ACCIDENTAL POISONING IN CHILDHOOD

BY

J. O. CRAIG and M. S. FRASER

From the Royal Hospital for Sick Children, Edinburgh, and the Department of Child Health, University of Aberdeen

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A recent increase in the number of children brought to hospital with accidental poisoning has been noticed in Edinburgh and Aberdeen. In a study of this trend, which has also been recorded in Manchester (Holzel and James, 1951), we have tried to determine whether it reflects a true increase of poisoning in the child population. We have then compared the incidence of the individual toxic agents and the mortality from each in order to show which poisons are most in need of control.

Material

Five hundred and two case-records have been examined of children under the age of 12 years who were accidentally poisoned in the years 1931 to 1951 inclusive. Two hundred and sixty-five were seen at the Royal Hospital for Sick Children, Edinburgh, and 237 at the Royal Aberdeen Hospital for Sick Children. The cases from these two hospitals were found to be so similar, both in frequency and in the types of poison swallowed, that it has been possible to combine them as a single source of material. In addition, the Registrars-General have provided us with the certified causes of death of 454 fatally poisoned children.

Poisoning by gas or smoke and bacterial food poisoning have been excluded, and also poisoning which occurred while a known therapeutic risk was being taken. We have discarded as harmless such incidents as the swallowing of insulin or soap, but have included all those in which poisonous substances were reputedly taken, whether symptoms occurred or not. In-patients and out-patients have been considered together, as a distinction between them depends partly on circumstances, such as the time of day at which a child reported. One hundred and thirty-one of the Edinburgh children were admitted and 110 in Aberdeen.

On all but one occasion (an accidental overdosage by injection), the poisons were ingested. Most of the cases were mild, and only two children died, one of morphine and one of methyl salicylate poisoning. When a child returned after taking poison on a second occasion, the incidents have been recorded as separate cases. This happened only twice; there were 502 poisonings which concerned 500 children.

The figures on which our diagrams are based are grouped in Appendix A, and the statistical analyses of the graphs will be found in Appendix B.

Incidence

In 1931 about five cases were brought to the hospitals each year; by 1951 the number had risen to more than 50 (Fig. 1). This tenfold increase is

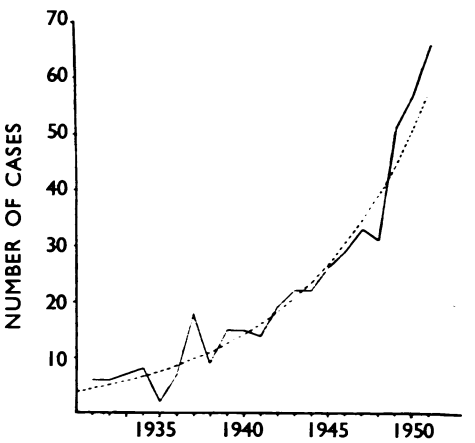

FIG. 1.—All poisoning cases, Edinburgh and Aberdeen. Average time-trend shown as dotted line.

striking, but does not in itself indicate that there has been a rise in poisoning in the child population. Social changes may have been largely responsible, causing parents to bring their children to hospital more readily. The effects of such changes can be assessed indirectly, in two ways: (1) By taking into account the general increase in the work of the hospitals; (2) by comparing the incidence of poisoning with that of a similar domestic accident, burns and scalds.

Further evidence on the reality of the increase can be obtained: (1) By studying the national mortality

from poisoning; (2) by classifying the hospital cases according to the source of the poison.

Hospital Turnover. Is the increase in the number of poisoned children attending hospital simply a reflection of a general increase in the use of hospital facilities? Fig. 2 shows that, even in relation to the hospital turnover, there has been a fivefold rise in poisoning. By its magnitude this rise suggests a true increase of poisoning in the population. If there were a growing tendency to bring trivial cases to hospital, those seen in recent years would be expected to be less severe than the earlier ones. Classification according to the severity of poisoning proved to be impracticable, but a bald comparison of those who developed symptoms and those who did not, produced no evidence that the poisonings now seen are less severe than they used to be.

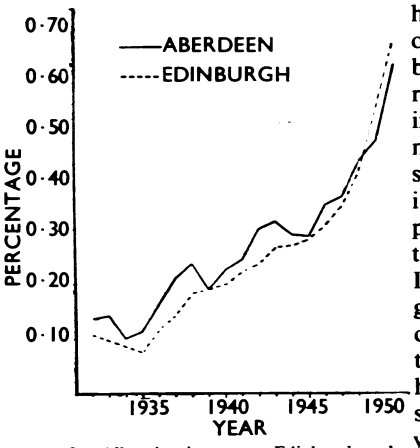

FIG. 2.—All poisoning cases, Edinburgh and Aberdeen, shown as percentage of turnover of appropriate departments.

