Secular Trends in Poisonings Leading to Hospital Admission among Finnish Children and Adolescents between 1971 and 2005

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Objective To investigate the secular trends in childhood poisonings leading to hospitalization in Finland.

Study design All children and adolescents age 0 to 19 years hospitalized in Finland with the primary diagnosis of poisoning between 1971 and 2005 were identified using the International Classification of Diseases.

Results During the study period, there were 41 862 hospitalizations with 96 427 hospital bed days for poisoning in 38 582 children and adolescents. The incidence of hospitalization declined from 91.3 admissions per 100 000 person-years in boys and 105.2 per person-years in girls in 1971 to 64.8 in boys and 83.5 in girls in 2005. In the 0- to 4-year age group, admissions declined by 51%. Hospitalizations for alcohol poisoning increased 1.7-fold (95% confidence interval = 1.4 to 2.2) in boys and 2.4-fold (95% confidence interval = 1.8 to 3.3) in girls. Alcohol poisoning was the primary diagnosis in 53% of those in the 10- to 14-year age group.

Conclusions Poisoning remains an important cause of morbidity in Finnish children and adolescents despite the decreased overall incidence of poisonings leading to hospitalization between 1971 and 2005. The increasing trend of hospital admissions for alcohol poisoning, especially in 10- to 14-year-olds, is noteworthy. Effective primary prevention programs and adult supervision should be targeted at reducing alcohol consumption and alcohol-related poisonings in youth. *(J Pediatr 2008;153:820-4)*

Poisoning in children and adolescents may lead to serious complications, hospitalization, and sometimes even death.[1] Poisoning in these age groups has been extensively studied in the United States, and there are a few reports from developing countries.[2] In other countries, however, research in this area is lacking. In the United States, an estimated more than 1 million children under age 6 years experience toxic exposures annually.[3] Poisoning is also an important cause of injury and mortality in adolescents.[4] Children under age 5 years dominate the statistics on emergency room visits for poisoning;[5-7] however, children in this age group are often asymptomatic and may not require hospital admission.[8]

Studies on the causes of hospitalization due to poisoning are scarce. In a study from Washington state, 75% of the hospitalizations for pediatric poisoning occurred in teenagers, and the incidence of hospitalizations for intoxication was 45 per 100 000 in children age 0 to 19 years.[1] Boys are more likely than girls to be hospitalized for poisonings under age 13 years;[9] however, this sex distribution reverses during the teenage years. For example, Gauvin et al[1] found that teenage girls have a 2.5-fold higher risk of hospital admission due to poisoning than teenage boys.

The causes of poisoning leading to hospitalization vary by age. Pharmaceutical agents are involved in most pediatric hospitalizations for poisoning in the United States;[1] analgesic agents (most commonly acetaminophen) are involved in 1/3 of cases. Alcohol is the most common nonpharmaceutical agent involved, accounting for 6% of all hospitalizations for poisoning in 0- to 18-year-old children and adolescents.[1] Pharmaceutical agents predominate in teenagers, whereas nonpharmaceutical agents are more common in children under age 12.[1] In Finland, children under age 6 years are more commonly hospitalized for nondrug poisoning.[10]

International studies investigating the secular trend in hospitalization for pediatric poisoning are lacking, and only few nationwide reports exist.[1,11] The present study examined the trend in poisoning leading to hospitalization in Finnish children and adolescents between 1971 and 2005.

ICD International Classification of Diseases

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METHODS

For this study, we used the database of Finland's National Hospital Discharge Register, which contains basic hospitalization data from all Finnish hospitals, including patient age, time of hospitalization, length of hospital stay, and diagnosis.[10] The data are collected and updated annually by the National Research and Development Center for Welfare and Health. The Ethics Committee approved the study design (National Research and Development Center for Welfare and Health, number: 1383/900/2006).

A computer search identified all patients between age 0 and 19 years who were hospitalized with a primary diagnosis of poisoning between 1971 and 2005. The International Classification of Diseases (ICD), eighth revision (ICD-8), was used from 1971 to 1986, and the ninth revision (ICD-9) was used from 1987 to 1995. In both ICD-8 and ICD-9, the codes 960-979 for intoxication by drugs, medicinals, and biological substances and codes 980-989 for effects of substances in chiefly nonmedical use were used. From 1996 to 2005, the tenth revision (ICD-10) was used, with corresponding codes T36-T65. The identification of intoxicants was based on the primary diagnosis and not on the external causes of injury, due to underreporting.[12] For the purpose of this study, the more specific ICD-10 codes were reclassified into the ICD-9 codes to ensure comparability among years.

