# Accidents in schoolchildren: epidemiologic, aetiologic and prognostic considerations

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A prospective follow-up study of school accidents occurring to 21 712 city pupils and to 1584 rural pupils aged 7–18 years during the school year 1977–78 was carried out. The facilities of the pupils to be referred to the school policlinics were practically as good to all pupils. The incidence of accidents was in Turku 363 per 1000 pupils aged 7–12 years and 233 per 1000 pupils aged 13–18 years. Minor injuries were in 84.2% of cases located in the extremities. In the great majority, they were slight sprains and strains (46.9%) or cutaneous lacerations and bruises (40.0%). More severe injuries were found in 4.9% among the Turku pupils and in 2.1% of those in Lieto. The accidents met by boys was almost double that found for girls. Individual exercise and sports turned out to involve approximately the same degree of risk as team sports. The site of injury was most commonly either the upper extremity (38%), lower extremity (28%), the head (22%) or the eyes (4%), the remaining 8% of injuries having been to the trunk. More than two thirds of the cases could be treated in two or three visits to nurse or doctor, the treatment period being two to seven days in the majority of cases. No delayed effects such as postconcusive headache or other psychosomatic symptoms occurred during the follow-up period of three years.

The World Health Organization has devoted particular attention to accidents occurring to children for some time, and to their prevention. Finland ranks among the first countries worldwide in the frequency of high accident mortality to both preschool and school-age children [17], even though a slight decreasing trend may now be found. In the case of the latter, accidents cause fairly frequent absences from school and form a considerable part of the school physician's and the school nurse's daily work [1, 11]. In spite of this, there has been little research on accidents to children at school.

Reliable information on the accidents occurring to children is needed to allow to find out the causes of school accidents and develop preventive methods and first aid readiness. The purpose of the present study is to study the school accidents occurring during the school year 1977-78 to pupils aged 7 to 18 years, attending the primary and secondary schools in two municipalities in southwestern Finland, i.e. in the city of Turku and the adjoining rural municipality of Lieto. In addition to the incidence and character of the accidents, the study is concerned with the effect of these accidents on the

pupils' schoolwork (absences), and with the possibly resulting permanent disabilities.

# STUDY POPULATION

The city of Turku has about 165 000 inhabitants, somewhat over one-third of whom live in the inner city. Part of the area administratively incorporated in the city is rural-like, with small population centres. In the school year 1977-78, Turku had 39 primary schools (for pupils aged 7 to 12 years), 14 lower secondary schools (age groups 13 to 15) and 11 upper secondary schools (age groups 16 to 18). The lower and upper secondary schools usually operate in the same building, forming an integrated administrative unit. There were a total of 54 school buildings. The pupils attending these schools totalled 21712, girls accounting for 10912 and boys for 10 800.

The rural municipality of Lieto (approx. 9500 inhabitants), a typical

municipality in rural southwestern Finland, had in that year a total of eight schools: primary education was provided by seven and lower and upper secondary education by one. These schools had a total of 1584 pupils, or 778 girls and 816 boys.

The distribution of the pupils among the different types of school in the two municipalities is shown in Table 1.

The pupils' accidents were recorded in the autumn term, which started on August 15 and ended on December 20, 1977, and in the spring term, from January 5 to May 31, 1978. In February the pupils had one week winter vacation. School was from Monday to Friday, only exceptionally on Saturdays.

#### METHODS

"School accidents" refer here to all injuries incurred by the pupils during the two terms on the way to or from school, during lessons or during recesses. The study was prospective in nature, with regard to both the primary data and the following three-year follow-up. For the purposes of data collection a questionnaire was drawn

TABLE I

Distribution	of	pupils	by	type	of	school	in	the	city	of	Turku	and
		the	rura	l mu	nic	ipality	of	Liet	0			

	Gir	rls	Bo	ys	Bo	th
Type of school	Turku	Lieto	Turku	Lieto	Turku	Lieto
$\begin{array}{c} { m Primary \ school} \ { m (age \ groups \ 7-12)} \end{array}$	5 755	393	$6\ 253$	470	12 008	863
Lower secondary school $(age groups 13-15)$	3 555	272	$3 \ 315$	259	6 870	531
Upper secondary school (age groups 16-18)	1 602	113	1 232	87	2834	190
Total	10 920	778	10 800	816	21 712	1584

up which, in addition to demographic data, recorded in detail the place and time of the accident and other data related to the event. The effects of the accident, the location of the injury, the treatment provided for it and its permanent consequences were also recorded. In cases of accident, the victim was first sent to the school nurse, who filled in this questionnaire. If a medical examination was considered necessary, the pupil was referred to the school physician, who completed the questionnaire and provided the treatment. If the school physician considered that adequate treatment was not possible in the school policlinic, the patient was sent to a hospital outpatient department.

