ORIGINAL ARTICLE

Injuries among disabled children: a study from Greece

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Objective: To compare the differential implications of sociodemographic and situational factors on the risk of injury among disabled and non-disabled children.

Design: Data from the Emergency Department Injury Surveillance System (EDISS) were used to compare, in a quasi case-control approach, injured children with or without disability with respect to sociodemographic, event and injury variables, and to estimate adjusted odds ratios for the injury in a disabled rather than a non-disabled child.

Setting: Two teaching hospitals in Athens and two district hospitals in the countryside that participate in the EDISS.

Patients: In the five year period 1996–2000, 110 066 children were recorded with injuries; 251 among them were identified as having a motor/psychomotor or sensory disability before the injury event.

Interventions: None.

Main outcome measures: Mechanism of injury, type of injury, risk-predisposing socioeconomic and environmental variables, odds ratio for injury occurrence.

Results: Falls and brain concussion are proportionally more common among disabled children, whereas upper limb and overexertion injuries are less common among them. Urban environment, migrant status, and cold months are also associated with increased odds for injuries to occur among disabled rather than non-disabled children. The odds ratio for the occurrence of an injury among disabled children increases with increasing age.

Conclusions: The results of the study provide the information for the targeting of trials of preventive measure in disabled children at increased risk of severe injuries.

In recent years, there has been an increased sensitivity to the challenges that disabled children face in their daily lives.^{1–3} However, the risk of injury has received relatively little attention and the epidemiology has not been adequately studied.^{1–2,4,5} There are two special factors that tend to alter the epidemiologic profile of injuries among disabled children. At first, exposure to injury risk of disabled children is reduced because of decreased mobility and, presumably, increased precautions. On the other hand, their injury risk for a given environmental exposure may be amplified because of the compromised adaptability to external hazards.²

Research on injuries among children with disabilities is hindered by the lack of comprehensive injury databases covering both previously healthy and already disabled children.⁶ Therefore, we used a large database (Emergency Department Injury Surveillance System, EDISS), which has been developed and run in Greece by the Center for Research and Prevention of Injuries among the Young to identify and investigate injuries among disabled children. This database covers all contacts of injured children in the emergency departments of four major hospitals across the country and allows, through the use of proper sampling fractions, the derivations of national estimates.⁷ The specific aim of this study was to compare the differential implications of socio-demographic and situational factors on the risk of injury among disabled and non-disabled children. In particular, we wanted to evaluate whether adverse social or environmental conditions differentially increase the odds for injuries among disabled rather than non-disabled children.

SUBJECTS AND METHODS

The EDISS records all childhood injuries treated at the emergency departments of a network of four participating

hospitals. Two of these hospitals (the district hospital of Volos in the Magnesia region of the Greek mainland and the district hospital of Kerkyra on the island of Corfu) have well defined population coverage of their respective regions. The other two hospitals, the Aglaia Kyriakou Children's Hospital and the Asclipeion Hospital are both located in the Greater Athens area and cover about 30% of the emergency department visits by children in this area.

Registered, trained, health visitors administered a structured questionnaire to all injured children and their escorts, who visited the emergency departments participating in the surveillance system. A precoded questionnaire, which covers sociodemographic variables (gender, age, nationality), event characteristics (place, time, activity, mechanism), and nature of injury (type of injury, injured body part, number of injuries, treatment) was used. The data were subsequently recoded using the *International Classification of Diseases*, 9th revision (ICD-9) classification and the European Home and Leisure Accident Surveillance System coding manuals.

During the five year period from 1 January 1996 to 31 December 2000, a total of 110 066 children with injuries were entered in EDISS. There were 251 children judged by the health visitors as being disabled with either motor/psychomotor or sensor disability. This judgment reflected the health visitors' opinion based on information from the child's guardian or the attending physician according to the National Health Interview Survey (from the National Institute on Disability and Rehabilitation Research), that explains impairment, and ICD codes.^{8,9} The patterns among the injured children judged to be disabled

Abbreviations: EDISS, Emergency Department Injury Surveillance System; ICD-9, *International Classification of Diseases*, 9th revision

Table 1 Distribution of the 110 066 children (0–14 years) with injuries recorded in the EDISS* database during the five year period 1996–2000 by demographic variables and permanent disability of the injured child

