Sequelae after unintentional injuries to children: an exploratory study

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Abstract

Goal—To determine the frequency and categories of sequelae related to accidental injuries (of all types) in childhood, a prospective follow up study was conducted on a geographically defined population near Paris, France.

Methods—The study concerned all child residents of one health care district, aged under 15 years, and hospitalised in the two public hospitals of the district, and/or transported by mobile emergency units, after an accident, during a one year period (in 1981–82; n = 785). Initial severity was scored using the injury severity score (ISS). Sequelae were defined as established impairments (leading or not to disabilities), identified by physicians, reporting their clinical diagnosis or complaints by the child and/or the family.

Results—After a follow up period of 3.6–29.2 months after the accident, six children died and 78 (10%) were lost to follow up. Among the 701 others, 73 (10.4%) presented 80 sequelae, major (limiting daily activities) in 44 children (6.3%), with no gender difference. These increased significantly with age. The main causes of major sequelae were eye injuries and sports related injuries to the limbs. ISS did not correlate well with sequelae, but the maximum abbreviated injury scale appeared to be a better predictor of long term functional prognosis.

Conclusion—Prospective follow up and population based studies are still needed, especially on children's injuries initially perceived as benign, such as most of the sports related injuries in our study.

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Keywords: injury sequelae; sports injuries

It is commonly accepted that injuries are the main cause of acquired disability in childhood and adolescence. Nevertheless, there are few data describing the prevalence of these disabilities in the general population, or the part played by injuries among all causes of disabilities. Little is known about the frequency of disabilities among injured populations, and the distribution of the various types of impairments and disabilities of accidental origin. In a British study, the prevalence rate of accident related disabilities in a cohort of children born in 1975 was estimated to be 4/1000 children aged 2 and 3 years.¹ In France, in 1980, it was shown that the prevalence rate of accident related severe disabilities in children aged 0–14

years was 6.7/10 000.² More recently, a study based on a national cohort of children born in England, Scotland and Wales in March 1958, showed that, by age 23 years, 62% of men and 26% of women reported at least one injury since age 16 requiring hospital treatment, and of these, 3.2% resulted in permanent disabilities.³

At all ages, but notably in children, most follow up studies deal with accidents known to be potentially severe and possibly the cause of disability, such as brain trauma,^{4–6} submersions, traffic accidents,^{7–8} or farm accidents.^{9–10} Very few include accidents of all types^{11–13} and some use very small samples.¹⁴

Moreover, reliable figures are very rare due to several methodological issues. The definition of disabilities varies from one study to another. Many studies are retrospective, based on hospital records, which usually leads to loss of information (especially on the circumstances of the accident). There are few studies conducted on well defined populations, enabling the calculation of rates. In fact, most studies deal with admissions to hospitals that do not serve geographically defined populations. Usually the period of follow up after the accident is short: in many cases outcome is assessed at hospital discharge. Even in cases where the period is longer, not all impairments are fixed by the end of the study. Finally, the percentage of “lost to follow up” is often not known or not reported, or, if indicated, is sometimes high, leading to complex biases.

The prospective follow up study presented here was conducted in a geographically defined population. Data were collected in all public and private health care facilities of one health care district and the incidence rate of unintentional injuries leading to contacting the health care services was approximately 10%.¹⁵ The general methodology of this survey is described elsewhere,^{15–16} including a reflection on the problems encountered in data collection in the private health care sector.¹⁶ These difficulties, as well as the predominant part played by the public health sector in France in the emergency care of severe injuries (notably traffic related), led us to implement the follow up study in the public sector only. The goal of this study was to identify the frequency and types of sequelae of injuries related to all categories of accidents, and to analyse the factors linked with the occurrence of these sequelae.

Population and methods

POPULATION

The study was conducted in a health care district near Paris, France, comprising 448 216

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Table 1 Distribution of minor and major sequelae after injuries

Type of sequelae	Sequelae		
	Minor (n)	Major (n)	No (%) all
Visual and hearing	0	18	18 (23)
Cosmetic	12	4	16 (20)
Limited joint mobility	6	9	15 (19)
Shortening, angulation of a limb	4	5	9 (11)
Electroencephalographic	0	9	9 (11)
Pain	7	1	8 (10)
Sensitive	0	2	2 (3)
Genital	0	1	1 (1)
Mental	0	1	1 (1)
Sleeping problems	1	0	1 (1)
Total	30	50	80 (100)

inhabitants (including 104 212 children under 15), at the time of the 1982 national census.