Each school in both Turku and Lieto has its own school nurse; in large and medium-sized schools she sees pupils on a daily basis at that school, while in small schools she is available two to four times a week. If the accident occurs at the time when the nurse is not available, the teacher has the right and the duty to send the pupil to the school policlinic. A taxi for instance may be used as needed. The distance of the school from the school policlinic and the physician has thus proved in practice to be insignificant as a factor affecting the rate of referral to the policlinic. The impression of these school physicians in both Turku and Lieto, according to their own report, is that the pupils of the small schools are sent to the school policlinic even more readily on those days on which the school nurse has no consulting hours than on other days.

On the basis of the treatment required, the injuries were classified into two categories: injuries which required examination and treatment by a physician, and minor injuries, regarded by the school nurse as needing no further care. Minor injuries were recorded only for the pupils in the city of Turku.

## RESULTS

Over the school year the 21712 pupils in the Turku schools suffered a total of 6603 accidents. If the accidents had been evenly distributed, they would have occurred to not quite one in three (30.4%) of the pupils. The incidence of accidents among the 7-12-year old children in the primary schools (363 per 1000 pupils) was, however, considerably higher than that among the 13–18-year old pupils of the secondary schools (233 per 1000 pupils).

Treatment was provided by the school nurse in 84% of all the accidents met by the Turku schoolchildren, by the school physician in 13% and in the hospital in 3% of cases. The school accidents in Lieto, totalling 35, were treated by the school physician in 88% of cases, by a private practitioner in 6% and in the hospital likewise in 6% of cases.

Minor injuries were by far most commonly located in the extremities: almost one-half (46.0%) were in the upper extremities and a somewhat lower percentage (38.2%) in the lower extremities. The rest of the injuries were in the head (8.9%), in the eves (2.9%) or on the trunk (4.0%). The great majority of the minor injuries were either slight sprains and strains (46.9%) or cutaneous lacerations and bruises (40.0%). Minor injuries in the head occurred in 12.4% of the subjects and the rest were mainly concussion injuries to the trunk or extremities.

The school nurses treated minor injuries in the first-aid facilities of the schools. These injuries interfered very little with schoolwork, only seldom causing at most a 1–2-day absence from school.

More severe injuries. Injuries referred to a school physician occurred in 1059 pupils in Turku and in 35 in Lieto. The accident incidence among the Turku pupils (4.9%) was more



FIG. 2

than double that found in Lieto (2.1%).

In Turku these injuries were somewhat less frequent in the primaryschool children, aged 7–12 (42 per 1000 pupils), than in the secondaryschool pupils aged 13–18 (57 per 1000 pupils). The distribution of accidents by age in the Turku and Lieto pupils is shown in Figure 1. In Turku the peak occurred in the 12-year-old group, while in Lieto the frequency was highest in the group aged 16.

In Turku the frequency of accidents met by boys was almost double (60 per 1000 boys) that found for girls (37 per 1000 girls). A similar relationship was recorded also in Lieto (27 per 1000 and 17 per 1000, respectively).

Figure 2 shows that accidents happened most commonly in October and November and from January

TABLE II

Incidence of accidents by day of week

Loca- tion	Mon	Tue	Wed	Thu	Fri
Turku	212	231	227	202	172
Lieto	14	5	2	7	7
Total	226	236	229	209	179

through March. The accident risk was somewhat higher on the first few days of the week (Table II). Most accidents happened between 9 a.m. and 2 p.m., at which time the majority of pupils were simultaneously at school (Figure 3).