Variable	Disabled			Non-disabled children		
	No	%	Prevalence (‰)	No	%	p Value (χ^2 ; 1 df)
Gender						0.92
Male	158	62.9	2.3	69 440	63.2	
Female	93	37.1	2.3	40 375	36.8	
Age (years)						0.001
<5	42	16.7	1.1	39 876	36.3	
5–9	75	29.9	2.7	27 444	25	
10–14	134	53.4	3.1	42 495	38.7	
Nationality						0.005
Greek	224	89.2	2.2	102 758	93.5	
Migrant	27	10.8	3.8	7 057	6.5	
Place of residence						0.001
Urban	217	86.5	2.6	84 704	77.1	
Rural	34	13.5	1.4	25 111	22.9	

*Emergency Department Injury Surveillance System.

were compared to the remaining injured children in the database, who were presumed to be non-disabled, in a quasi case-control approach. Because all children were injured and the distinction between groups relied on previously existing disability, the study cannot be considered a formal case-control investigation; instead, it resembles the approach used for the analysis of proportional occurrence data when the population at risk is not explicitly defined.¹⁰ In the context of the study, the impact of disability on severity of injuries and the importance of factors (for example, sociodemographic and environmental) that may interact with disability in the occurrence of injuries were ascertained.

The initial analysis was performed through use of simple cross tabulations and the SAS statistical package has been utilized. Subsequently, multiple logistic regression was undertaken¹¹ as the analysis of choice in case-control studies. The adjusted odds ratios for an injury suffered by a disabled child rather than a non-disabled one were calculated or specified comparisons. Incidence rates of injury events cannot be directly estimated in this design and indirect calculations are precluded by the absence of data concerning the prevalence of disabled children in the underlying population. The basic model included sociodemographic (age, gender, nationality) and event characteristics (place of occurrence, time and mechanism of occurrence). Injury characteristics (type of injury, injured body part, number of injuries, and duration of hospitalisation) were alternatively added in the basic model; inclusion of all of them in the basic model introduces collinearity.

RESULTS

The 251 disabled children with injuries represented 2.3 per thousand of all children in the database. The prevalence of disabled children in the general population in countries with adequate statistics is reported as higher.¹² Among the EDISS registered children, 167 were recorded with motor and developmental disabilities (44% mental retardation, 32% motor impairments, 6% paralysis, 4% deformities, 4% orthopedic impairments, 4% Down's syndrome, 2% congenital absence or loss of an extremity, 2% serious speech impairment, and another 2% epilepsy) and the remaining 84 were recorded with serious permanent sight or hearing defects (76% blindness or serious visual impairment, 24% deafness or serious hearing impairment).¹²

Disabled children who sought emergency department care for an injury represent 1.1‰ of all injured children between 0–4 years of age, but this figure nearly triples to 3.1‰ among

those in the 10–14 age bracket (table 1). The prevalence of disability as a pre-existing condition in injured children is also significantly higher among migrants (3.8 per thousand) than among Greeks (2.2 per thousand) and higher among urban (2.6 per thousand) than among rural (1.4 per thousand) residents.

Injuries in disabled and non-disabled children are compared by mechanism and activity variables in table 2. Injuries from falls are over-represented among disabled children, whereas those from overexertion are under-represented. Injuries among disabled children presenting in the emergency department tend to be serious as evidenced by the relative over-representation of brain concussion, multiple injuries, and longer hospitalised lesions. In contrast, upper limb injuries are proportionally less common among disabled than non-disabled children.

In complementary analyses we found that injuries among disabled children are proportionally less common during the warmer half of the year, that is, from April to September, than during the colder half from October to March, as well as during weekends (data not shown). Our data also suggest that injuries due to violence may be more common among disabled (three children or 1.2%) than among the non-disabled children (440 children or 0.4%). Finally, more than half (52%) of the disabled children were injured while under supervision, whereas the corresponding proportion among non-disabled children was lower (40%).