The study population is made up of 785 children under 15 who were residents of the area, and who experienced an accident between 1 August 1981 and 31 July 1982 and were admitted to either of the two public hospitals of the district (Poissy and Saint Germain-en-Laye) and/or transported by these hospitals' mobile emergency units.

It was not possible to identify injuries to residents that were sustained and completely treated outside the study district.

DEFINITIONS

An accident was defined as "an unexpected, unintentional and violent event, affecting a child, with or without detectable lesions, and subsequently leading to medical attention". Food poisoning, insect bites, sunburn, and frostbite were excluded. If the same child was injured more than once during the study period, all injuries were registered, but for repeated visits or admissions and/or visits in several medical facilities for the same injury, the child was counted only once. Therefore the statistical unit of measurement is the victim.

Initial severity was scored using the injury severity score (ISS),¹⁷ derived from the abbreviated injury scale (AIS), and by the 1980 version of AIS.¹⁸ Severity was also assessed using the maximum abbreviated injury scale (MAIS) score. These scales were used for all traumatic injuries (n = 601).

Fractures were divided into: major (affecting the epiphyseal plate, comminuted fractures, open fractures and multiple fractures) and minor (all others).

Sequelae were defined as fixed impairments (leading or not to disability) with no prospect of future improvement. They were identified by the physician through clinical examination and/or complaints reported by the child and/or the family. They were considered as major or minor according to the existence or not of a limitation in daily activities (reported by the family and defined according to the child's age).

METHOD OF DATA COLLECTION

Through interviews with the family (and of the child, when possible according to age), and recording of information from the medical files, details were obtained on age and sex, place and type of accident, location and type of

Table 2 Distribution of major sequelae by characteristics of victims and injuries

	No*	Major sequelae (%)	p Value
Sex			
Male	475	7	NS
Female	224	5	
Age (years)			
0-5	281	3	<0.04
6-11	259	7	
≥12	159	10	
Place of injury			
Home	247	6	<0.02
School†	85	4	
Traffic	147	10	
Sports‡	59	14	
Other and unknown	161	3	
Location of traumatic lesions			
Skull	170	4	<0.01
Face and neck	58	17	
Upper limb	124	8	<0.001
Lower limb	50	4	
Multiple lesions	121	9	
Type of traumatic lesions			
Deep or extensive wound	54	22	<0.001
Major fracture, dislocation	78	9	
Minor fracture, sprain	130	7	
Contusion	190	4	
Minor cut and laceration	70	6	

*Lost to follow up and fatal cases excluded (n=701).

†Excluding school physical education.

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lesions, number of hospital admissions, length of stay, and cost of hospitalisation.

In order to identify sequelae, all medical files were reviewed and physicians interviewed, after the last consultation, the end of treatment and rehabilitation, and when full recovery of the child was established, according to the physician's judgment. Thus the follow up lasted 3.6-29.2 months (median = 14.8 months). Families were not interviewed at this stage of the survey.

ANALYSIS

Statistical differences were determined by the χ^2 method. Differences between groups were considered as statistically significant for p values of 0.05 or less.

Results

STUDY POPULATION

Among 785 injured and transported and/or hospitalised children: 362 were considered fully recovered at discharge after the first hospitalisation; 339 were followed as outpatients (some were readmitted); six died; and 78 (10%) were lost to follow up. Therefore, the frequency of sequelae was calculated on the population excluding fatal cases and those lost to follow up (n = 701).

FREQUENCY AND TYPE OF SEQUELAE

Among 701 children, 73 (10.4%) presented 80 sequelae, 29 of which were considered minor (4.1%) and 44 as major (6.3%).

Among the 80 sequelae, the most frequent were sensory impairments (table 1), mainly visual (13 cases out of 18), and mostly severe. Cosmetic sequelae were frequent but usually benign (mainly broken teeth). Sequelae affecting the musculoskeletal system accounted for 30% (n = 24).

Table 3 Percentage of major sequelae according to the length and number of hospitalisations

	No*	Major sequelae (%)	p Value
Length of the first hospitalisation			
≤ 1 day	214	0.5	
2–3 days	244	4	
4–6 days	145	5	
≥ 7 days	96	27	<0.001
No of hospital admissions			
1	655	5	
≥ 2	43	23	<0.001
Total length of hospitalisation			
≤ 1 day	209	0.5	
2–3 days	241	4	
4–6 days	146	5	
≥ 7 days	101	26	<0.001

*Lost to follow up and fatal cases excluded (n=701).

