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Accidental poisoning of preschool children from medicinal substances, Australia

Peter O'Connor

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Abstract

Poisoning of children aged 0–4 years (preschoolers) from medicinal substances is very rarely a cause of death in Australia and the total health burden is relatively small. Over the period for which data is available nationally, no significant change in the incidence rate is evident. It is suggested that a high proportion of cases is admitted to hospital for observation following suspected ingestion of a harmful substance, rather than because of evidence of toxic effects. While poisoning from aromatic analgesics, including Paracetamol, are common, they do not rank amongst the agents responsible for more significant health care burden or death. The number of high health burden cases is greatest in Australia for anticoagulant medications, tranquillisers, barbiturates and antipsychotic and neuroepileptic medications. Deaths most commonly occur from the ingestion of cardiovascular drugs. Research elsewhere has suggested that access to these agents often occur in the home of a grandparent. Poisoning by iron supplements is less of a problem in Australia than has been reported overseas. A higher rate of medicinal poisoning was found for preschoolers residing in country areas. The literature on risk factors and prevention is reviewed and reported.

Background

Injury was first recognised as a national health priority area in 1986 (Better Health Commission, 1986). Subsequently, national goals and targets were devised for reducing the incidence and impact of injury on health. One of the indicators of the National Health Priority Areas for Injury Prevention and Control (DHFS, 1998), is the hospital separation rate due to poisoning among children aged 0–4 years (i.e. preschool children). The indicator covers poisoning from medicinal and nonmedicinal substances. A recent report by the AIHW National Injury Surveillance Unit addresses poisoning from nonmedicinal substances in preschoolers (O'Connor, 2000). The present report addresses the parallel issue of poisoning from medicinal substances in preschoolers.

Whilst the NHPA poisoning indicator has been framed in terms of hospital separations, the present report also addresses mortality from medicinal poisoning. The data analysis is limited to the information available to the Research Centre for Injury Studies (RCIS) which consists of:

1. Death data provided by the Australian Bureau of Statistics.
2. Hospital separations data provided by the Australian Institute of Health and Welfare (AIHW).

Hospital emergency department data will not be used as the National Injury Surveillance Unit's Injury Surveillance Information System ceased data collection in 1993. It is likely that there would have been substantial changes in the type, nature and composition of medicinal substances since that time. Moreover, cases resulting in significant acute illness are likely to result in admission. Those not admitted may often attend simply for reassurance.

A review of the international literature on risk factors and prevention was undertaken, the results of which are assimilated into the discussion section of the report. Terms used are defined in a Glossary (Appendix 3).

Methods

Data sources

Deaths data

Deaths data are from the Australian Bureau of Statistics (ABS) mortality unit record data collection, 1979–97.

Case definition

The cause of each death registered in Australia is classified by the ABS according to the International Classification of Diseases (ICD). The 9th revision (ICD-9) has been used for death registrations beginning in 1979 (World Health Organization, 1979). All deaths given an ICD-9 'External Cause' code by the ABS, in the range E850–858 ('Accidental poisoning by drugs, medicaments and biologicals') are included in this analysis.

Data are presented according to the year in which deaths were registered. Nine per cent of deaths registered in 1997 occurred in an earlier year. A similar proportion of deaths which occurred in 1997 will not have been registered until after 1998. Information on these cases is not yet available. State-specific data are presented on the basis of the state or territory in which death was registered. This is normally the one in which death occurred.

Data reliability

The chief question concerns the reliability of information about type of injury death. This depends principally on the information available in coroner's records, and on the reliability of the application of ICD-9 E-codes, generally based on that information. Little empirical information is available. There is considerable potential for factors to do with information recording or coding to affect data in different ways for different states and territories. Hence, apparent differences between jurisdictions should be interpreted with caution. Beginning with 1993 registrations, coding has been centralised at the Brisbane office of the ABS.

Hospital separations data

Data sources

Hospital admission statistics are obtained from the Australian Institute of Health and Welfare (AIHW) National Hospital Morbidity Database (AIHW, 1998a). The Database includes data from public acute and Department of Veterans' Affairs hospitals, and private and psychiatric hospitals.

Case definition

Data in this Report are based on the principal diagnosis, which is defined as the diagnosis to be mostly responsible for the patient's admittance to hospital, as well as the external cause associated with the occurrence of the injury. An external cause (E-code) is recorded whenever a patient has a principal or additional diagnosis of an injury or poisoning.

