitals. Furthermore, many of the severely injured patients were referred from outlying hospitals. Therefore, our data underestimate the number of visits to the emergency department and inflate the proportion of admissions in the pediatric population of Ottawa-Carleton.

We were unable to measure bicycle-related injuries as a proportion of pediatric trauma. To quantify more accurately the burden of bicycle-related injuries we examined the number of trauma admissions for children aged 5 years or older from Apr. 1 to Oct. 30. In 1988 bicycle-related injuries accounted for

14.8% of trauma admissions, as compared with 17.5% in 1986 and 17.1% in 1987.<sup>7</sup> Our findings provide further evidence that bicycle-related injuries are an important cause of disability and death in childhood and underscore the need for effective prevention programs.

The mean age of the children in our study (9.4 years) is close to the mean age of children in a similar study in the United States (8.7 years).<sup>5</sup> Typically what we are seeing in the emergency department is not a foolhardy adolescent but, rather, a young, inexperienced rider. Educational efforts should start early, in kindergarten and the early grades, and should be directed toward children who are new riders. Because over twice as many boys as girls are injured additional time should be spent educating boys, perhaps through cub scouts or sports groups. Since so many of the bicycles were new or recently repaired, there may also be an opportunity for bicycle stores to participate in safety promotion programs.

Our findings that 83% of the children were within a kilometre from home and 80% were riding for recreation or to visit friends suggest insufficient parental supervision and a false perception on the part of families that bicycles are just another toy.

Poor riding skills and careless behaviour accounted for injuries in over 60% of our cases. This evidence indicates a need for better cycling skills, more careful behaviour and an awareness that the bicycle is a vehicle. We know that only about 25% of the children had previous safety instruction; this shows that many more young cyclists could be reached. Furthermore, safety courses must include more emphasis on helmet promotion, particularly since helmet use was extremely low in our study population (2%). A number of studies have shown that bicycle safety helmets effectively prevent head injuries, the most common cause of death and disability in bicycle accidents.<sup>8-11</sup> Helmet use is not popular among adults; thus, their example cannot be expected to influence children to wear helmets. In a 1988 survey in Ottawa 10.7% of cyclists were observed wearing helmets; the highest rate (17.9%) was among older, commuting cyclists and the lowest (0.8%) among primary school children.<sup>7</sup>

Constraints to the use of bicycle helmets include inadequate knowledge about the need and effectiveness of helmets, price, comfort, convenience and, particularly among children, peer pressure. A multidisciplinary community approach to helmet promotion involving such groups as parents, schools, sports organizations, police and health care professionals should be encouraged. Evidence from two studies we conducted in Ottawa has shown that interventions by physicians alone have little impact (unpublished data), whereas the findings from a

Table 4: Injury profile for 97 children admitted to hospital

Type of injury	No. (and %) of injuries*
Head and skull injury	48 (44)
Arm fracture	33 (30)
Leg fracture	13 (12)
Abdominal trauma	6 (6)
Oral trauma	2 (2)
Pelvic fracture	2 (2)
Soft-tissue infection	2 (2)
Nasal fracture	1 (1)
Spinal fracture	1 (1)
Perineal trauma	1 (1)
Total	109 (100)

\*The total number of injuries (109) is greater than the total number of admissions (97) because some children had multiple injuries.

study in Seattle have indicated that focused, community-wide campaigns are effective in achieving greater helmet use.<sup>12</sup>

Additional preventive measures include design and evaluation of instructional programs for children, motorist education and improved availability of bicycle paths. The ultimate responsibility lies with parents. They must be informed about the dangers cycling can pose for young children and encouraged to ensure that basic safety requirements are met, the most practical and immediate of which is the use of protective headgear.

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## Conferences

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**Oct. 11-12, 1990:** Histopathologic Diagnosis of Inflammatory and Neoplastic Skin Diseases: Assessment of Patterns and Silhouettes

Halifax Sheraton

Dr. Noreen Walsh, Department of Pathology, Victoria General Hospital, Rm. 721, D.J. MacKenzie Building, 1278 Tower Rd., Halifax, NS B3H 2Y9; (902) 428-3897

**Oct. 11-14, 1990:** Canadian Pain Society (IASP Chapter) Annual Meeting

London, Ont.

Ms. Inese Kramins, Local Arrangements Committee, Department of Psychology, University of Western Ontario, London, Ont. N6A 5C2

**Oct. 12-14, 1990:** Freud and the History of Psychoanalysis Trinity College, University of Toronto

Dr. Andrew Brink or Herma Joel, 300 Larkin Building, Trinity College, 6 Hoskin Ave., Toronto, Ont. M5S 1H8; (416) 978-8454

**Oct. 13, 1990:** Undersea and Hyperbaric Medical Society (Great Lakes chapter) 11th Annual Scientific Meeting Toronto General Hospital

Dr. Rhonda Wilansky, Hyperbaric Department, CCRW G-821, 200 Elizabeth St., Toronto, Ont. M5G 2C4; (416) 340-4481, FAX (416) 340-3698

**Oct. 16-20, 1990:** Annual Joint Meeting of the Canadian Cardiovascular Society, the Canadian Council of Cardiovascular Nurses, the Heart and Stroke Foundation of Canada and the Canadian Society of Clinical Perfusionists

World Trade and Convention Centre, Halifax Betty Fata, 645-375 Water St., Vancouver, BC V6B 5C6; (604) 681-5226, FAX (604) 681-2503

**Oct. 17-20, 1990:** Canadian Group Psychotherapy Association 11th Annual Conference

Minto Place Suite Hotel, Ottawa

Dr. Allen A. Surkis, 675-1650 Cedar Avenue, Montreal, PQ H3G 1A4; (514) 934-8010

**Le 18-20 oct. 1990:** 11e congrès annuel de la Société québécoise de biochimie clinique

Hôtel Château Mont Sainte-Anne, Beauport, PQ

Pierre Douville, président du Comité organisateur, Service de biochimie, Hôtel-Dieu de Québec, 11 Côte du Palais, Québec, PQ G1R 2J6; (418) 691-5135

**Nov. 1-2, 1990:** 1990 Gairdner Foundation International Awards Lectures

University of Toronto, main auditorium

Sally-Anne Hrica, executive director, Gairdner Foundation, 220-255 Yorkland Blvd., Willowdale, Ont. M2J 1S3; (416) 493-3101, FAX (416) 493-8158