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Some epidemiological observations on medicinal and non-medicinal poisoning in preschool children

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Abstract

***Study objective*—The aim was to identify and compare rates of admission to hospital of preschool children for medicinal and non-medicinal poisoning in a defined population.**

***Design*—The study was an analysis of computerised abstracts of hospital inpatient records for poisoning.**

***Setting*—Six districts in southern England covered by the Oxford record linkage study.**

***Subjects*—The subjects were children under six years of age residing in the six districts from 1975 to 1986.**

***Measurements and main results*—6152 children, drawn from an average annual resident population of 164 000 children in 1975–1986, experienced 6562 hospital admissions for poisoning before six years; 3702 (56·4%) were attributed to medicinal and 2860 (43·6%) to non-medicinal agents. Of the latter, 646 (9·8% of the total) were recorded under the *International classification of diseases* code, described as "noxious food" (almost exclusively plant material). Average annual admission rates in children under six were 1·88 per 1000 for medicinal agents and 1·45 for non-medicinal substances. Analgesics accounted for 28·1% of the admissions for medicinal poisoning; berries and mushrooms for 97·4% of the plant materials; and corrosive aromatics, acids and alkalis for 22·0% of the other non-medicinals. Admission rates were higher in males than females in each category of poisoning. In children aged 1–4 years there was a significant decrease in admission rates between 1975 and 1986, averaging per annum 5·8% for medicinal poisoning, 6·9% for non-medicinal poisoning (excluding plant material), and 12·8% for plant material poisoning. Significant seasonal variation was found for each class of poisoning.**

***Conclusions*—Admission rates for medicinal and non-medicinal poisoning in preschool children declined between 1975 and 1986. The decline could reflect a change in thresholds for admission although, if so, this would be against the general trend in paediatric medical admissions, which is upward. An alternative explanation is a decline in the incidence of poisoning.**

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Studies of trends in hospital admission rates for and the characteristics of children with accidental poisoning can draw attention to changing problems and dangerous situations. Studies on poisoning in children have focused, in the main, either on medicinal poisoning or on non-medicinal agents.[1–5] Comparative studies of medicinal and non-medicinal poisoning in the same population seem uncommon. In this paper, we therefore report on hospital admission rates and trends from 1975 to 1986, comparing medicinal and non-medicinal poisoning in preschool children residing in six health districts in southern England.

Methods

The Oxford record linkage study is a collection of computerised abstracts of hospital inpatient records (including day cases) together with data from birth registrations and death certificates.[6] Data have been collected since 1963 within one health district and by 1975 data collection covered six of the eight districts in the Oxford Regional Health Authority area. The average annual population in the six districts between 1975 and 1986 was 1·9 million people including 164 000 children aged 0–5 years. The data presented here are based on records of patients who were both resident in and treated in the six districts between 1975 and 1986.

Preschool children were included in the study if they had a hospital admission during 1975–1986 with a diagnosis in the blocks of the *International classification of diseases* (ICD) designated as (1) "poisoning by drugs, medicaments and biological substances"; and (2) "toxic effects of substances chiefly nonmedicinal as to source".[7 8] The diagnostic data on these records were available and analysed at the full four digit level of the ICD. Population data for each single year of age were not routinely available for the six districts. Estimates were therefore made applying the proportions of children under six years in each single year age band in the population of England and Wales to the population figures for children aged 0–4 and 5–9 years in the six districts. All admissions for poisoning among children at each single year of age from 0 to 5 years between 1975 and 1986 were analysed and annual admission rates were calculated for each calendar year. The percentage change per annum in admission rates from 1975 to 1986 and its 95% confidence intervals were calculated by logistic regression using GLIM.

Results

In all, 6152 children experienced 6562 hospital admissions for poisoning from 1975 to 1986, ie, 410 (6·2%) of the admissions were second or subsequent events. Hereafter the results refer to the analyses of individual admissions (rather than individual children). Of these admissions, 3702 (56·4%) were for poisoning with medicines, and 2860 (43·6%) were for non-medicinal substances. Of the latter, 646 (9·8% of the total) were recorded under the code for "noxious food". This is the formal ICD term but we use the term "plant material" for the purposes of this paper. As described in more detail below, the great majority of these admissions followed ingestion of berries or mushrooms. The numbers and rates of hospital admissions in the major categories of drugs and non-medicinal agents are shown in tables I and II, respectively. Average annual admission rates in children under six years of age were 1·88 per 1000 children for medicinal agents and 1·45 per 1000 children for non-medicinal substances.