AGE AND SEX DISTRIBUTION

The percentage of major sequelae was similar in both sexes but significantly increased with age (table 2).

PERCENTAGE OF MAJOR SEQUELAE ACCORDING TO THE PLACE OF ACCIDENT

Traffic and above all sports related accidents were responsible for the highest percentages of sequelae (table 2). This result is consistent with the increase of the frequency of sequelae with age, as the role of traffic and, more specifically, sports related injuries increase with age.

PERCENTAGE OF MAJOR SEQUELAE ACCORDING TO THE TYPE AND LOCATION OF THE LESIONS (TABLE 2)

The high percentage of sequelae after lesions of the face and deep wounds is mainly related to eye injuries (25 cases resulting in 13 major sequelae). Upper limb lesions were responsible for a percentage of sequelae twice that of lower limb lesions. These upper limb lesions were more frequent among sports injuries (43%) than among all other types. In the same way,

major fractures (especially epiphyseal) and dislocations were mainly observed among children who sustained a sports related injury. Residual deformities of the musculoskeletal system and limitations of mobility were observed in 12% of children admitted after a sports injury (compared with 5% in home or traffic accidents, and 4% in school), but this difference is not significant, due probably to an insufficient number of cases.

In cases of isolated head trauma, the percentage of major sequelae was 7% if the child presented with altered consciousness and 3% if not. The presence of severe head traumas in the “multiple lesions” category accounts for the high percentage of major sequelae for these cases.

PERCENTAGE OF MAJOR SEQUELAE ACCORDING TO THE CHARACTERISTICS OF HOSPITALISATION (TABLE 3)

There is a significant relationship between the percentage of sequelae and the length and number of hospitalisations. This result is related to the high frequency of both epiphyseal fractures and major sequelae among children sustaining sports injuries. These fractures, compared with other categories, were more often treated by open reduction and internal fixation. This type of treatment was also associated with two or more hospitalisations in 20% of sports injuries compared with 2%–5% for other types of injuries. In addition, the hospitalisations were the longest for sports injuries.

The percentage of sequelae was also significantly linked to the cost of hospitalisation: the median cost was (in French francs) 2879 in the absence of sequelae, 4909 for minor sequelae and 8722 for major sequelae (\$1US = 6–9 French francs during the follow up study period).

RELATIONSHIP BETWEEN THE PERCENTAGE OF MAJOR SEQUELAE AND INITIAL SEVERITY

Severity, scored by the ISS, was identical in both sexes, but varied according to age, the greatest severity being observed among children aged 6–11 years (table 4). It is in this age group that the percentage of children injured in traffic as pedestrians or cyclists was the highest. In contrast, the initial severity of sports injuries was generally low (table 4).

Finally, no significant relationship was observed between the existence of major sequelae and initial severity when scored by the ISS, but a significant difference was found when using the MAIS for scoring severity (table 5).

Table 5 Percentage of sequelae according to the ISS and MAIS scores

	No*	Major sequelae (%)	p Value
ISS			
0–4	323	6	
5–9	173	8	
≥ 10	27	15	NS
MAIS			
1	159	2	
2	271	9	
≥ 3	93	11	<0.01

*Lost to follow up and fatal cases excluded, traumatic injuries only (n=523).

Table 4 Distribution of the ISS scores, at the time of accident, by characteristics of the victims and injuries

	No*	ISS scores (%)			p Value
		0–4	5–9	≥ 10	
Sex					
Male	428	61	33	6	
Female	172	59	34	7	NS
Age (years)					
0–5	177	75	22	3	
6–11	257	52	38	10	
≥ 12	166	57	38	5	<0.001
Place of injury					
Home	150	73	21	6	
School†	85	71	29	0	
Traffic	165	34	52	14	
Sports areas‡	61	66	31	3	
Other and unknown	139	68	29	3	<0.001
Location of traumatic lesions					
Skull	191	76	19	5	
Face and neck	63	78	21	1	
Upper limb	143	59	40	1	
Lower limb	57	68	32	0	
Multiple lesions	146	29	53	18	<0.001
Type of traumatic lesions					
Deep or extensive wound	63	62	25	13	
Major fracture, dislocation	89	22	71	7	
Minor fracture, sprain	150	57	36	7	
Contusion	218	69	28	3	
Minor cut and laceration	73	62	31	7	<0.001

*Traumatic injuries (n=601).