Principal diagnoses and E-codes are classified according to the Australian Version of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM; World Health Organization, 1995). All hospital separations given an ICD-9-CM Chapter 17 'Injury and Poisoning' code for the principal diagnosis (800–999), and an associated E-code in the range E850–858 ('Accidental poisoning by drugs, medicaments and biologicals'), are included in this report.

Data on patients admitted in any one financial year but discharged in another are included for the year in which they were separated. Records for 1996–97 are for hospital separations in the period 1 July 1996 to 30 June 1997. A record is included for each separation, not for each patient, so patients who separated more than once in the year have more than one record in the database. For incidence estimates, cases transferred from one hospital to another and statistical discharges are excluded, as both are considered to be re-admissions rather than new incident cases. However, for assessment of bed days and average length of stay (ALOS), these cases are included as it is important to assess the total healthcare burden arising from the admission and re-admission of incident cases.

Data reliability

The case selection criteria of the present study are based on the approach recommended in the 1997 NHPA report for estimating incident cases (DHFS, 1998, p.102), which excludes transfers between hospitals and some other modes of separation from hospital. Inclusion of those modes of separation would raise the number of cases by 5%.

Rate calculation

Population based rates are produced using ABS population data obtained from the AIHW.

Incidence rates have been calculated as cases per million of the usual resident population of Australia. ABS population data were used for this purpose. Annual rates were calculated using mid-year population estimates for each year.

All (or nearly all) episodes of hospital inpatient care are counted, so sampling errors do not apply to these data. However, the time periods used to group the cases (i.e. calendar years) are arbitrary. Use of another period (e.g. July to June) could result in different rates.

Time series

Time trends have been presented for deaths for the period 1979–1997 and for hospital separations for the period 1993–94 to 1996–97.

Confidence intervals

Where case numbers are small, the effect of chance variation on rates can be large. Confidence intervals (95%, based on a Poisson assumption about the number of cases in a time period) have been placed around rates, where relevant, as a guide to the size of this variation. Chance variation alone would be expected to lead to a rate outside the interval only once out of 20 occasions. An extreme rate in a single period of enumeration should not be ignored simply because of a wide confidence interval—a time series may show such a rate to be part of a trend.

Urban, Rural & Remote Classification Coding

Population data held by the Australian Institute of Health and Welfare (AIHW) are sourced from the ABS Demography section and are updated, as revised / new estimates become available. All population estimates currently produced by ABS are based on a usual residence concept, i.e. where people usually reside, and are referred to as estimated resident populations (ERPs), with the smallest unit being the Statistical Local Area (SLA).

Because SLA boundary changes are continually occurring, concordance tables are needed to reflect the SLA boundaries used in a particular data series. These concordances are used to convert SLA data to the 7 level urban / rural / remote classification RRMA (formerly RaRA). ABS produces annual revisions of SLA boundaries on 1 July each year as part of the annual Australian Standard Geographic Classification (ASGC).

Hospital separations data available from the AIHW has a data item for place of residence, coded to the RRMA classification (AIHW, 1998b).

The categories are described in the table below.

RRMA Category	Type
M1	Capital cities
M2	Other metropolitan centre
R1	Large rural centre
R2	Small rural centre
R3	Other rural area
Rem1	Remote centre
Rem2	Other remote area

In the present report, for some comparisons, categories M1 and M2 are collectively referred to as city residents, whereas the rest are collectively referred to as country residents.

Results

Incidence of poisoning of preschool children by medicinal substances

Accidental poisoning from medicinal substances is an infrequent cause of death in preschool children. Over the period 1979–1997, the all ages total number of poisoning deaths (medicinal and nonmedicinal) in Australia was 4,538. Sixty of these were aged 0–4 years (1%). In this age group, 33 of the deaths (55%) were due to medicinal substances i.e. an average of less than two cases per year over the period with an annual range of zero to five cases.

In contrast, poisoning of preschool children is a much more substantial problem when defined in terms of hospital separations. Over the period 1993–94 to 1996–97 the total number of new incident cases of poisoning at all ages (medicinal and nonmedicinal), based on hospital separations data, was 53,049, of which 14,071 (27%) were aged 0–4 years. In this age group, 10,175 of the cases (72%) were due to medicinal substances i.e. an average of more than 2,500 cases per year over the period.