Burns and Scalds. Burns and scalds resemble poisoning in that they are domestic accidents, are often very mild, and affect a similar age group. Only the Aberdeen hospital figures have been used, as there has been a campaign in Edinburgh against burning accidents. In Fig. 3 it will be seen that burns and scalds have increased by 150% (from 100 to 265 cases per annum) during the 21-year period. The relative rise in poisoning has been far greater, but the difference in the numerical strength of the two groups is so obvious that comparison on a percentage basis is scarcely justified. Of undoubted importance, however, is the fact that these household accidents have not increased in the same manner; the rise of burns and scalds has been linear, but that of poisoning curvilinear.

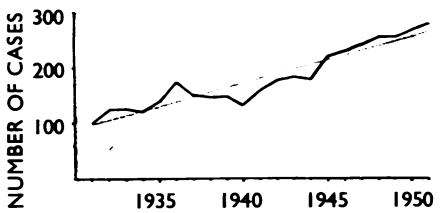

FIG. 3.—Burns and scalds, Aberdeen. Average time-trend shown as dotted line.

Mortality. Any true increase of poisoning should be reflected in the numbers of deaths from this cause. Close correspondence cannot be looked for, since the death rate can readily be affected by such factors as improved treatment and changes in the common types of poison. Swinscow (1953) has suggested that alteration in methods of certification may have been important after 1940, but the influence of this appears doubtful.

The annual numbers of deaths in Scotland are too small for reliable analysis, but the outlines of the British and Scottish mortality figures (Fig. 4) are so similar in their general characteristics that it seems justifiable to compare our morbidity figures with the British mortality. Swinscow, taking account of population changes, found no firm evidence of a continuing rise in poisoning deaths after 1940. When a longer period is considered, however, the impression of an increase dating from 1935 becomes clear, and this is strengthened by the previous long period of decline (Fig. 5). There is no evidence that toxic agents of recent introduction have caused the higher mortality, and the figures since 1935 are thus

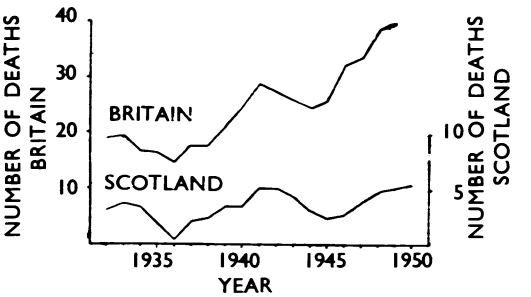

FIG. 4.—Deaths from poisoning in childhood, Britain and Scotland, shown as three-year moving averages.

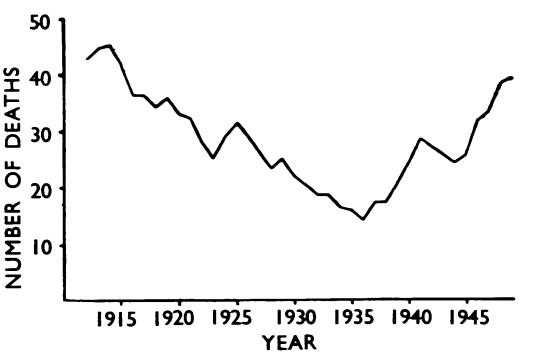

FIG. 5.—Deaths from poisoning, Britain, 1912-1949, shown as three-year moving averages.

compatible with an increase of poisoning among British children.

Sources of Poison. The 502 cases have been classified as follows:

GROUP 1.	Household substances, e.g., disinfectants, fuels, cleaning agents, insecticides	(203)
GROUP 2.	Medicines.	
	2A. Those intended for internal use	(185)
	2B. Those intended for external application, e.g., liniments, nose and eye drops	(75)
GROUP 3.	Vegetable matter, e.g., berries, seeds ..	(35)
GROUP 4.	Source unidentified	(4)

Cases due to a single toxic agent may contribute to more than one group, e.g., those due to atropine are divided between Groups 2A, 2B and 3.

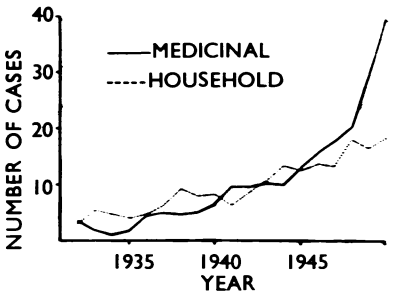

FIG. 6.—Poisoning cases in the two main groups, Edinburgh and Aberdeen, shown as three-year moving averages.