Logistic regression derived, mutually adjusted odds ratios for an injury of a disabled rather than a non-disabled child for a series of variables are shown in table 3. Urban environment, migrant status, and cold months are also associated with increased odds for an injury to occur among disabled rather than non-disabled children. At the same time, it seems that disabled children do not have an increased risk for accident during the weekends, a common pattern in their non-disabled counterparts. The multivariate analysis also confirms that falls and brain concussion are proportionally more common among disabled children, whereas upper limb and overexertion injuries are less common among them. There is a tendency of more frequent hospitalisations for injuries among disabled children, whereas the probability of death was too low to allow meaningful comparisons between the two groups; in total, there were 51 (0.05%) deaths among non-disabled children but there were no deaths among disabled children.

DISCUSSION

The findings of our study point to higher prevalence of disability among older than among younger injured children,

Table 2 Distribution of the 110 066 children (0–14 years) with injuries recorded in EDISS* database for the five year period 1996–2000 by event and injury descriptive variables and permanent disability of the injured child

Variable	Disabled		Non-disabled		p Value
	No	%	No	%	
Mechanism of injury					0.001
Road traffic	11	4.4	3 906	3.6	
Fall	148	59.0	52 954	48.2	
Mechanical contact	59	23.5	28 056	25.5	
Foreign body	12	4.8	4 157	3.8	
Overexertion and related	21	8.3	20 742	18.9	
Activity					0.001
Road traffic	11	4.4	3 906	3.6	
Play and other	168	66.9	78 018	71.0	
Education	55	21.9	13 212	12.0	
Sports	4	1.6	11 919	10.9	
Vital needs	13	5.2	2 760	2.5	
Type of injury					0.001
Concussion	26	10.4	5 076	4.6	
Contusion and minimal	88	35.1	38 177	34.7	
Open wound	87	34.6	37 494	34.2	
Fracture, amputation	28	11.1	13 981	12.8	
Sprain, distortion	17	6.8	10 225	9.3	
Burn, corrosion	4	1.6	2 544	2.3	
Poisoning	1	0.4	2 318	2.1	
Injured body part					0.001
Brain	26	10.4	5 239	4.8	
Skull	39	15.5	13 641	12.4	
Face	62	24.7	30 032	27.4	
Upper limbs	50	19.9	31 639	28.7	
Lower limbs	48	19.1	18 952	17.3	
Trunk	26	10.4	10 312	9.4	
Number of injuries					0.001
One	205	81.7	95 189	86.7	
Multiple	46	18.3	14 626	13.3	
Hospitalisation†					0.002
Non-hospitalised	220	87.6	100 706	91.7	
1 days	9	3.6	4 641	4.2	
2–6 days	17	6.8	3 577	3.3	
7+ days	5	2.0	891	0.8	

*Emergency Department Injury Surveillance System.

†All 51 deaths, all among non-disabled children, are included in the "7+ days of hospitalisation" category. There were no deaths among disabled children.

among migrant rather than native Greek injured children, and among urban rather than rural injured children. Our study also provides empirical documentation of a series of intuitively appealing notions in that it indicates that the injury risk for a disabled child is increased with: (a) increased mobility or attempts to increase mobility (as suggested by the strong positive association with age, although several other behavioural and activity patterns change with age), (b) increased complexity of the environment and adjustment needs (as suggested by the higher incidence in the urban rather than the rural environment, although the possibility that there are more disabled children in urban environments cannot be excluded), and (c) conditions that reduce effective supervision (as suggested by the relatively higher incidence of injuries among migrant disabled children). Unpublished data from our database show that a higher fraction of migrant children were unsupervised during the event (62%) in comparison with native Greek children (48%). Our data also suggest that injuries due to violence may be more common among disabled than among other children, although the data are too sparse to allow statistical documentation.

It is disturbing that injuries among children are over-represented during the generally sedentary educational and vital needs related activities. The relatively higher frequency of such injuries among disabled children should point to the inappropriateness of the physical surroundings (for example, buildings and other facilities) that currently fail to accommodate the special needs of some of their users, relatively lax supervision, or increased exposure to these environments.

Another interesting finding is the lack of a seasonal pattern in injuries among disabled children. Among healthy children, there is an increase in the occurrence of injuries during the warmer summer months and the weekends year round. This pattern is probably due to the increased activity that non-disabled children enjoy and exposure to complex environments outside schools and homes. The lack of a summer and weekend peak in injuries among disabled children probably reflects the fact that, for them, increased spare time fails to translate to increased activity. As an extreme example for this pattern, it is indicative that few injuries were observed among disabled children during athletic activities, a finding that has also been reported by other authors,¹³ probably because disabled children fail to engage in such activities. This finding points to the need to increase the friendliness of the surroundings for children with special needs, especially in the two settings (home and school) where disabled children currently spend most of their time.