Time series trend

Linear regression revealed that there has been no statistically significant change in the death rate from medicinal poisoning in children aged 0–4 years from 1979–1997 (Figure 1).

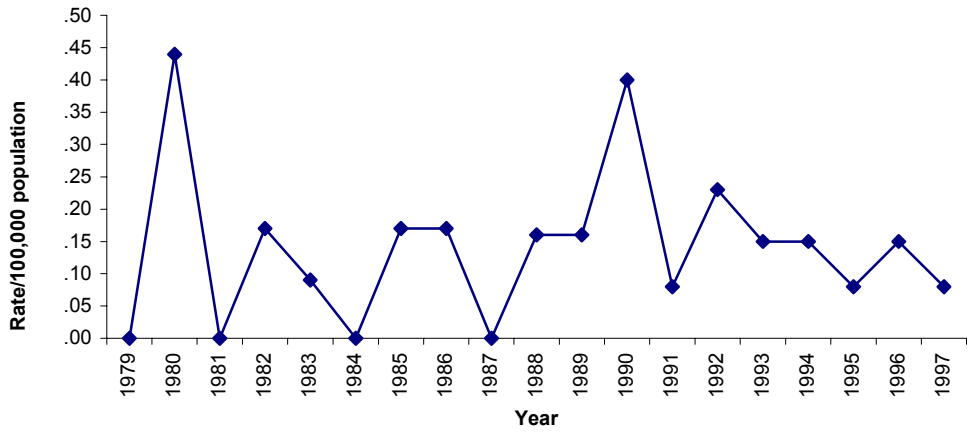

Figure 1: Deaths from medicinal poisoning in children aged 0–4 years, Australia 1979–1997 (crude rate for age)

Figure 2 shows the trend in the incidence of hospitalisation due to poisoning from medicinal substances over the period 1993–94 to 1996–97. The crude rate for the age

group 0–4 years ranged between 184 and 204 cases per hundred thousand of population. No decrease is evident in recent years. However, the time series is too short to enable comment on whether the longer-term trend is static, increasing or decreasing.

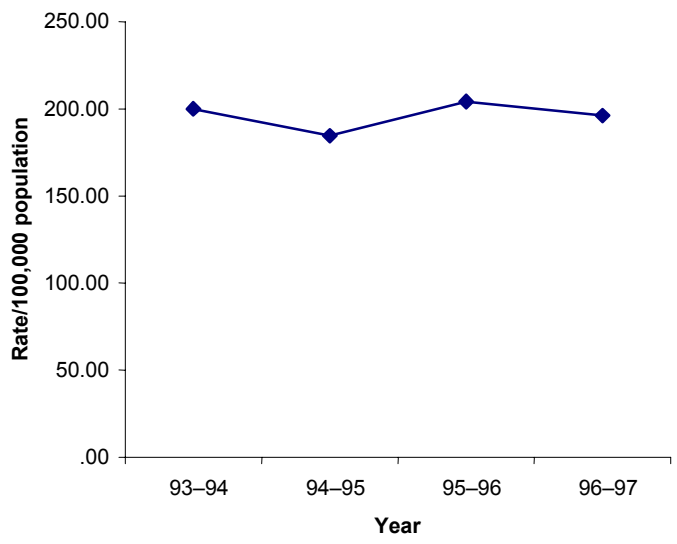

Figure 2: Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data), Australia 1993–94 to 1996–97 (crude rate for age)

Demographic features of cases

Given that the number of deaths is small, the following detailed analysis of demographic features has been restricted to hospital separations data. Contrasting information on fatalities is included where relevant.

Age and sex

The rate of hospitalisation in 1996–97 due to poisoning from medicinal substances peaked in the third year of life (Figure 3). In contrast, poisoning deaths during the period 1979–1997 peaked in the second year of life (46% aged 1 year). Fifty four per cent of the cases admitted to hospital were male, compared with 49% amongst those killed.