When the general trends of the two large groups are examined it appears that medicinal poisoning has recently increased much more rapidly than the household group (Fig. 6). This is of such importance that the two groups will be considered separately. The increase in poisoning due to household substances (Fig. 7) has been steady and linear, like that

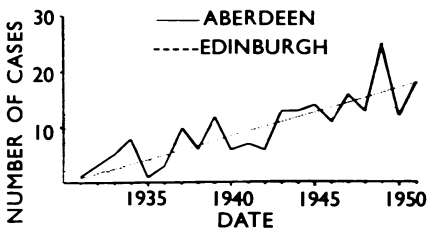

FIG. 7.—'Household' poisoning cases, Edinburgh and Aberdeen. Average time-trend shown as dotted line.

of burns and scalds; it seems that it is to this group of poisons that burns and scalds are most comparable. Yet the percentage increase in the household group has been about four times as great as that of burns and scalds, for what this type of comparison is worth.

In contrast to the household poisons, the medicinal group altered sharply in incidence about the year 1948 (Fig. 8). It is true that changes in population or social custom might have increased the hospital incidence of poisoning, for example, by diverting patients from the family doctor to the casualty department, but such a rise would not have affected the medicinal group alone. Some new influence is indicated.

From these lines of enquiry, it appears certain that a sharp rise in accidental poisoning has occurred since 1948 in the child population. A lesser increase in the period 1935-1948 is suggested, but the evidence for this is not conclusive.

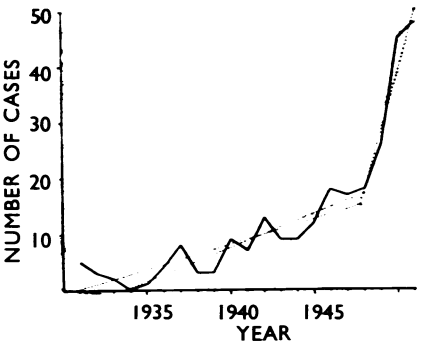

FIG. 8.—'Medicinal' poisoning cases, Edinburgh and Aberdeen Average time-trends shown as dotted lines.

Age and Sex. The age incidence of the whole series is shown in Table 1. The mean age for both Edinburgh and Aberdeen cases lay between 32 and 33 months.

TABLE 1
AGE INCIDENCE.

Age in Years	Number of Cases	Age in Years	Number of Cases
Under 1 ..	25	6–7	13
1–2 ..	184	7–8	7
2–3 ..	147	8–9	9
3–4 ..	55	9–10	5
4–5 ..	30	10–11	3
5–6 ..	15	11–12	1

Age was not quoted in 8 cases. Total, 502.

In Fig. 9 (Edinburgh cases only) attention is directed to the early years of life. Although there is

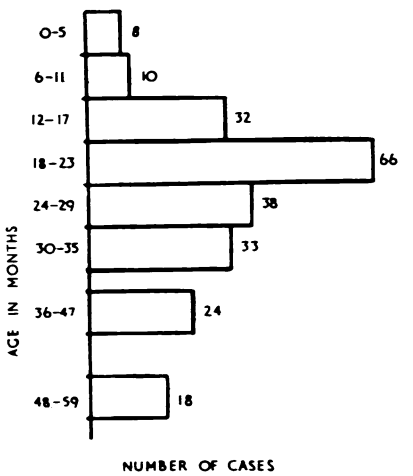

FIG. 9.—Age-incidence of poisoning in the early years, Edinburgh.

TABLE 2

ANALYSIS BY HOUSEHOLD POISONS

Number of Cases in Edinburgh and Aberdeen		Number of Deaths in Britain	
Disinfectants	39	Disinfectants	28
Kerosene	31	Caustic alkali	23
Turpentine	25	Phosphorus	17
Bleach	22	Ammonia	11
Ammonia	16	Kerosene	8
Dyes and inks	16	Acetic acid	6
Rat poison (phosphorus 4)	5	Arsenic, non-medicinal	5
Carbon tetrachloride	5	Nicotine	4
Potassium permanganate	5	Petrol	4
Caustic soda and potash ('Lye')	4	Cyanides	4
Petrol	3	Potassium bichromate	3
'Insecticide'	3	Soldering fluid (zinc and HCl)	3
Acetic acid	3	Hydrochloric acid	3
'Acid'		Metaldehyde	3
Shoe polish, paint, D.D.T., 'oil', of each	2	Potassium permanganate	3
		Turpentine, 'corrosive', sodium nitrate, carbon tetrachloride, copper sulphate, 'insecticide', sulphuric acid, of each	2
Varnish, corrosive sublimate, red squill, oxalic acid, lead, potassium bromate, soldering fluid, furniture polish, 'garden fluid', naphthalene, formalin, 'brasso', of each	1	Blue vitriol, 'cleaning fluid', oxalic acid, lead, sodium arsenate, potassium sulphide, zinc, zinc phosphide, benzine, 'paint solvent', window polish, antimony, methyl alcohol, 'paint-brush wash', mercuric nitrate, potassium chromate, of each	1