†Excluding school physical education.

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COMPARISON OF CASES FOLLOWED UP AND LOST TO FOLLOW UP

The 78 cases lost to follow up and the 707 (including six fatal cases) followed up did not differ for sex and age distribution, characteristics and severity of injury, or number and length of hospitalisation.

Discussion

In the definition of sequelae, we included both impairments (as defined in the World Health Organisation (WHO) International Classification of Impairments, Disabilities and Handicap) diagnosed by physicians, and children's and/or families' complaints (about disabilities) reported by the physicians. Most authors study disabilities, defined as a limitation of daily activities,^{6 13 19} possibly including limitations in sports activities.¹³ The consequences of injuries can also be studied in terms of quality of life,²⁰ or allocation of a disability pension.⁵ Nevertheless the latter may lead to selection bias in terms of severity and socioeconomic status. Since we could not interview the families on disabilities, and had to rely on medical files and the physicians' judgment, we decided to use the word "sequelae" as the broadest and most "neutral" term, as did Marchi *et al.*²¹ The importance of collecting self reported subjective data has been stressed by Barker *et al.*⁶ and Marchi *et al.*,²¹ but, if many agree on the value of self reported problems, as they are recorded in telephone inquiries,^{8 11 13 19} medical examination gives more accurate results as concerns impairments.

Because our study was prospective, this resulted in a minimal loss of information on data that are often missing in medical files, such as the place of occurrence.²² Although several early studies are based on the retrospective analysis of hospital data,^{4 10 11 23} the most recent studies on injury related disabilities are prospective.^{3 12 13 21 24}

There is no agreement on the ideal length of follow up. In some studies, disabilities are identified at hospital discharge.⁶ More often, the length of the follow up varies from six months¹³ to 12 months^{12 14 25} or 18 months.¹¹ Follow up periods longer than two or three years are rare.²¹ Whereas for minor trauma, the level of disablement seems to be fixed one year after the injury, such is not the case for major trauma.²⁵ Therefore, we chose the concept of "fixed deficit", as did Cogbill *et al.* in a study of agricultural injuries.¹⁰ Increasing the length of the follow up period leads to more cases lost to follow up. It is only 10% in our study and these cases do not differ from the others.

We conducted a population based study, as did Gofin *et al.*¹³ and Marchi *et al.*²¹ In France, injured patients of all socioeconomic status seek medical care in the public sector (which has the best technical equipment and trained personnel in intensive care) in case of severe injury. Therefore, investigating the two public hospitals of the district and their mobile emergency units ensured the registration of the cases the most likely to result in disabilities. Through the registers of the mobile emergency

units, we could also trace the children admitted in Paris' highly specialised units (neurosurgery, intensive care, burn units).

The data presented here are relatively old (1981–82 for the data on initial injuries). Nevertheless we decided to publish them because there are few studies of this type and because the French component of the European Home and Leisure Accidents Surveillance System (EHLASS) has shown no major changes over time in the distribution of the different categories of injuries in children.²⁶

In our study the percentage of sequelae is 10.4%, including 6.3% of major sequelae. These figures are difficult to compare with those from other studies due to differences in age categories and types of injuries. Three studies of sequelae address all categories of child injuries.^{11–13} In the Israeli study, 8.3% of children under 17 years had a limitation of daily activities six months after the accident.¹³ In a French study, 6.2% presented disabilities (among which one third were considered as severe) 18 months after the injury.¹¹ Among high school students we recorded 13% with "difficulties in daily life", including 5% that were moderate or severe one year after the accident.¹² Percentages of sequelae are much higher after very serious injuries, with figures from 14%–41% in studies addressing injuries such as brain trauma (Glasgow coma score <12),⁴ cervical spinal cord injuries,²³ farm injuries,⁹ or severe traffic related injuries.¹³ A nation-wide Israeli study of eye trauma showed loss of one eye in 20% of cases, with sports injuries accounting for 5%.²⁷ In our study, eye trauma and sports injuries show especially high rates of sequelae (14%), which is similar to the rate reported by Marchi *et al.* for sports injuries.²¹

We found no difference in the frequency of sequelae according to sex but their percentage regularly increases with age, because of the increase of traffic and sports injuries, as in other studies of children and young adolescents.^{11–13}