Analgesics or psychotropic drugs were consumed in 44·0% of the admissions for medicinal poisoning. Of the analgesics, the main contributor was aspirin in the early years of the study, and acetaminophen was the single analgesic most commonly recorded for admissions at the end of the period studied. Of the admissions for plant material poisoning, 97·4% were recorded as the consumption of berries and mushrooms. Of the non-medicinals, carbon monoxide was numerically a comparatively small contributor. Corrosive aromatics, acids, and alkalis accounted for 22·0% of admissions.

Considering the age profiles of the admissions for poisoning with medicinal agents (table I), 3·9% of all admissions in the age group 0–5 years were for children under one year of age, 23·8% for children aged one year, 40·4% aged two years, 20·9% aged three years, 8·1% aged four years, and 2·8% aged five years. Fifty six percent of the episodes were for males and there was a male predominance in each category of medical agent.

Considering the admissions for poisoning with non-medicinal agents, 5·8% of all admissions in the under six years age group were for children under one year of age, 39·0% for children aged one year, 29·0% aged two years, 13·5% aged three years, 7·9% aged four years, and 4·7% aged five years. Admissions for males were more common than for females in each major category, and the sex ratios varied quite widely according to the nature of the substances used. For example, males accounted for 58·9% of all admissions for non-medicinals, 51·9% of admissions following consumption of plant material, 61·6% of admissions for toxic effects of alcohol, and 76·2% of admissions in the category of poisoning with gases, fumes, or vapours.

Admission rates for children aged less than one year of age and for those aged five years were low and similar from calendar year to year throughout the period. Episode based admission rates for children aged 1–4 years in each year 1975–86 are shown for medicinal agents (fig 1), non-medicinal agents excluding plant material (fig 2), and plant material (fig 3). In these children there was a significant decrease in episode based admission rates averaging 5·8% per annum (95% CI −6·68 to −4·89) for medicinal poisoning, 6·9% per annum (95% CI −8·07 to −5·76) for non-medicinal poisoning excluding plant material, and 12·8% per annum (95% CI −14·89 to −10·68) for plant material poisoning.

No significant pattern was found for the admissions when analysed by day of the week of occurrence. There was significant variation by month of occurrence for admissions for medicinal poisoning ($\chi^2_{11} = 79{\cdot}1$, $p < 0{\cdot}0001$) and for non-

Table I Average annual episode based hospital admission rates, per 100 000 population in each single year age group, for medicinal poisoning of children in the Oxford region 1975–1986

		All aged <6 years		Age (year)					
ICD code 8/9	Agents	n	Rate	<1	1	2	3	4	5
965	Analgesics	1042	52·8	9·6	65·4	138·8	75·2	26·0	5·0
970/969	Psychotropics	588	29·8	7·1	49·6	69·6	35·0	12·8	6·2
963	Systemic agents	273	13·8	1·2	16·1	37·4	17·4	9·3	2·4
973, 975/972, 974	Cardovascular drugs and diuretics	186	9·4	3·7	15·5	27·2	9·1	1·1	0·6
964	Blood agents	177	9·0	1·5	19·2	23·2	7·0	2·7	0·9
967-969/967-968	Sedatives and hypnotics	176	8·9	2·5	12·4	21·0	12·2	4·2	1·5
960-961	Anti-infectives	128	6·5	1·9	8·7	14·8	6·7	5·4	1·8
972/971	Autonomic nervous system drugs	114	5·8	3·1	7·4	10·8	8·2	4·2	1·2
974/973	Gastrointestinal drugs	101	5·1	1·2	8·7	14·2	5·2	1·5	0·3
962	Hormones	100	5·1	0·0	6·8	13·6	7·0	2·1	1·2
966	Anticonvulsants	39	2·0	0·3	4·7	3·7	0·9	1·5	0·9
971/970	Central nervous system stimulants	18	0·9	0·9	0·9	1·6	0·6	1·5	0·0
976-979/975-979	Other	760	38·5	11·7	58·0	85·6	51·5	17·6	8·8
Total		3702	187·6	44·8	273·5	461·6	236·0	89·9	30·6