TABLE 3

MEDICINES INTENDED FOR ORAL USE EXCLUDING ATROPINE

Number of Cases in Edinburgh and Aberdeen		Number of Deaths in Britain	
Barbiturates	36	Strychnine	41
Iron (ferrous sulphate 21)	24	Iron	31
Salicylates	20	Quinine	20
Purgatives	15	Opium series	19
Opium series	10	Salicylates	19
Antihistamines	10	Barbiturates	10
Ephedrine	4	Digitalis	9
Thyroid	4	Antihistamines	6
Stilboestrol	4	Purgatives	6
Sulphonamides	3	Amidone, chloral, of each	2
Amidone ('physeptone')	3		
Amphetamine, ergot, isoprenaline, quinine, strychnine (in purgative tablets), of each	2		
Digitalis, mist. arsenic and ipecac., bromide, mandelate tabs., Lugol's iodine, nitroglycerine, chloral, pethidine, of each	1	Ipecacuanha, sulphone, 'irritant pills', 'kerol', of each	1

TABLE 4

MEDICINES INTENDED FOR EXTERNAL USE EXCLUDING ATROPINE

Number of Cases in Edinburgh and Aberdeen		Number of Deaths in Britain	
Camphor	29	Methyl salicylate (oil of wintergreen)	36
Iodine	11	Camphor	12
'Liniment'	6	Lethane	5
Sassafras	5	'Liniment'	2
Eucalyptus	4		
Methyl salicylate (oil of wintergreen)	3		
'Three oils', surgical spirit, of each	2		
Gentian violet, boric acid, 'eardrops', benzyl benzoate, calamine lotion, 'contraceptives', of each	1	Ol. citronella, iodine, eucalyptus, 'tar preparation' of each	1

TABLE 5

VEGETABLE MATTER EXCLUDING ATROPINE

Number of Cases in Edinburgh and Aberdeen		Number of Deaths in Britain	
Laburnum	15	Fungi	5
'Berries'	10	Water dropwort	4
Green elderberries	2	'Berries'	2
		Hemlock	2
Daphne berries, mistletoe, whinseeds, fungus, sycamore seeds, poppy heads, of each	1	Privet	1

TABLE 6
ATROPINE GROUP

Number of Cases in Edinburgh and Aberdeen		Number of Deaths in Britain	
Atropine eyedrops	5	'Belladonna'	8
Belladonna mixtures	2	Deadly nightshade	7
Deadly nightshade (clinical)	1	'Nightshade'	2
		'Atropine'	3
		Belladonna tablets	1
Hyoscine (medicinal)	6	'Hyoscyamus'	3
		Henbane (*Hyoscyamus niger*)	1
Woody nightshade (bittersweet)	1	Woody nightshade	3

a peak in the second year, poisoning is frequent throughout the pre-school years. There was no significant change in age incidence after 1948. The vegetable group of poisons affects older children; of 15 who had eaten laburnum seeds, for instance, the mean age was 5 years 9 months.

About three boys were poisoned for every two girls. This in itself is not significant, but it agrees with the figures of Ryan (1951) for sex incidence in Queensland and Swinscow's figures for mortality.

Frequency of Individual Poisons

In order to discover which poisons are most common in childhood and which are most lethal, Tables 2-6 have been drawn up to compare incidence and mortality. The incidence is derived from our 502 cases. The mortality is based on the deaths from accidental poisoning (excluding gas and food poisoning) of 454 British children under 10 years of age. Five hundred and one deaths occurred in the 21-year period (Fig. 4), but the certified causes are obtainable only for 401 in England and Wales in the years 1931-49 and for 53 deaths in Scotland in 1939-51. A few cases had to be excluded from the tables because the poisons were not named with sufficient accuracy.

These tables must be studied with an important reservation, that the comparison is between incidence in Scotland and mortality derived largely from England. Reasons have already been given for the quantitative use of the British mortality figures. That a qualitative use is also justified will appear in Table 7. This table shows the pattern of fatal poisoning in Scotland, and also shows that the Scottish and English patterns are remarkably similar. Crude as it is, this method of comparison provides useful information.

Table 2 shows that the most important household poisons are disinfectants, kerosene, caustic alkalies, and phosphorus (rat poison). The group of acids, excluding carbolic, accounted for 16 deaths. Turpentine and bleach are common poisons but are very seldom fatal; no death has been attributed to bleach in the last 20 years. Non-medicinal arsenic, potassium permanganate and carbon tetrachloride are uncommon poisons but carry a fair mortality.

Poisoning is not always recognized, and figures for the occurrence of lead, nicotine (usually insecticide), and cyanides, for instance, must be accepted with reserve.

Table 3 brings out clearly the importance of ferrous sulphate. The barbiturates and aspirin are prominent, and the toxicity of strychnine is particularly striking in view of its apparently low incidence. Digitalis and quinine are also rare but dangerous. A few deaths are attributed to purgatives, but some of these may have been due to other ingredients of compound tablets, such as atropine or even strychnine.