The percentage of major sequelae located in both upper and lower limbs is three times that of skull lesions. Several studies, in which severe head trauma and/or high severity scores are not predominant, as is the case in our study, consistently indicate that non-life threatening lesions of the extremities often result in disabilities.^{3 20 21} These disabilities are frequently the consequence of fractures, sprains and dislocations related to sports injuries,^{3 21} as we observed more specifically in the analysis of a subsample of children sustaining sports related injuries.²⁸ Fractures of the upper limb were especially frequent, and, in preadolescents, epiphyseal lesions were responsible for problems in bone growth and articular mobility. Furthermore, through repeated hospital admissions, long stays in hospital and costly surgical techniques, sports related injuries widely contribute to the high use of medical resources.

The comparison of the cases admitted in the public and the private health care sectors¹⁵ showed a greater severity, a higher percentage

of traffic injuries, and a higher rate of admissions at all ages, in the public sector. By contrast, the percentage of sports related injuries was higher in the private sector. Therefore, including this sector would have possibly led to a higher rate of sequelae from sports injuries, indicating the public health importance of these injuries.

The analysis of the relationship between initial severity and the existence of sequelae is especially important as it leads to questioning the predictive power, as concerns long term functional prognosis, of the most commonly used severity scales (AIS, ISS). Several studies show that the frequency of disabilities increases with severity^{6 13 21} or with hospital admission.³ But many other studies conclude that ISS does not correlate with functional status in the case of minor or moderately severe injuries²⁹⁻³¹ and limb lesions.¹⁴ ISS does correlate well with mortality but not with disability.⁸ In fact, functional impairment and recovery relate more to the body part involved than to ISS.¹⁴ Eye injuries and sports related limb lesions, scored low by ISS, were the main sources of sequelae in our study. However, we used the 1980 version of AIS¹⁸ and further revisions brought improvements in the scoring of limb lesions.³² In our study, MAIS appeared as a better predictor than ISS (which can be the sum of small scores). This was also noted in a study of limb lesions in adolescents and adults.²⁰

AIS and its derived scale, ISS, were created for scoring traffic injuries and are not well adapted to injuries affecting a growing skeleton (in particular the epiphyseal plate). New scales have been created to measure functional independence in children, but at the time of our survey, no appropriate tool to identify and measure impairments and disabilities had been validated on a French population of injured children. The International Classification of Impairments, Disabilities and Handicap was published by the WHO in 1980 and translated into French in 1988. Till now, it is not often used, though it represents a real effort to implement internationally common definitions of impairments, disabilities, and handicap. Although prospective follow up studies began to appear in the 1990s, there is still a need for more such studies, particularly in the case of children's injuries initially perceived as benign. Our study has implications for the prevention of disabilities, indicating the importance of rehabilitation and long term medical supervision of some categories of lesions, notably those resulting from sports accidents. It also suggests that sports related injuries are a priority for primary prevention.

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- 1 Jones CEM, Radford M. Origin of handicap in young children. *Arch Dis Child* 1981;56:535-7.
- 2 Tiret L, Nicaud V, Maguin P, et al. Les handicaps d'origine accidentelle chez les jeunes. In: M Manciaux, C Romer, eds. *Les accidents de l'enfant et de l'adolescent. La place de la recherche*. Paris: INSERM/WHO/La Documentation Française, Collection Analyses et Prospective, 1988: 77-87.