There are inherent methodological difficulties in investigating the epidemiology of injuries among disabled children; such difficulties pertain to the need for a consistent definition of disability, as well as the requirement to assess the counter-acting impacts of an increased injury hazard per time unit exposed and a decreased person-time at risk. In addition, in comparison with their non-disabled counterparts, disabled children may present different hospital contact rates when injured, as well as different admission rates after contacting a hospital. Perhaps due to the above methodological problems, few studies have explored the risk of injuries among disabled

Table 3 Multiple logistic regression derived odds ratios (OR) and 95% confidence intervals (CI) for an injury of a disabled rather than a non disabled child for a series of demographic and injury characteristics

Variable	Category or increment	OR	95% CI	p Value
Age	5 years more	1.68	1.43 to 1.97	0.0001
Gender	Male	Baseline No relation		
Nationality	Greek Migrant	Baseline 1.74	1.16 to 2.62	0.01
Place of residence	Urban Rural	Baseline 0.51	0.36 to 0.74	0.0003
Day of injury	Weekday	Baseline No relation		
Month of injury	April–September October–March	Baseline 1.37	1.06 to 1.75	0.01
Mechanism of injury	Mechanical contact Fall Overexertion and related	Baseline 1.47 0.57	1.09 to 1.99 0.35 to 0.95	0.01 0.03
<i>Additional, alternatively introduced, variables</i>				
Type of injury	Open wound Concussion Fracture amputation	Baseline 1.96 0.57	1.25 to 3.08 0.37 to 0.88	0.003 0.01
Injured body part	Trunk Upper limbs	Baseline 0.44	0.26 to 0.73	0.001
Number of injuries	One Multiple	Baseline No relation		
Hospitalisation days*	Non-hospitalised 2–6 days 7+ days	Baseline 2.06 2.58	1.24 to 3.42 1.04 to 6.40	0.005 0.04

*All 51 deaths, all among non-disabled children, are included in the “7+ days of hospitalisation” category. There were no deaths among disabled children.

children^{14–15} as opposed to permanent disability as a potential consequence of an injury.^{16–18} The basic problem seems to be the different definitions of disability given by parents, health professionals, and government and non-governmental organizations that deal with this issue. Some confusion might also arise from the revisions made to the definitions of the terms “impairment”, “disability”, “special needs” “special skills”, and “handicap”.^{19–20}

Some of these inherent problems can also be seen in our study. Specifically, our data do not allow for a direct calculation of hazard rates, because person-time at risk could not be properly sampled or defined. In addition, the decision whether a child was considered disabled depended on the information given at the time of the interview from the child’s guardians and the attending physicians. It is plausible that some non-obvious ailments may have been overlooked given the tendency, still prevalent among many parents today, to try and conceal their child’s disability. Another limitation of our study was its proportional nature, stemming from the absence of a suitable comparison group representing the study base. Such a comparison group, however, is difficult to identify, because person-time of particular activities is difficult to ascertain.

Prevention of injuries among disabled children is particularly important, because injuries suffered by these children tend to be more severe. The excessive severity of injury in disabled children in this study may be due to the fact that disabled children cannot adequately protect themselves in challenging situations. The present investigation has several implications concerning prevention of injuries among disabled children. Educational efforts to prevent injury in disabled children should focus on parents and teachers, since injuries

Key points

- Data from a comprehensive database were used to investigate injuries among disabled and non-disabled children.
- Falls and brain concussion are proportionally more common among disabled than non-disabled children, whereas upper limb and overexertion injuries are less common.
- Urban environment, migrant status, and cold months are associated with increased risk for injury in disabled.
- The odds ratio for the occurrence of injuries among disabled children increases with increasing age.

among disabled children often occur within settings and during timeframes where they have a supervisory role. It is also imperative that the physical surroundings accommodate the special needs of a disabled child and that educational activities adhere to strict safety specifications.

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