Camphor liniments are prominent in Table 4. Methyl salicylate (oil of wintergreen) resembles strychnine in that it is a rare poison with a very high mortality. Iodine is very seldom fatal, but lethane is dangerous.

In Tables 5 and 6 a direct comparison between incidence and mortality is not justified, owing to differences in flora between Scotland and England. Deadly nightshade is the most dangerous of the vegetable poisons, although uncommon in Scotland. Laburnum poisoning is common; death from this cause has been recorded, but is very rare.

The chief results of the preceding tables are summarized in Table 7, in which the virulence of a

TABLE 7
THE MAIN POISONS ASSESSED AS REGARDS POTENTIAL DANGER

Agent	Frequency (Edinburgh and Aberdeen)	Mortality (Britain)	Number of Deaths (Scotland)
Disinfectants	+++*	++	8
Barbiturates	++++	++	0
Kerosene	++++	+	0
Camphor	+++	++	0
Turpentine	+++	+	0
Iron	+++	++++	7
Bleach	+++	—	0
Salicylates	+++	++	4
Ammonia	++	++	2
Atropine series	++	+++	0
Antihistamines	++	+	1
Opium series	++	++	2
Phosphorus	++	++	0
Strychnine	+	++++	8
Methyl salicylate	+	++++	6
Quinine	+	+++	3
Caustics ('lye')	+	+++	0

* An incidence or mortality of 1-9 cases has been scored as +, 10-19 = ++, 20-29 = +++, and over 30 = ++++.

particular poison can be roughly measured by the relation between the frequency of its occurrence and the frequency of death.

The Changing Incidence of Certain Poisons. In Table 8 the numbers of cases attending hospital due to the commoner poisons are shown in three-year groups. The household poisons (Nos. 1-5) have risen slightly, as have the medicinal applications (Nos. 6-7). In the group of internal medicines (Nos. 8-11), only the purgatives follow the trend of the household group; the others show a much steeper recent increase. The sharp rise in ferrous sulphate poisoning is not surprising, but it should be realized that the barbiturates and aspirin are increasing in a manner only slightly less striking. The figures for the vegetable group have risen unexpectedly in the post-war years. If there should prove to be a true increase in vegetable poisoning, this will remain to be explained. We can offer no convincing reason for it.

TABLE 8
THE INCIDENCE OF CERTAIN POISONS OVER A 21-YEAR PERIOD

Agent	1931–33	1934–36	1937–39	1940–42	1943–45	1946–48	1949–51
Disinfectants	4	4	5	6	8	2	10
Kerosene	0	1	4	3	11	2	10
Turpentine	2	1	6	0	4	6	6
Ammonia	0	1	2	1	3	5	3
Bleach	0	0	0	4	2	7	10
Camphor	3	0	3	8	6	3	6
Other applications	3	2	5	8	5	13	10
Purgatives	0	0	4	1	2	4	4
Aspirin	1	1	1	0	2	3	11
Barbiturates	0	0	0	4	3	9	20
Ferrous sulphate	0	0	0	0	1	4	16
Vegetable group	3	1	1	2	4	8	16

In looking for any trend in mortality, we have had to use the figures for England and Wales only in six-year groups (Table 9). The danger of attaching too much importance to these small figures is illustrated by the entry for methyl salicylate; a progressive increase in wintergreen poisoning is not probable, since 14 of these deaths occurred in 1944-45. There was a similar transient rise due to quinine, with eight deaths in 1940-41. On the other hand, the deaths from ferrous sulphate show a steady increase. It had been responsible for a considerable number of deaths before the danger of iron poisoning was generally recognized. The deaths of 17 British children were certified as due to ferrous sulphate poisoning in the 10 years before Forbes (1947) described it, and one child had died of ferric carbonate poisoning.

TABLE 9
NUMBERS OF DEATHS FROM CERTAIN POISONS, ENGLAND AND WALES

Agent	1932–37	1938–43	1944–49
Aspirin	2	5	9
Atropine (all sources)	8	4	6
Barbiturates	1	2	7
Disinfectants	5	9	4
Iron	1	6	18
Methyl salicylate	4	8	18
Morphine	4	6	7
Quinine	3	11	3
Strychnine	9	12	10
Vegetable poisons, including those containing atropine	6	4	15

The Principal Childhood Poisons. The only poison which is both common and very dangerous in Britain at present is ferrous sulphate. Indeed, had the mortality details been available for England and Wales in 1950-51, the figure for ferrous sulphate might well have been higher. The same applies to amidone and the antihistamines, drugs of recent origin which are dangerous to children.*

Two rare poisons, strychnine and methyl salicylate, are so virulent that they have caused the greatest numbers of deaths during the 21-year period and have taken a steady toll throughout. Strychnine is taken most often in the form of tonic or laxative tablets. Other poisons which are rare but dangerous are quinine, digitalis, morphine and phosphorus (rat poison).