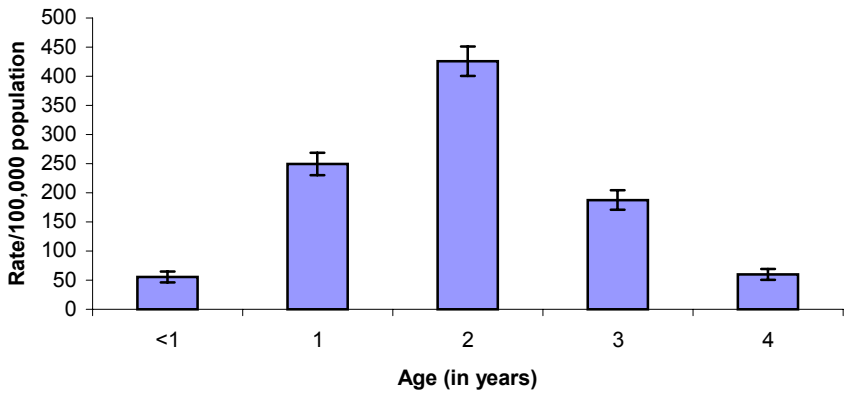

Figure 3: Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by individual year of age, Australia
1996–97 (crude rate for age)

Place of residence

In the hospital morbidity data collection, cases are coded on the basis of place of usual residence (SLA) to a category of the Rural and Remote Areas (RRMA) classification.

Figure 4 shows the rate of medicinal poisoning to preschoolers, based on hospital separations data, by RRMA. The incidence rates were highest in rural and remote areas. The rate for remote centres (Rem1) was significantly higher, statistically, than the rate for all other areas, with the exception of other remote areas (Rem2). The remote centre rate was about 2.7 times higher than the capital city (M1) rate. All of the rural and remote area rates were significantly higher, statistically, than the capital city and other metropolitan centre rates.

Type of place of injury

Most of the poisoning's occurred at home (76%, Table 1). However, for a fifth of cases no place of occurrence was specified. The high level of unspecified cases reduces the utility of data on place of injury.

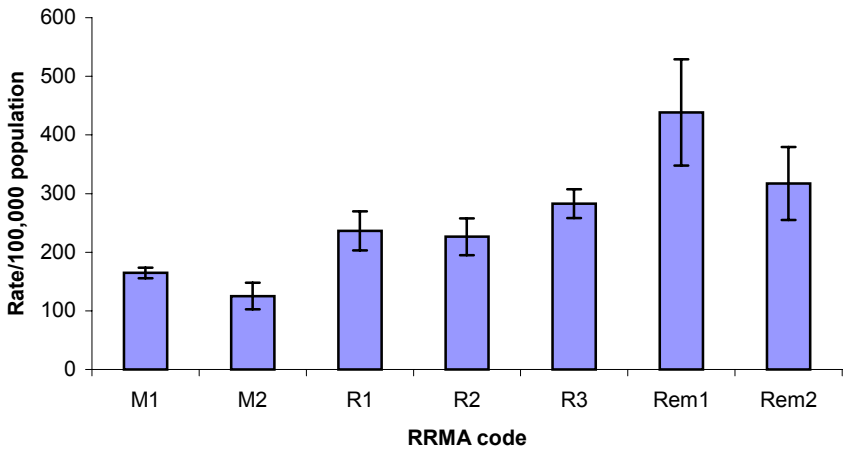

Figure 4: Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by location of residence (RRMA code), Australia 1996–97 (crude rate for age)

Clinical profile

The following analysis is restricted to hospital separations data.

Length of stay in hospital

One measure of the healthcare burden of medicinal poisoning in children aged 0–4 years is the total hospital bed days consumed. However, estimation of this quantity is not straightforward.

The first episode of care of a newly incident case will commence with admission to a hospital. Prior to discharge, the case may be transferred to another hospital. Each hospital only records the number of days that the case spent in their care. To determine the total bed days for an episode of care requires these to be added across hospitals. In addition, as some cases may be readmitted for further episodes of care related to the injury, these must also be added in order to calculate the total burden that arises from the newly incident cases. As there is no case linkage across hospitals in national data, the length of stay cannot be calculated for individual cases. Rather it can only be estimated in aggregate. An estimate of the total burden can be made by adding the length of stay for all separations having the relevant poisoning E-code, which will include separations of newly incident cases as well as readmissions and transfers.

The total bed days for poisoning from medicinal substances in children aged 0–4 years was 1,704 in 1996–97. There were 1,177 same day admissions (i.e. where length of stay was zero). Most of the separations had a very short stay (94% one day or less)—Figure 5.