Table II Average annual episode based hospital admission rates, per 100 000 population in each single year age group, for non-medicinal poisoning of children in the Oxford region 1975–1986

		All aged <6 years		Age (year)					
ICD code 8/9	Agents	n	Rate	<1	1	2	3	4	5
988	Noxious food	646	32·8	8·3	49·6	52·3	39·9	25·7	21·5
983	Corrosive aromatics, acids and alkalis	488	24·7	8·7	58·6	49·8	22·2	7·8	2·9
981	Petroleum products	304	15·4	3·4	52·4	24·4	7·0	4·5	2·1
982	Industrial solvents	248	12·5	4·0	37·8	23·5	7·3	3·0	0·6
980	Toxic effects of alcohol	216	11·0	4·3	20·5	19·5	10·1	8·4	3·5
987	Gases, fumes or vapours (other than CO)	42	2·1	1·2	4·0	3·4	0·9	1·8	1·5
984, 985	Lead and other metals	24	1·2	0·6	3·4	1·9	0·6	0·6	0·3
986	Carbon monoxide	11	0·6	0·0	0·6	0·6	0·9	0·6	0·6
989	Other substances	881	44·6	21·0	118·2	81·0	28·9	15·5	6·5
Total		2860	144·8	51·6	345·2	256·3	117·9	67·8	39·4

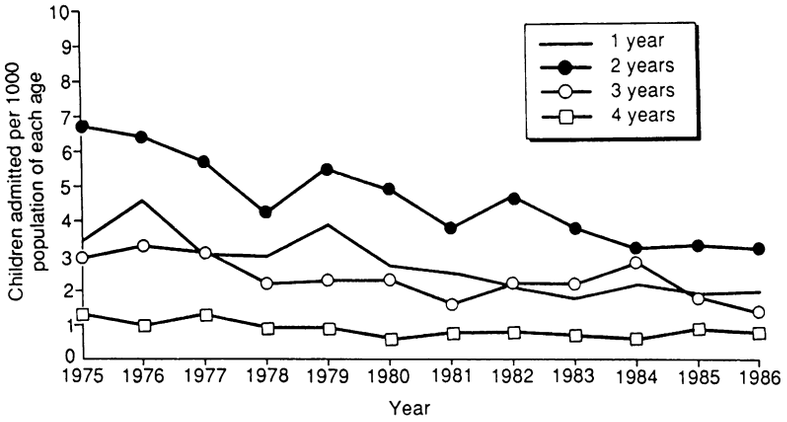

Figure 1 Trends in episode based age specific admission rates for medicinal poisoning of children 1975–1986

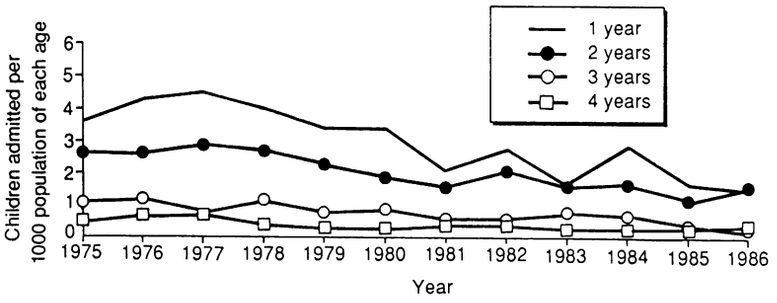

Figure 2 Trends in episode based age specific admission rates for non-medicinal poisoning, excluding plant material, of children 1975–1986

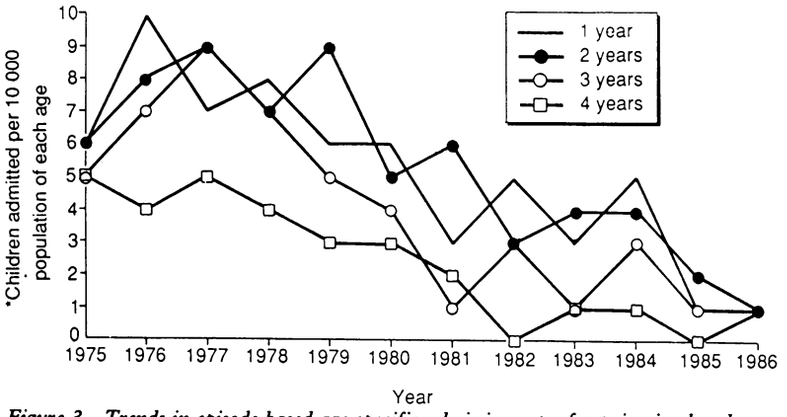

Figure 3 Trends in episode based age specific admission rates for poisoning by plant material of children 1975–1986
*Note change of scale compared with figs 1 and 2

