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Risk factors for childhood poisoning: a case-control study in Greece

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Abstract

***Objectives*—To identify child or family related risk factors for unintentional childhood poisoning in Greece and to explore whether product specific poisonings might have special features that make them amenable to preventive interventions.**

***Setting*—A case-control study was undertaken in Athens, Greece in 1995. Cases were 100 consecutive children brought with poisoning to the emergency clinics of the two university affiliated children's hospitals. For every case two age, gender, and hospital matched controls were chosen from among children brought to the outpatient clinics of these hospitals on the same date.**

***Methods*—All children and their guardians were interviewed by the same person using a standard questionnaire that covered demographic, socioeconomic, behavioral, and past injury characteristics. Information was also obtained concerning type and conditions of poisoning for cases. Statistical analysis was undertaken by modeling the data using conditional logistic regression.**

***Results*—Socioeconomic factors were not important risk indicators in these data but children living with other than both parents were at increased risk (odds ratio (OR) = 4·7, p = 0·08), as were children with a history of previous poisoning that required medical care (OR = 5·1, p = 0·05). Unintentional poisonings caused by chewing or swallowing cigarettes were concentrated in families where both parents were smokers.**

***Conclusions*—Absence of a parent appears to be associated with increased likelihood of childhood poisoning. The importance of product accessibility is underlined by the concentration of tobacco poisoning among children of parents who were both smokers. In the cultural context of this study, sociodemographic factors do not appear to represent demonstrable risk factors. Instead, control of childhood poisoning should be concentrated on safe packaging, storage, and disposal of potentially hazardous products.**

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Injuries represent the leading cause of mortality and morbidity among children.[1 2] One category of major importance, unintentional poisoning, constitutes about 2% of all injury deaths in developed countries and about 5% in less developed ones.[1] These proportions have decreased over time, more so in developed than in less developed countries.[1 3–5] Hospital admissions for poisonings have been stable or have slightly declined in recent years,[6 7] although the pattern of poisoning has changed markedly.[8 9] This change follows the introduction of new consumer products. Although medicinal products still prevail in the spectrum of causal agents,[8] a decrease in poisoning by analgesic antipyretics was observed after the introduction of child resistant drug container laws.[8 9]

Less than one in 1000 cases of unintentional poisoning is fatal, but deaths are only the tip of the iceberg. In absolute terms, poisoning morbidity still represents a sizeable proportion of childhood injuries, with substantial material and psychological costs. The associated family anxiety and emotional burden due to implied lapses in parental supervision are heavy and should also be taken into account when assessing the magnitude of this problem.[5 10 11]

It is generally believed that preventive strategies are more effective when high risk children or external predisposing conditions are targeted. However, research on socioeconomic characteristics and behavioral correlates of unintentional childhood poisoning, such as non-compliant or imitative behavior, curiosity, or hyperactivity has so far failed to identify major risk factors.[12 13] Consequently, most efforts to control poisonings now focus on reducing accessibility to dangerous products.[14–16] Because little epidemiologic research has been done on childhood poisoning in Greece, where cultural norms differ from other parts of the Western world, we undertook a case-control study to identify child or family related risk factors for poisoning in a urban Greek population.

Methods

From 1 February to 24 April 1995, 100 consecutive cases of unintentional poisoning involving children were brought to the emergency clinics of the two university affiliated children's hospitals of Athens. These hospitals admit as inpatients or see as emergency department patients on alternate days. For every case two control children were chosen among those who were brought for a non-injury condition to the outpatient clinics of these hospitals, mainly for

conditions of the respiratory and digestive system or infectious diseases. These were matched for hospital, age (within six months), gender, and date of hospital contact. After informed consent was obtained, all children and their guardians were interviewed by the same person using a standard questionnaire that covered demographic, socioeconomic, behavioral, and past injury characteristics. The nature of the study did not allow blinding of the interviewer with respect to case-control status of the child. For cases, information was also obtained concerning type and conditions of poisoning.

The analysis was done initially using bivariate classification of the data and subsequently by conditional logistic regression.[17] In addition to gender, age, hospital, and date of hospital contact that were inherently controlled for, the following variables were simultaneously evaluated: maternal occupation (housewife, manual worker, non-manual worker), paternal education ($\leqslant 11$ *v* 12+ years), child cohabitation status (both parents *v* other than both parents), current maternal smoking (no *v* yes), sibship size (single child *v* $\geqslant 2$ children) and previous injurie(s) (none, poisoning that required medical care, other injury).

Three variables, namely, mother or father's use of seatbelt, and mother's use of safely packaged products, mainly with regards to detergents, were used as indices of parental safe behavior. The latter was reasonable because in Greece, there are no legal requirements for using child resistant containers for drugs or other chemical products. These three variables are, however, highly inter-related and were introduced into the statistical model one at a time to minimize collinearity.

Results

Table 1 shows the distribution of poisoned children by injury characteristics. Most unintentional poisonings occur in the living room and bedroom taken together, but if the time usually spent in each room is taken into account, the kitchen emerges as the most dangerous. There is no information on time-activity patterns in Greek households, but family life is generally anchored in the living room where the television set is situated.