To compute the incidence and incidence rate ratios of intoxications leading to hospitalization, the annual mid-populations were obtained from the Official Statistics of Finland,[13] a computer-based national population register. The number of children and adolescents age 0 to 19 years was 1 517 738 in 1971 and 1 227 846 in 2005. Thus, the numbers and incidence rates of hospitalization due to poisoning were true results reflecting the actual child and adolescent population in Finland during the study period, rather than cohort-based estimates.[13] SPSS 14.0 for Windows software (SPSS Inc, Chicago, Illinois) was used to analyze the data. When comparing skewed hospitalization time between sexes, the Mann-Whitney U-test was used. Incidence rate ratios and 95% confidence intervals for incidence rates were calculated using the OpenEpi program.

RESULTS

During the study period of 1971 to 2005, a total of 41 862 hospitalizations for poisoning were recorded in 38 582 children and adolescents age 0 to 19 in Finland. The incidence rate declined during this 35-year period. In 1971, the rate was 91.3 admissions per 100 000 person-years in boys and 105.2 per 100 000 person-years in girls. The peak year was 1986, with 121.4 admissions per 100 000 person-years was in boys and 107.7 per 100 000 person-years in girls. At the end of the study period in 2005, the corresponding figures were 64.8 in boys and 83.5 in girls. During the entire study period, 32 patients died of poisoning during the initial hospitalization and 380 died later, nearly all (99.8%) more than 30 days after initial hospitalization.

Poisonings accounted for a total of 96 427 hospital-bed days (incidence, 208.6 days per 100 000 person-years) during the study period. The median length of hospital stay during the study period was 1 day (range, 1 to 938 days). Patients were hospitalized for 1 day in 64% of the cases and for 3 or more days in 19% of the cases. In 98.9% of the patients, the hospital stay was < 2 weeks, and in 99.7% it was < 30 days. Most of the patients (92%) were hospitalized for poisoning only once during the study period, but 8% of the patients had 2 or more admissions. Rehospitalization was slightly more frequent in girls than in boys (9% vs 7%; $P < .001$).

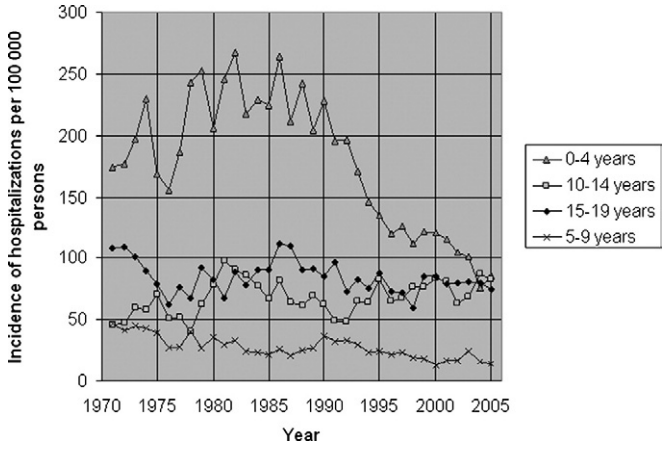

Figure 1. Incidence of poisoning (per 100 000 person-years) leading to hospital admission in Finnish boys between 1971 and 2005.

The median age at the time of hospitalization was 6 years in boys and 13 years in girls ($P < .001$). The male: female incidence ratio of poisoning leading to hospitalization was 1.3 in the 0- to 4-year age group, 1.5 in the 5- to 9-year age group, 1.0 in the 10-to 14-year age group, and 0.6 in the 15- to 19- year age group.

The incidence of hospitalization declined by 51% in the youngest age group (0 to 4 years) over the 35-year study period. This downward trend was most obvious in the last 2 decades. The annual incidence of hospitalization for pediatric poisoning was the lowest in the 5- to 9-year age group in both sexes, except for the year 1971 in boys (10.4 to 46.8 per 100 000 children) (Figures 1 and 2). In 1971, the highest incidence of poisoning hospitalization occurred in the 0- to 4-year age group in boys (174.0 per 100 000 boys) and in the 15- to 19-year age group in girls (195.0 per 100 000 girls). In 2005, boys age 0 to 4 years still had the highest incidence of hospitalization in males, but the incidence of 85.2 per 100 000 persons was only marginally higher than that of the 10- to 14-year (82.5) and 15- to 19-year (74.9) age groups.

The most dramatic decline in the incidence rates in both boys and girls was seen in the 0- to 4-year age group. This decrease started in the early 1990s. In other age groups, the changes were not so clear during the 35-year study period. The incidence of poisoning hospitalization increased slightly in the 10- to 14-year-olds and showed a decreasing trend in the 5- to 9-year-olds. The trend toward decreasing poisonings also was seen in the 1970s in the 15- to 19-year-olds.