There was no significant difference, statistically, in the length of stay of residents of capital cities (M1) and remote centres (Rem1).

Table 1: Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by place of occurrence, Australia 1996–97 (case count and percentage)

Place of occurrence	Case count	Per cent
Home	1,940	76
Farm	43	2
Industrial place	2	0
Place recreation/sport	3	0
Street/highway	3	0
Public bldg	5	0
Residential inst	12	0
Other specified	20	1
Not specified	510	20
Missing	2	0
Total	**2,540**	**100**

Procedures

Only 7% (n=168) of estimated new incident cases required a procedure (based on 'Principal Procedure' code). The most common procedures were:

- Nonoperative alimentary tract irrigation, cleaning and local instillation—Gastric lavage (26%, n=43 cases).
- Nonoperative intubation and irrigation—Insertion of other (naso-) gastric tube (20%, n=34 cases).

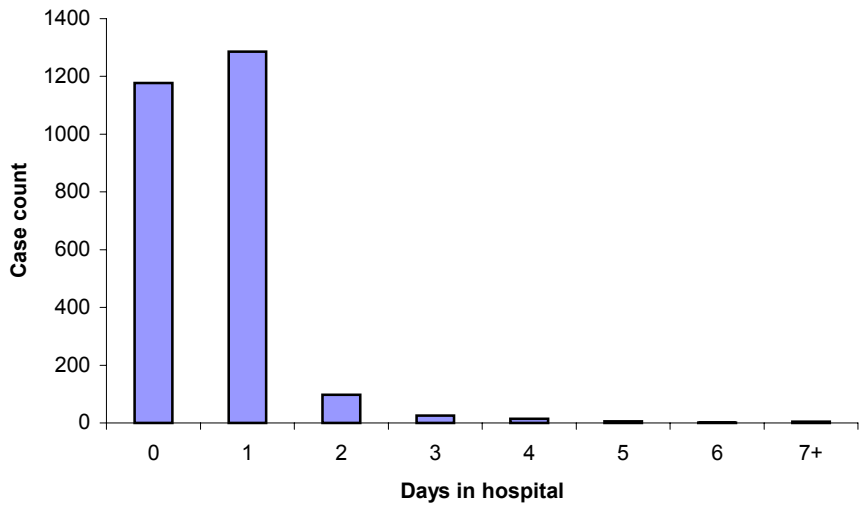

Figure 5: Distribution of bed days for separations due to cases of poisoning from medicinal substances, Australia 1996–97 (separations)

Type of substance

In this section, data on the substance of medicinal poisoning are reported on the basis of the injury and poisoning code of the ICD-9-CM classification, rather than the external cause code, for hospitalisations (principal diagnosis only), and on the basis of external cause for fatalities. The main categories of substance are essentially the same in the two sections of the ICD-9-CM classification, but there is a higher level of detail in the injury and poisoning codes of the types of medicinal substance ingested. The fatality date for 1979–1997 did not include injury and poisoning codes.

Fatalities

The external cause codes do not provide much detail in terms of the substance ingested. Poisoning from cardiovascular drugs were most common (6 cases, Table 2), and all of these deaths occurred prior to 1993. Anti-infective agents and opiates and related narcotics were also common agents in poisoning deaths amongst preschoolers. Between 1979 and 1992 there were no deaths of preschoolers from opiates and related narcotics, whereas since 1993 there has been one death per year from this type of substance. There have been no preschooler deaths from anti-infective agents since 1991.

Hospital separations

The highest proportion of cases were poisoned by 'Analgesics, antipyretics, antirheumatics' (23%). The frequency of poisoning from this group of agents was highest in two year olds (Figure 6).

A more detailed breakdown of the substances involved is presented in Table 3.

'Aromatic analgesics, not elsewhere classified' were one of the most common agents of poisoning in preschoolers. This category of poison includes paracetamol, phenacetin and acetanilide.

Other common agents of poisoning were: antiallergic and antiemetic drugs, expectorants, benzodiazepine-based tranquillisers, other antihypertensive agents, and antidepressants.

The types of poisons which accounted for an average length of stay of greater than one day are listed in Table 4. On the basis of health burden, these agents could be considered to be amongst the more resource intensive medicinal poisoning's.