The barbiturates are very common but carry only a moderate risk to life. It is probable that the toxicity of phenobarbitone in childhood has been exaggerated, since its danger in the individual case appears to be less than that of aspirin, household ammonia, or camphorated oil (Table 7). Kerosene is also common, but seems to cause few deaths. However, some deaths due to kerosene may have been registered under the lung complications.

Disinfectants are still commonly swallowed, but deaths due to this group have diminished with the substitution of less toxic substances for phenol and cresol. Caustic alkalies (lye), although apparently rare in Scotland, are common and dangerous elsewhere.

It is true that local custom and conditions modify the pattern of accidental poisoning. In California, for instance, the commonest toxic agent in childhood is an arsenical ant poison (King, 1950). Lye is the commonest in North Carolina (Arena, 1948) and Hungary (Csöke, 1948). Poisonings due to kerosene outnumber all others in Manila (Tupas and Dauis-Lawas, 1950) and Queensland (Ryan, 1951). Of 1,086 cases in Queensland, there was only one instance of ferrous sulphate poisoning, but this was the commonest poison recorded in Manchester by Holzel and James. It accounted for six of their 34 cases, most of which were due to medicinal sub-

* Since this paper was accepted we have received the following figures of deaths in England and Wales, under 10 years of age, in 1950-51: iron tablets 15, antihistamines 14, strychnine 10, aspirin 6, methyl salicylate 5, amidone 2.

stances. Bearing in mind such regional variations, we believe that our figures are broadly applicable to Great Britain.

Discussion

The Rising Trend. Evidence has been presented to show that accidental poisoning has been increasing in the child population, certainly since 1948 and probably since 1935. Some additional lines of investigation which did not invalidate this conclusion can now be briefly mentioned.

Variations in the toddler population of Edinburgh and Aberdeen in recent years were found to have been negligible by comparison with the increase of poisoning.

There has not been any considerable shift of cases from neighbouring hospitals; the records we have consulted show that the other hospitals have had a similar increase.

We have found no evidence that improvement in diagnosis has played a significant part in raising the hospital incidence, although some cases of iron poisoning may have been overlooked in earlier years.

It is obvious that the abrupt rise in medicinal poisoning occurred at about the same time as the introduction of the National Health Service, but it cannot be assumed that this was entirely a matter of cause and effect. For example, Ryan (1951) showed that poisoning increased sharply in Brisbane Children's Hospital from 1946 to 1949, although it is not clear how far this was due to medicines. Again, while prescribing has increased by 50% in Scotland since 1948, medicinal poisoning has been trebled. This difference is so great that a possible cause for it has been sought. If it were due to growing parental carelessness or a greater readiness to bring children for treatment, a comparable rise would be expected in poisoning due to household substances but the increase in household poisoning remains linear. It may be that many of the 'new' prescriptions have gone to homes where overcrowding and lack of experience in dealing with medicines might cause them to be poorly guarded. There has been a growing tendency to prescribe tablets rather than liquids. In Aberdeen in 1931 liquid medicines were dispensed twice as commonly as tablets, but since 1946 the two forms of prescription have been roughly equal in frequency (Fraser, 1953). Even when liquids were more in favour, tablets were the more frequent cause of poisoning (Appendix A). A relative increase in the dispensing of tablets would therefore raise the poisoning rate, but since this factor seems to have been fully developed before 1948, it cannot have played any part in the later rise.

The personality of the child who takes poison by accident remains to be considered. If emotional disturbance in early childhood were increasing, this might influence the poisoning rate. A child who feels insecure may revert to infantile behaviour, with a renewed tendency to transfer objects to his mouth. This is a very theoretical consideration, but should perhaps not be dismissed completely.

The one clear fact that emerges is that the rise in medicinal poisoning has occurred during a period of increased prescribing. It may reasonably be expected that, if the amount of prescribing becomes stabilized, the rapid increase in poisoning will cease.

Prevention. Poisoning is one of the minor accidents of childhood. For every child who dies from this cause, 20 are killed on the roads. Poisoning is on the increase, however, at a time when we are accustomed to diminishing diseases, and most of that increase is due to medicinal poisons. The problem is thus one for the medical profession in particular.

For the purpose of prevention, more information is needed. For example, it may be found that the rise which we have described, and which has been noted in Manchester, is characteristic only of large towns; the increase recorded by Ryan in Brisbane did not occur in the rural areas of Queensland. It is also possible that figures taken from children's hospitals do not exactly reproduce the national poisoning pattern (see Appendix C).