Table III shows the situations in which the accidents occurred. They were most common during classes, particularly during physical education classes. In the Turku schools, individual exercise and sports (209



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Situation in which the school accident occurred

011 - 11			T	urku		Lieto	
Situation			No.	Per cent	No.	P	er cent
On the way to or from	school		103	9.7		0	
Classes			526	49.8 *		22	62.9
— physical education		431			18		
- gymnastics	97				4		
- basketball	87				4		
— track and field	59				3		
- skating	50				0		
— football	42				0		
— icehockey	21				5		
— other game	72				2		
- skiing	3				0		
— manual training		51			2		
— other classes		44			2		
Recess			428	40.5		13	37.1
- school yard		233			6		
- stairs		75			4		
— other place		120			3		
Total			1057	100.0		35	100.0

TABLE IV

Nature of injuries according to sex in Turku schools

	(	Girls	1	Boys	В	oth
Injury –	No.	Per cent	No.	Per cent	No.	Per cent
Sprain or strain	210	53	253	39	463	44
Concussion injury to head	63	16	95	14	158	15
Fracture, rupture	55	14	79	12	134	13
Wound	29	7	149	23	178	17
Cutaneous laceration, bruise	25	6	39	6	64	6
Foreign body	11	3	17	3	28	3
Other injury	6	1	21	3	27	2
Total	399	100	653	100	1052	100

Main treatment method of injuries

Treatment method	Tu	ırku	I	Lieto
reatment method	No.	Per cent	No.	Per cent
Elastic bandage/Tensoplast	268	26	10	29
Splinting	252	24	8	23
Bed rest	160	15	5	14
Bandaging of the wound	91	9	3	8
Suturing of the wound	89	8	6	17
Medication	59	6	0	
Plaster cast	46	4	1	3
Other treatment	28	3	1	3
No treatment	54	5	1	3
Total	1047	100	35	100

accidents) turned out to involve approximately the same degree of risk as team sports (222 accidents). In Lieto the corresponding figures were 7 and 11. During recess the school yard was naturally the most common scene of accidents.

The site of injury was most commonly either the upper extremity (38%) or the lower extremity (28%); these injuries, together with those to the head (22%) and the eyes (4%), accounting for over 90\% of all accidents. The rest consisted of injuries to the trunk (8%).

There was some variation in the nature of the injury in the two sexes (Table IV). Sprains and strains were common injuries in girls, occurring in over half (53%) of cases for girls compared to only 39% for boys. Another clear difference was in the occurrence of various types of wounds, which were more than three times as

common in boys (23%) as in girls (7%).

The methods of treatment (Table V) naturally depended on the nature of the injury; elastic bandage or splinting were thus the main method of treatment in every second case. In one case out of seven, bed rest formed sufficient treatment. Half of the wounds were treated by bandaging; medication, suturing and plaster casts were seldom necessary.

TABLE VI

Number of examination and treatment visits in individual accidents

No. of minita	Ca	ises
INO. OI VISIUS	No.	Per cent
1	227	23
2	478	48
3	178	18
4 - 12	113	11
Total	996	100



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One or two treatment visits were enough for over two thirds of the Turku schoolchildren; one out of five needed three visits and one out of ten four or more visits (Table VI). The duration of the treatment period was. however, in the great majority of cases two to seven days in both Turku and Lieto (Fig. 4). Treatment periods of over two weeks' duration, on the other hand, were rare, accounting for less than 10% of cases in both Turku and Lieto. The effect on schoolwork (Figure 5) was slight; in only 12% of cases in Turku and 3% in Lieto did schoolwork have to be interrupted entirely for more than one day, while 21% of the former and 3% of the latter suffered no interruption.

The injuries almost always healed in a couple of weeks, with a few exceptions in which treatment lasted two to three months. No fatal accidents occurred during the school year, nor were any permanent disabilities or defects incurred. There were also no delayed effects such as postconcussive headache or other psychosomatic symptoms found during the threeyear follow-up.

## DISCUSSION AND CONCLUSIONS

Due to their common occurrence, accidents in children have been studied in recent years fairly extensively, and from various points of view. The research has concerned the accident incidence rates and factors affecting them [6-9], accident recurrence in certain children [10] and, in particular, the possibilities of accident prevention [2,3,5]. Only rarely has attention been paid to school-related accidents [4, 6]. The school years, however, include a certain period during which the child is not yet able to cope with traffic as well as an adult; he also lives through puberty and learns to identify himself and others both as individuals and as a member of a group. Accident-proneness is known to be related, among other factors, to the social environment [7], and the school presumably plays its own role in this respect.