Table 2: Deaths due to poisoning from medicinal substances in children aged 0–4 years (based on ABS deaths data) by type of substance, Australia (aggregated case count 1979–1997)

Type of substance	E-code	Case count
Opiates and related narcotics	8500	5
Salicylates	8501	1
Barbiturates	8519	1
Chloral hydrate group of drugs	8520	1
Phenothiazine-based tranquillisers	8530	1
Anticonvulsant & anti-Parkinsonism drugs	8550	1
Parasympatholytics	8554	1
Anti-infectives	8579	5
Primarily systemic agents	8581	3
Agents primarily affecting blood constituents	8582	4
Agents primarily affecting cardiovascular system	8583	6
Other drugs	8588	2
Unspecified drugs	8589	2
Total		**33**

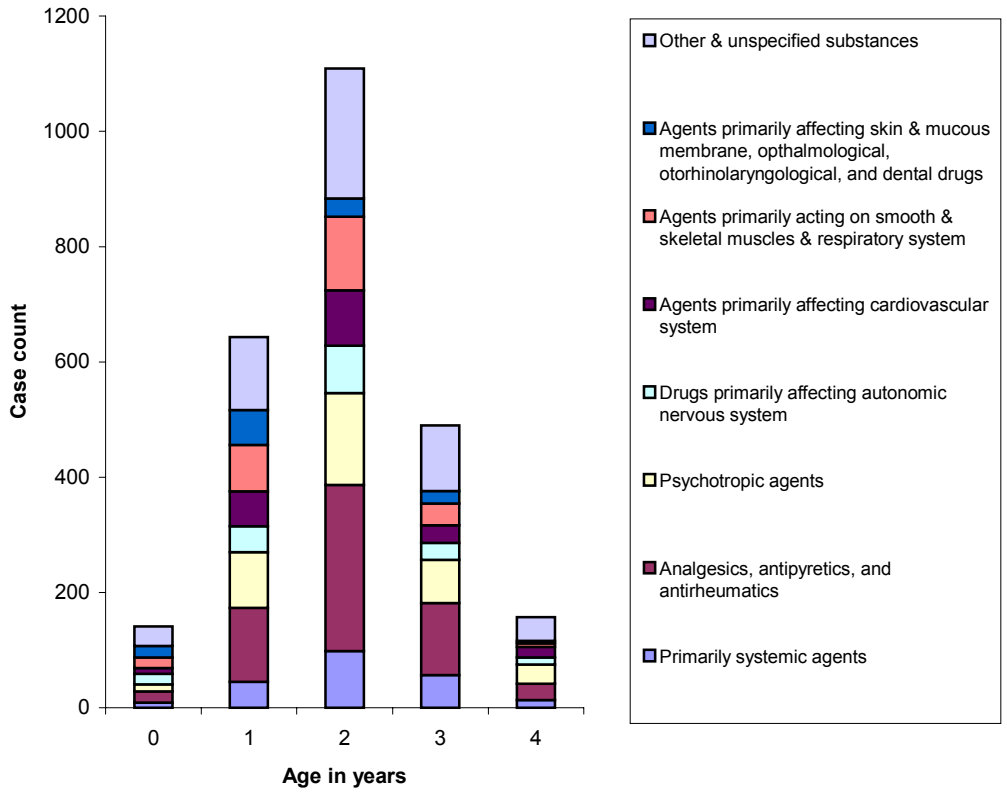

Figure 6: Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by type of substance and age in individual years, Australia 1996–97 (case count)

Table 3: Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by type of substance, Australia 1996–97 (case count)

Substance	External cause code	Case count
Antibiotics		
Penicillins	9600	5
Erythromycin & other macrolides	9603	7
Tetracycline group	9604	4
Cephalosporin group	9605	5
Other specified antibiotics	9608	4
Anti-infectives		
Sulfonamides	9610	1
Antimalarials & drugs acting on other blood protozoa	9614	18
Other antiprotozoal drugs	9615	1
Anthelmintics	9616	10
Other & unspecified anti-infectives	9619	1
Hormones & synthetic substitutes		
Adrenal cortical steroids	9620	3
Androgens & anabolic congeners	9621	1
Ovarian hormones & synthetic substitutes	9622	8
Insulins & antidiabetic agents	9623	36
Posterior pituitary hormones	9625	2
Thyroid & thyroid derivatives	9627	33
Antithyroid agents	9628	3
Primarily systemic agents		
Antiallergic & antiemetic drugs	9630	203
Antieoplastic & immunosuppressive drugs	9631	9
Alkalising agents	9633	2
Vitamins, not elsewhere classified	9635	6
Other specified systemic agents	9638	1
Unspecified systemic agent	9639	1
Agents primarily affecting blood constituents		
Iron & its compounds	9640	37
Liver preparations & other antianaemic agents	9641	2
Anticoagulants	9642	24
Fibrinolysis-affecting drugs	9644	1
Analgesics, antipyretics, and antirheumatics		
Methadone	96502	9
Other opiates & related narcotics	96509	37
Salicylates	9651	15
Aromatic analgesics, not elsewhere classified	9654	429
Antirheumatics	9656	70