- 3 Barker M, Power C, Roberts I. Injuries and the risk of disability in teenagers and young adults. *Arch Dis Child* 1996;75:156-8.
- 4 Gaillard M, Hervé C, Reynaud P, et al. Epidémiologie des traumatismes crâniens graves chez l'enfant et pronostic des blessés hospitalisés en neurochirurgie. *Ann Pediatr* 1989; 36:194-8.
- 5 Engberg A, Teasdale TW. Traumatic brain injury in children in Denmark: a national 15-year study. *Eur J Epidemiol* 1998;14:165-73.
- 6 Di Scala C, Grant CC, Brook MM, et al. Functional outcome in children with traumatic brain injury. Agreement between clinical judgement and the functional independence measure. *Am J Phys Med Rehabil* 1992;71: 145-8.
- 7 Bull JP. Disabilities caused by road traffic accidents and their relation to severity scales. *Accid Anal Prev* 1985;17: 387-97.
- 8 Olkkonen S, Lahdenranta U, Slati P, et al. Bicycle accidents often cause disability: an analysis of medical and social consequences of non fatal bicycle accidents. *Scand J Soc Med* 1993;21:98-106.
- 9 Swanson JA, Sachs MI, Dahlgren KA, et al. Accidental farm injuries in children. *Am J Dis Child* 1987;141:1276-9.
- 10 Cogbill TH, Steenlage ES, Landerasper J, et al. Death and disability from agricultural injuries in Wisconsin: a 12-year experience with 739 patients. *J Trauma* 1991;31:1632-7.
- 11 Laborde A, Zmirou D. Impact épidémiologique et économique des accidents de l'enfant: soins aigus et suites d'accidents en Savoie. *Pediatr* 1991;46:625-31.
- 12 Yacoubovitch J, Lelong N, Cosquer M, et al. Etude épidémiologique des séquelles d'accidents à l'adolescence. *Arch Pediatr* 1995;2:532-8.
- 13 Gofin R, Adler B, Hass T. Incidence and impact of childhood and adolescent injuries: a population-based study. *J Trauma* 1999;47:15-21.
- 14 Hu X, Wesson DE, Logsetty S, et al. Functional limitations and recovery in children with severe trauma: a one-year follow-up. *J Trauma* 1994;37:209-13.
- 15 Tursz A, Crost M, Guyot MM, et al. Childhood accidents: a registration in public and private medical facilities of a French health care area. *Public Health* 1985;99:154-64.
- 16 Tursz A, Crost M, Pivault M, et al. Enregistrement des accidents de l'enfant dans les structures de soins et de prévention d'un secteur sanitaire. *Rev Epidemiol Sante Publique* 1984;32:286-94.
- 17 Baker SP, O'Neill B, Haddon W Jr, et al. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *J Trauma* 1974;3:187-96.
- 18 American Association for Automotive Medicine. *The abbreviated injury scale*. Morton Grove, IL: AAAM, 1980.
- 19 Casey R, Ludwig S, McCormick MC. Morbidity following minor head trauma in children. *Pediatrics* 1986;78:497-502.
- 20 Fern KT, Smith JT, Zee B, et al. Trauma patients with multiple extremity injuries: resource utilisation and long-term outcome in relation to injury severity scores. *J Trauma* 1998;45:489-94.
- 21 Marchi AG, Di Bello D, Messi G, et al. Permanent sequelae in sports injuries: a population based study. *Arch Dis Child* 1999;81:324-8.
- 22 Tursz A. Epidemiological studies of accident morbidity in children and young people: problems of method. *World Health Stat Q* 1986;39:257-67.
- 23 Orenstein JB, Klein BL, Gotschall CS, et al. Age and outcome in pediatric cervical spine injury: 11-year experience. *Pediatr Emerg Care* 1994;10:132-7.
- 24 Ferrando J, Plasencia A, MacKenzie E, et al. Disabilities resulting from traffic injuries in Barcelona, Spain: 1-year incidence by age, gender and type of user. *Accid Anal Prev* 1998;30:723-30.
- 25 Maurette P, Masson F, Nicaud V, et al. Posttraumatic disablement: a prospective study of impairment, disability and handicap. *J Trauma* 1992;33:728-36.
- 26 EHLASS. *Accidents domestiques et de loisir. Résultats France*. Paris: Ministère de la Solidarité et de l'Emploi (yearly publication).
- 27 Yanko L, Neumark Y, Hemo Y, et al. The Israeli ocular injuries study: incidence of legal blindness from ocular trauma. *Isr J Med Sci* 1995;31:423-8.
- 28 Tursz A, Crost M. Sports related injuries in children: a study of their characteristics, frequency and severity, with comparison to other types of accidental injury. *Am J Sports Med* 1986;14:294-9.
- 29 Wesson DE, Williams JJ, Spence LJ, et al. Use of the injury severity score (ISS) in a pediatric population. *30th Annual proceedings*. Montréal: American Association for Automotive Medicine, 1986.
- 30 Yates DW, Heath DF, Mars E, et al. A system for measuring the severity of temporary and permanent disability after injury. *Accid Anal Prev* 1991;23:323-9.
- 31 MacKenzie EJ, Shapiro S, Moody M, et al. Predicting post-trauma functional disability for individuals with severe brain injury. *Med Care* 1986;24:377-87.
- 32 Civil ID, William Schwab C. The abbreviated injury scale, 1985 revision: a condensed chart for clinical use. *J Trauma* 1988;28:87-90.