The total accident frequency of 30.4% found in the present study corresponds closely to the total frequency of 34.0% obtained for school pupils in Helsinki in the same school year 1977-78 [14]. Both figures may be below average, since the winter of 1977-78 was milder than usual in Finland, and winter sports activity in the schools, as well as injuries caused by such sports, were therefore less common than normally. This assumption, on the other hand, conflicts with the low school accident frequency of 2.9% obtained for schoolchildren who were referred to a physician in Helsinki during the winter of 1967-68, with plenty of snow, as compared to the almost equally low frequency of 3.0% obtained in the same city in the winter of 1968 69, in which there was a normal amount of snow, and with the relatively low frequency of accidents in the winter months compared to the other months in Helsinki [12], where the criteria of remittance were similar to the present study. In the

latter too, from January to March, accidents were frequent.

Since accidents requiring medical examination affect the child's shoolwork much more than do the slight scratches and strains treated by the school nurse, attention was paid mainly to the injuries of those children who were referred to the school policlinic. These occurred in the present study in 4.9% of the pupils in Turku and in 2.1% of those in the rural municipality of Lieto.

Although the differences between individual schools were not studied in greater detail, attention was nevertheless drawn to the lower accident frequency for small schools. Variations in this frequency have been studied previously e.g. in Helsinki schools; in a study of inner-city schools in the school year 1966-67, for instance, it was found to be 3.7%in schools with over 1000 pupils and 3.0% in schools with fewer than 1000 pupils. In the suburbs of Helsinki the corresponding figures were 2.7% and 2.6%; accident frequencies are thus evidently lower in smaller communities [15]. Both the smaller size of the schools and the rural-like environment probably provide an explanation for the low frequency in the Lieto school as well.

According to both the present study and previous reports [4, 14, 16], the ratio of accidents between boys and girls appears to be 1.5 to 1, and they are evidently more common in prepuberty than at an earlier age.

According to the present results, the accident risk is somewhat higher on the first few days of the week, a finding which is consistent with the figures for the schools in the city of Helsinki [13].

Half of the accidents in Turku (49.8%) occurred during lessons, somewhat over one third (40.5%) during recess and the rest (9.7%) on the way to or from school. In Lieto the traffic was evidently safer, since not a single accident happened there on the way to school. Recesses were likewise more tranquil than in Turku; 37.1% of the accidents occurred during recess and 62.9% during lessons. When compared to the Helsinki schools, 32.0-39.4% of the accidents met by the Helsinki school pupils in the school years 1962-74 occurred during lessons, 53.5 60.0% during recesses and 7.1-9.4% on the way to or from school [12-15]. Thus in approximately 10%of cases the accident occurs when the child is on his way to school or returning home. In the study carried out by Thiele et al [16] the figure was as high as 15.4%.

Among the different school subjects, physical education is well known to involve a higher accident risk than other subjects. In the present study 40.8% of all accidents met by Turku pupils occurred during physical education classes. In Helsinki in the school years 1976–79 such accidents accounted for 35-47% of all accidents. Thiele et al [16] reported similarly that 43.1% of all accidents had occurred in connection with school sports. It is interesting to note that in the present study accidents occurred almost as frequently in connection with individual exercise or sports (19.8%) as with team sports (21.0%). The quantitative ratio of the two modes, however, could not be worked out in the study.

During recess, injuries are incurred most commonly in the school yard; in the present study 22.0% of the injuries in Turku and 17.1% of those in Lieto occurred there. In the same school year, 28% of all injuries of the school pupils in the city of Helsinki were incurred in school vards. The figure is somewhat higher than that found in the present study and is probably mainly a reflection of the greater prevalence of violence in the Helsinki schools compared to Turku and Lieto. Such violence is also referred to by Thiele et al [16]; in their study 39.2% of injuries were incurred during recess. School violence is not, however, something new, as 42.3-47.3% of the injuries in the Helsinki schools in the school years 1962-74 were incurred in school yards. School yards which are too small or which involve unsuitable structural factors may contribute to the incidence of these injuries. These factors were not, however, dealt with in the present study.

In the great majority of cases the injury was a bruise, strain, sprain, open wound or fracture. Injuries to the eyes, for instance, occurred in a few per cent of cases [14].

The accidents necessitated one or two treatment visits in approximately 70% of cases and more than two in the others. The number of visits is thus relatively low; yet the injuries caused considerable absences from school. These were, however, often partial, for instance release from physical education or manual training. Twelve per cent of the pupils in Turku and 3% of those in Lieto had to stay at home for at least one week.

The injuries were mild in so far as no deaths or permanent disabilities resulted. Out of the approximately 63,000 pupils in Helsinki in the school year 1977–78 one died through a school accident and several had to be hospitalized for a few weeks or undergo surgical procedures. Against this background too the injuries can be considered mild.

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