continued

Table 3 (continued): Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by type of substance, Australia 1996–97 (case count)

Substance	External cause code	Case count
Other non-narcotic analgesics	9657	5
Other specified analgesics & antipyretics	9658	16
Unspecified analgesic & antipyretic	9659	9
Anti-convulsants & anti-Parkinsonism drugs		
Hydantoin derivatives	9661	3
Other & unspecified anticonvulsants	9663	66
Anti-Parkinsonism drugs	9664	7
Sedatives & hypnotics		
Barbiturates	9670	10
Chloral hydrate group	9671	1
Bromine compounds	9673	1
Other sedatives & hypnotics	9678	46
Unspecified sedative or hypnotic	9679	1
Other central nervous system depressants		
Central nervous system muscle-tone depressants	9680	1
Surface (topical & infiltration anaesthetics)	9685	2
Psychotropic agents		
Antidepressants	9690	111
Phenothiazine-based tranquillisers	9691	51
Butyrophenone-based tranquillisers	9692	18
Other antipsychotics, neuroleptics, and major tranquillisers	9693	16
Benzodiazepine-based tranquillisers	9694	129
Psychodysleptics (hallucinogens)	9696	13
Psychostimulants	9697	34
Other specified psychotropic agents	9698	5
Central nervous system stimulants		
Unspecified central nervous system stimulants	9709	1
Drugs primarily affecting autonomic nervous system		
Parasympathomimetics	9710	11
Parasympatholytics	9711	60
Sympathomimetics	9712	98
Sympatholytics	9713	17
Agents primarily affecting cardiovascular system		
Cardiac rhythm regulators	9720	31
Vardiotonic glycosides & drugs of similar action	9721	17
Antilipemic & antiarteriosclerotic drugs	9722	1
Coronary vasodilators	9724	16
Other vasodilators	9725	1

continued

Table 3 (continued): Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by type of substance, Australia 1996–97 (case count)

Substance	External cause code	Case count
Other antihypertensive agents	9726	122
Other & unspecified agents primarily affecting cardiovascular system	9729	27
Agents primarily affecting gastrointestinal system		
Antacids & antigastric secretion drugs	9730	11
Irritant cathartics	9731	4
Emollient cathartics	9732	1
Other cathartics, including intestinal atonia drugs	9733	10
Digestants	9734	2
Antidiarrhoeal drugs	9735	41
Emetics	9736	1
Other specified agents primarily affecting gastrointenstinal system	9738	13
Unspecified agent primarily affecting gastrointestinal system	9739	2
Water, mineral, and uric acid metabolism drugs		
Purine derivative diuretics	9741	10
Carbonic acid anhydrase inhibitors	9742	1
Other diuretics	9744	16
Electrolytic, caloric, and water balance agents	9745	6
Uric acid metabolism drugs	9747	12
Agents primarily acting on smooth & skeletal muscles & respiratory system		
Oxytocic agents	9750	1
Smooth muscle relaxants	9751	5
Skeletal muscle relaxants	9752	3
Other & unspecified drugs acting on muscles	9753	3
Antiussives	9754	41
Expectorants	9755	180
Anti-common cold drugs	9756	2
Antiasthmatics	9757	27
Other & unspecified respiratory drugs	9758	9
Agents primarily affecting skin & mucous membrane, ophthalmological, otorhinolaryngological, and dental drugs		
Local anti-infectives & anti-inflammatory drugs	9760	55
Antipruritics	9761	40
Local astringents & local detergents	9762	4
Emollients, demulcents, and protectants	9763	10
Keratolytics, keratoplastics, other hair treatment drugs & preparations	9764	14
Eye anti-infectives & other eye drugs	9765	1
Anti-infectives & other drugs & preparations for ear, nose, and throat	9766	3
Dental drugs topically applied	9767	5

continued

Table 3 (continued): Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by type of substance, Australia 1996–97 (case count)