Safe storage was assessed according to whether the specific poisoning agent was safely stored (locked or otherwise unreachable by a child). It is clear that storage, however important, is no guarantee against unintentional poisoning because one fourth of the events happened with the respective agent allegedly safely stored. An important, but unexpected finding, is that chewing and swallowing cigarettes was responsible for 15% of all unintentional poisonings in this age group.

Among the 100 unintentionally poisoned children 79 were toddlers and two thirds were boys (table 2). There were no significant differences between cases and controls with respect to sibship size, maternal occupation, or father's years of schooling — a powerful predictor of socioeconomic status in Greece.[18] The data in this table are not directly interpretable because many variables are intercorrelated. However, these data suggest that previous unintentional poisoning, living with other than both parents, and parental smoking, are risk factors. By contrast, indicators of the parents' attitudes towards safety — notably

Table 1 Distribution of 100 unintentionally poisoned children by injury characteristics

Characteristics	*No (%)*
Place*	
Living room, bedroom	48 (53·9)
Kitchen	31 (34·8)
Garden and surroundings	5 (5·6)
School	2 (2·3)
Other specified	3 (3·4)
Storage*	
Clearly unsafe	66 (74·2)
Presumed safe	23 (25·8)
Supervisor*	
Parent(s)	72 (80·9)
Other than parent(s)	13 (14·6)
Nobody	4 (4·5)
Supervisor presence*	
No	67 (75·3)
Yes	22 (24·7)
Type of poisoning agent	
Medication	58 (58·0)
Cigarettes	15 (15·0)
Pesticides, herbicides	12 (12·0)
Petroleum products	5 (5·0)
House cleaning products	3 (3·0)
Other specified	7 (7·0)

*Eleven cases of medicinal overdose are excluded.

Table 2 Distribution of 100 unintentionally poisoned children and 200 matched controls by modeled variables, figures are number (%)*

Variable	*Cases*	*Controls*
Age (years)		
$\leqslant 1$	14 (14·0)	30 (15·0)
2–4	79 (79·0)	153 (76·5)
5+	7 (7·0)	17 (8·5)
Gender		
Boy	65 (65·0)	130 (65·0)
Girl	35 (35·0)	70 (35·0)
Maternal occupation		
Housewife	58 (58·0)	119 (59·5)
Non-manual worker	29 (29·0)	64 (32·0)
Manual worker	13 (13·0)	17 (8·5)
Paternal schooling (years)		
$\leqslant 11$	40 (40·0)	80 (40·0)
12+	60 (60·0)	120 (60·0)
Cohabitation		
Both parents	94 (94·0)	197 (98·5)
Other	6 (6·0)	3 (1·5)
Paternal smoking		
No	34 (34·0)	73 (36·5)
Yes	66 (66·0)	127 (63·5)
Maternal smoking		
No	50 (50·0)	113 (56·5)
Yes	50 (50·0)	87 (43·5)
Sibship size		
Single child	38 (38·0)	78 (39·0)
$\geqslant 2$ children	62 (62·0)	122 (61·0)
Previous accident(s)		
None	67 (67·0)	149 (74·5)
Poisoning	7 (7·0)	3 (1·5)
Other	26 (26·0)	48 (24·0)
Additional variables		
Maternal use of safety belt		
No	45 (45·0)	92 (46·0)
Yes	25 (25·0)	56 (28·0)
No car	30 (30·0)	52 (26·0)
Paternal use of safety belt		
No	43 (43·0)	100 (50·0)
Yes	27 (27·0)	48 (24·0)
No car	30 (30·0)	52 (26·0)
Use of safe product packaging		
No/unaware	73 (73·0)	151 (75·5)
Yes	27 (27·0)	49 (24·5)

*Controls were matched for age (±6 months), gender, hospital, and date of hospital contact (exact).

seat belt use or safe product packaging — did not appear to be protective factors.

Table 3 shows conditional logistic regression derived odds ratios (ORs) and associated 95% confidence intervals (CIs) for each variable studied. The results, after mutual adjustment, support the impressions conveyed through the simple bivariate distributions in table 2. Thus, neither maternal occupation nor paternal schooling are significant predictors. Single children, and children of non-smoking mothers, are at somewhat lower risk, but these results are also not statistically significant. Only living with other than both parents, and a history of previous unintentional poisoning, appear to be risk factors, although both relations are of borderline statistical significance. Adding alternatively paternal or maternal use of seat belts or safe product packaging to the model confirms that these indices are unrelated to the risk of poisoning.

Table 4 shows the distribution of the 15 children who were poisoned by swallowing or chewing cigarettes and the 285 other children who were not poisoned by such products, according to reported parental smoking habits.[19] In this table, the new control group combines the original control series and the 85 cases who were poisoned by other than tobacco products — a legitimate action, because both series represent the same study base, comprise children unaffected by tobacco poisoning, and have identical distributions by parental smoking habits. The ORs for unintentional tobacco poisoning, with children whose parents are both non-smokers as baseline, is 3·2 (95% CI 0·4 to 26·1) for children with one smoking parent and 7·9 (95% CI 1·3 to 46·9) for children with both parents smoking. The linear trend is statistically highly significant ($p = 0·01$)[20] and indicates that parental smoking habits are powerful determinants of childhood tobacco poisoning.