medicinal poisoning excluding plant material ($\chi^2_{11} = 131{\cdot}8$, $p < 0{\cdot}0001$). Both of these groups had similar seasonal profiles and admission rates were a little higher from May to September. As might be expected, there was a very striking and statistically significant summer excess, notably in the months of August and September, for admissions for poisoning with plant material ($\chi^2_{11} = 715{\cdot}2$, $p < 0{\cdot}0001$).

Discussion

As reported before,[9] and verified in this study, non-medicinal products are ingested more often than drugs by infants and one year old children, while drugs are a greater risk to children aged two years and over; and boys are more frequently involved than girls. It seems likely that non-medicinal products may be stored in areas accessible to crawlers, such as under kitchen sinks and perhaps in garden sheds, while children who have learned to walk or climb may be more attracted to medicinals usually stored in higher cupboards or shelving units.

The data presented in this paper only include poisonings which resulted in inpatient admission. We have no comparable data for poisoning when medical care was not sought or when it did not result in hospital admission. Therefore it is necessary to consider the influence on our data of parental thresholds in seeking care and clinical thresholds for admission of children to hospital. It is possible that the decline in admissions for childhood poisoning may reflect a decline in episodes of poisoning. It is also possible that the decline may reflect a rise in parental thresholds in seeking care and/or clinical thresholds for admitting patients. If these latter factors changed in respect of poisoning, the change is against the general trend for paediatric medical admissions in the Oxford region. Hill has reported that paediatric medical admissions in this region rose strikingly,[10] and considerably more than the general rise in inpatient admissions,[6] during the years covered by this study. She attributed this rise to the lowering of thresholds for admission for common paediatric medical conditions.

In 1968 the Central Health Services Council and Scottish Health Services Council reported on the hospital treatment of acute poisoning and drew attention to the rise in the number of children admitted to hospital with poisoning.[11] Representatives of the British Paediatric Association and the Department of Health met to investigate the matter. In 1974 a working party of the United Kingdom Medicines Commission recommended that hazardous solid dose medicines should be unit packaged (bubble packs), but that use of child resistant containers should not be compulsory.[12]

From January 1, 1976, all children's aspirin and paracetamol preparations were required to be presented in child resistant containers or in dark tinted unit packaging.[13] On March 2, 1981 the Pharmaceutical Society initiated a voluntary scheme for the use of child resistant containers to cover all dispensed solid oral dose medications. Our data, and national data on medicinal poisoning, show gradual but not dramatic declines in admissions. The impact of child resistant containers has been the subject of debate.[14–17] The use of child resistant containers and special labelling of household products may have contributed a little to the reduction in childhood poisoning (although, in the United States, poison warning stickers are not believed to have a deterrent effect[18]). However, our expectation was that, with the public focus on safe containers for potentially harmful substances, rates of poisoning with substances packaged in safe containers would have declined while poisoning with substances not in safe containers might not. Contrary to our expectations, admission rates for poisoning with physical substances not in safe containers and with berries, plants, and mushrooms decreased more than poisoning with safely packaged medicines.

Even though between 1974 and 1980 only 69 children under the age of five died as a result of

ingestion of drugs, and 11 as a result of non-medicinals in England,[19] the resultant morbidity, cost to the National Health Service, and distress to the child and family are all important reasons for maintaining a vigilant programme of poison prevention for preschool children. The profile of poisoning according to substance indicates that it is important to target health promotion not only on medicines but also on household and industrial products and on substances found in the natural environment. The fact that relatively few children were admitted to hospital more than once, ie, that the profile of admissions does not represent large numbers of children with frequent admissions, also suggests that educational programmes should be targeted at parents and the public in general and not particularly at the families of children who have been poisoned.

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