Too little is known about the circumstances in which poisoning occurs. In any enquiry, the following details should be included in the case history: (1) In what receptacle was the poison kept? For example, was it in a box or a screw-cap bottle, or was it in a receptacle intended for something else, such as kerosene in a lemonade bottle? (2) Was it under lock and key? (3) By whom was the poison given if it was not self-administered? (4) What are the social conditions, e.g., the number of persons per room? (5) What is the temperament of the child, and does the parent-child relationship seem to be good?

Preventive efforts in the meantime should be chiefly devoted to the medicinal cases, and the family doctor has an important part to play. He should ensure that the dangers of medicines are explained to their recipients, that medicines are dispensed in a form in which the danger is minimized, and that particular care is given to what medicines are prescribed in homes where there are young children. Parents must be encouraged to keep *all* medicines out of the reach of small children; even aspirin and laxative tablets are potentially lethal. A specific warning should be given when prescribing ferrous sulphate, strychnine preparations, and oil of wintergreen.

Summary

Among children attending two Scottish hospitals, accidental poisoning has become much more frequent during the past 20 years. An attempt has been made to determine whether this represents a true increase of poisoning in the child population. For the years 1935-48 the evidence favours this but is not conclusive. There can be no doubt, however, of a sharp general increase in the years 1949-51; it is chiefly explained by a rise in the accidental ingestion of medicines.

The poisons most commonly swallowed by Scottish children are disinfectants (not lye), barbiturates, kerosene and camphor liniments. Those which are most often fatal to children in Great Britain are ferrous sulphate, strychnine, methyl salicylate and the disinfectants.

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APPENDIX A

Year	Edinburgh H.	Edinburgh M.	Edinburgh A.	Edinburgh V.	Aberdeen H.	Aberdeen M.	Aberdeen A.	Aberdeen V.	Mortality EW.	Mortality S.	Mort. EW. H.	Mort. EW. M.	E. and Ab. T.	E. and Ab. L.	Ab. BS.
1931	1	1	1	2	–	1	2	–	17	2	9	4	–	2	100
1932	–	2	1	1	3	–	–	–	19	1	9	5	2	–	122
1933	3	–	–	–	2	–	2	–	12	6	5	1	–	–	125
1934	4	–	–	–	4	–	–	–	15	4	6	6	–	–	131
1935	1	1	–	1	–	–	–	·	12	–	5	7	–	–	139
1936	–	2	–	–	3	–	2	–	16	1	7	8	1	1	173
1937	5	3	2	–	5	2	1	–	15	–	8	4	4	–	151
1938	3	1	1	1	3	–	1	–	16	5	6	6	–	–	149
1939	4	1	2	–	8	–	–	–	15	2	6	6	1	–	150
1940	3	4	4	–	3	–	1	–	22	3	7	10	3	1	135
1941	4	–	4	–	3	1	2	1	27	5	7	12	–	1	160
1942	2	6	2	1	4	2	3	–	23	7	11	7	7	1	178
1943	9	2	2	1	4	4	1	1	18	3	7	6	5	–	185
1944	8	3	2	–	5	1	3	1	18	3	6	3	3	1	180
1945	9	4	2	1	5	5	1	–	30	2	6	8	7	2	220
1946	6	6	5	–	5	6	1	–	23	2	6	12	8	3	230
1947	5	5	5	3	11	5	2	1	36	4	13	17	7	2	245
1948	6	9	2	4	7	5	2	–	31	5	15	13	14	–	255
1949	15	7	1	2	10	14	4	2	35	5	10	18	19	2	255
1950	4	21	3	4	8	18	3	2	39	5	?	?	33	6	266
1951	10	20	2	3	8	23	3	3	?	6	?	?	36	6	278

EW. = England and Wales. S. = Scotland. E. = Edinburgh. Ab. = Aberdeen. H. = Household poisons. M. = oral medicines. A. = medical applications. V. = vegetable poisons. T. = tablets, etc. L = liquids. BS. = burns and scalds.
Four cases of unknown poisons are excluded. In six instances of 'medicinal' poisoning, it is either not clear whether the poison was taken in liquid or solid form, or else the child was known to have taken both.

APPENDIX B

STATISTICAL ANALYSIS

The purpose of the analyses is to describe the average time-trend over the 21-year period for each set of figures, to compare these trends and to seek any significantly different or similar rates of increase.

Method

In those groups (Figs. 4, 5 and 6), in which only a general description is indicated and no further analyses or comparisons are made, the average time-trend is shown by three-year moving averages of actual numbers of cases or deaths. These moving averages compensate to some extent for annual fluctuations.

In those groups in which comparisons of rates of increase are made, lines or curves have been fitted by the method of least squares, and these lines will be discussed in detail.

Results

Poisonings from All Causes, Edinburgh and Aberdeen, 1931-1951. From the original figures, the mean = 22·0 and the standard deviation of mean = 17·2.