Table 3 Conditional logistic regression derived ORs and 95% CI for unintentional poisoning by modeled variables

Variable	*OR*	*95% CI*	*p Value*
Maternal occupation			
Housewife	–		
Non-manual worker	0·9	0·5 to 1·6	0·64
Manual worker	1·5	0·6 to 3·7	0·42
Paternal schooling (years)			
⩽11	–		
12+	1·1	0·6 to 1·8	0·85
Cohabitation			
Both parents	–		
Other	4·7	0·8 to 26·1	0·08
Maternal smoking			
No	–		
Yes	1·2	0·7 to 2·1	0·45
Sibship size			
Single child	–		
⩾2 children	1·2	0·6 to 2·0	0·73
Previous accident(s)			
None	–		
Poisoning	5·1	1·0 to 26·4	0·05
Other	1·2	0·7 to 2·2	0·56

*Table 4 Distribution of 15 children with unintentional poisoning from tobacco products and 285 unaffected children, by parental smoking habits**

Smoking parents	*Neither*	*Either*	*Both*	*Total*
Tobacco poisoned	1	4	10	15
Unaffected	81	102	102	285
OR (95% CI)	Reference	3·2 (0·4 to 26·1)	7·9 (1·3 to 46·9)	
		χ^2 for trend: 2·49; p~0·01		

*Modified from Petridou *et al* with permission.[19]

Discussion

The present case-control study was not population based. There are only two children's hospitals in Athens and they admit inpatients or see children in the emergency department on alternate days throughout the year. It is reasonable, therefore, to assume that cases and controls were comparable. Moreover, full cooperation by parents or guardians reduces the possibility of selection bias. Lastly, the clinical setting enhances participants' confidence and facilitates communication, thus reducing the likelihood of information bias.[21] A further limitation is that 11 cases were due to overdose, but their exclusion from the analysis would have little effect on our interpretation of the results and little effect on statistical power. Finally, we judged that it was not possible to obtain sensible information about storage practises for controls (for whom there was no poison or time of poisoning).

Few analytic epidemiologic studies on unintentional childhood poisoning have been undertaken worldwide[13 22 23] and the results are not in agreement. This is not necessarily due to methodological weaknesses or differences. It may also reflect the fact that childhood poisoning depends on lifestyle factors and environmental conditions that vary substantially across countries and population groups.

In the present investigation neither socioeconomic factors nor indicators of parental attitudes towards safety, such as use of seat belt and safe product packaging, were associated with unintentional poisoning. There are several possible explanations for the absence of a relationship with socioeconomic factors and these are not necessarily mutually exclusive. First, that most Athenians with young children are literate and consequently, socially marginalized groups are rare.[24] Second, poisoning is a manifestation of the explorative and adventurous nature of young children, who, at this age have not been influenced by sociocultural differentials. It is also possible that a higher risk for injury among the poor is compensated by the presumably lower prevalence of products often involved in poisoning.

The importance of supervision is reflected in the increase of risk among children living with other than both parents, although this difference was only of borderline significance. Similar results have been reported by other investigators,[25] although the evidence remains inconclusive.

Personality characteristics may influence injury risk, including risk for poisoning, and this may be responsible for the preponderance of boys among injury victims.[7 13 26 27] Increased levels of testosterone may be responsible for the more aggressive behavior of boys.[28] However, after controlling for gender there is no easy way

to determine this predisposition and our study did not directly evaluate personality characteristics. Nevertheless, injury repetition is one obvious empirical realization of predisposition.

In this study, as in others,[25 29] children with a previous episode of poisoning were at increased risk for subsequent poisoning event(s). Yet, the proportion of injuries (attributable proportion) that can be accounted for by this indicator is small and has no major policy implications. In contrast, the storage of poisonous products in locked drawers or in theoretically inaccessible places is the logical cornerstone of a poisoning prevention strategy. Data indicate, however, that adults frequently undestimate the inventiveness of children who can use furniture or instruments to gain access to presumably safely stored materials. This should not be interpreted as indicating that safe storage is not a priority, but instead that still greater precautions are needed when storing hazardous products.

Chewing or swallowing cigarettes or cigarette butts was the second most common type of poisoning in this study, responsible for 15% of all cases. Because most types of childhood poisoning depend on the accessibility of the respective products, this type of poisoning is likely to be common in any population with a high prevalence of smoking. Pointing out to care givers the potential of tobacco products to cause poisoning may enhance their awareness. This is a necessary, although hardly sufficient, condition for reducing poisoning by tobacco products.

Finally, although the results also show that insufficient parental supervision increases the risk of poisoning, and that there is a tendency for repetition in certain children, these factors do not involve a large number of cases. The absence of demonstrable risk implications of major sociodemographic factors may also be important; it implies that control of poisoning should be concentrated on safe packaging, safe storage, and safe disposal of dangerous products, rather than on unfocused health education messages.

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