The curve which has been fitted indicates the trend

much more closely than a straight line, and in spite of the divergencies from the curve the correlation coefficient is 0·912. The S.D. from the average time-trend is 4·1, much lower than the S.D. of 17·2 from the 21-year mean.

The equation of the curve estimating the 'expected' number of poisoning cases is $P_e = 3{\cdot}909 \times (1{\cdot}137)^Y$ where Y = the year-number after 1930. The increments throughout have been on the average 13·7% of the previous year's total, meaning that in the early years there was less than one additional case per annum, but in the more recent years the increments averaged six to eight additional cases per annum. It is clear from the diagram that in fact the rate of increase in the last three or four years has been even steeper than that given in our equation, and the divergencies between the 'expectations' and the actual observations are most consistent in the years 1949-1951.

Burns and Scalds, Aberdeen, 1931-1951. The mean = 181·8, the S.D. of the mean = 53·3.

The equation of the fitted trend, giving an estimate of the average number of burns in terms of the year of occurrence is $B_e = 89{\cdot}5 + 8{\cdot}4Y$. The increase in the number of cases has been steady. The average number of additional cases per annum throughout the two decades has been between eight and nine. The 'expected' numbers correspond particularly well with the actual numbers treated in recent years. The divergencies from the average time-trend, e.g. the low figures in the early war years, are not in fact of great importance, as is evident from the correlation coefficient of 0·953. The S.D. from the average time-trend (16·6) is small compared with the S.D. from the 21-year mean (53·3).

Household Poisonings. The mean = 9·7, the S.D. of the mean = 5·9.

The equation of the line is $H_e = 0{\cdot}880 + 0{\cdot}799Y$. The numbers fall into a fairly regular pattern, and the time-trend is one of steady increase between 1931 and 1951. The 'expected' numbers often differ from the actual numbers, but they agree extremely closely with the 3-year moving averages. The increase in household poisonings averaged 0·8 added poisoning cases each year. The divergencies of the 'expected' numbers are relatively unimportant, as can be seen from the correlation coefficient of 0·826. The S.D. from the average trend is 3·4, as compared with the S.D. of 5·9 from the 21-year mean.

Medicinal Poisonings. The mean = 12·4, the S.D. of the mean = 12·8.

No curve was found to describe the fitted trend as well as the pair of straight lines, which have a correlation coefficient of 0·847. The medicinal poisonings followed a steady upward trend during the period 1931-47 (M_e = 0·9044Y—0·9044), similar to the household poisons. The two coefficients of Y are very similar. The trend of medicinal poisonings then changed abruptly, and between 1948 and 1951 is represented by the equation $M_e = 10{\cdot}9Y - 178{\cdot}3$. The S.D. from the average time-trend is 2·9, a remarkably low figure compared with the S.D. of 12·8 from the 21-year mean.

In Fig. 8 the average time-trend for the period 1935-47 is also shown. This line allows for the possibility that the period 1931-35 was a period of fall, but differs very little from the 1931-47 line.

Up to 1948, the average increment was nearly one additional case per annum, but since 1948 it has been nearly 11 added cases per annum. The difference between these two rates of increase is highly significant.

Conclusions

The similarity between the burns and the household poisonings lies in the fact that both have an average trend which is linear. On the other hand, there has been a distinct change in the trend of the medicinal poisoning cases. It is not suggested here that there is a causal connexion between that change in the trend and the period in which it seems to have occurred.

LILLI STEIN,

Department of Social Medicine, University of Edinburgh.

APPENDIX C

A NOTE ON LEITH HOSPITAL

Leith is the port of Edinburgh. The general hospital there draws its patients largely from crowded tenements, and differs in that respect from the children's hospitals of Edinburgh and Aberdeen where the patients represent almost all social grades. It has about 25 beds for children, and 73 cases of poisoning were admitted between 1931 and 1951. This small series has been tabulated in three-year groups:

Source of Poison	1931–33	1934–36	1937–39	1940–42	1943–45	1946–48	1949–51
Household ..	2	2	3	6	4	8	7
Medicinal ..	1	3	3	3	5	9	14
Vegetable ..	1	0	0	0	0	1	1
Total ..	4	5	6	9	9	18	22

The figures are small and take no account of out-patients, but they do show the general rising trend and the recent medicinal preponderance, although the latter was not clearly seen until 1950.

The common poisons at Leith were camphor (10 cases), ammonia (six), bleach (five), disinfectants (four) and petrol (four). The commonest medicinal poisons were aspirin, the opium group and digitalis (three cases of each). Strychnine poisoning occurred once and was due to Easton's tablets; it caused the only death among the 73 cases.

The pattern of individual poisons is rather different from that found in the two hospitals for children. It suggests that the social groups which a hospital serves may help to determine the variety of poisonings seen there. The difference is not gross, but it should receive attention in any future enquiry.