Substance	External cause code	Case count
Other agents primarily affecting skin & mucous membrane	9768	6
Other & unspecified drugs & medicinal substances		
Dietetics	9770	26
Lipotropic drugs	9771	1
Alcohol deterrents	9773	1
Other specified drugs & medicinal substances	9778	9
Unspecified drug or medicinal substances	9779	18
Bacterial vaccines		
Pertussis vaccine, including combinations with pertussis component	9786	1
Other & unspecified bacterial vaccines	9788	1
Other injury and poisoning code (not medicinal)	Assorted codes	9
Total		**2,540**

Table 4: List of poisons accounting for an average length of stay of greater than one day in children aged 0–4 years (based on hospital separations data), Australia 1996–97 (case count).

Poison	Diagnosis code	Average length of stay	n
Emollient cathartics	9732	5.0	1
Alkalising agents	9633	3.0	2
Adrenal cortical steroids	9620	1.7	3
Methadone	96502	1.7	9
Hydantoin derivatives	9661	1.7	3
Butyrophenone-based tranquillisers	9692	1.5	18
Anticoagulants	9642	1.3	24
Uric acid metabolism drugs	9747	1.2	13
Antieoplastic & immunosuppressive drugs	9631	1.2	9
Barbiturates	9670	1.2	10
Other antipsychotics, neuroleptics, and major tranquillisers	9693	1.1	17

Place of residence (city versus country) and type of substance

The incidence rate of medicinal poisoning in preschoolers, based on those admitted to hospital, was significantly higher amongst country[1] residents overall (Figure 7). A more detailed analysis by specific types of poison is presented in Appendix 1, Table A1.1 and in Figures A1.1–A1.16.

[1] Place is defined according to RRMA category. Categories M1 and M2 are collectively referred to as city residents, whereas categories R1, R2, R3, Rem1 and Rem2 are collectively referred to as country residents.

Figure 8 presents incidence rates for those substances for which there was a statistically significant difference in the rates on the basis of place of residence. The difference in rates between city and country residents was strongest for 'aromatic analgesics, not elsewhere specified'.

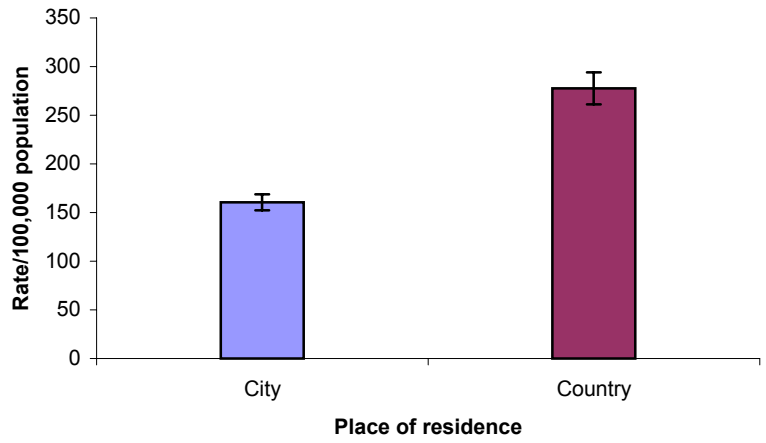

Figure 7: Estimated new incident cases of poisoning from medicinal substances in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

Place of residence (RRMA code)

As the city versus country differences in rates of poisoning were highest for 'aromatic analgesics, not elsewhere specified'; a more detailed breakdown according to RRMA code was undertaken for these substances (Figure 9 and Appendix 2, Table A2.1).

While the rates of the remote areas (Rem1 and Rem2) were higher than the rates for rural areas (R1, R2, R3), which in turn were higher than metropolitan areas (M1 and M2), not all differences were statistically significant. The rates for the remote areas (Rem1 and Rem2), and other rural areas (R3), were significantly higher, statistically, than the rate for other metropolitan centres (M2). The rate for other rural areas (R3) was also significantly higher, statistically, that the rate for not capital cities (M1).

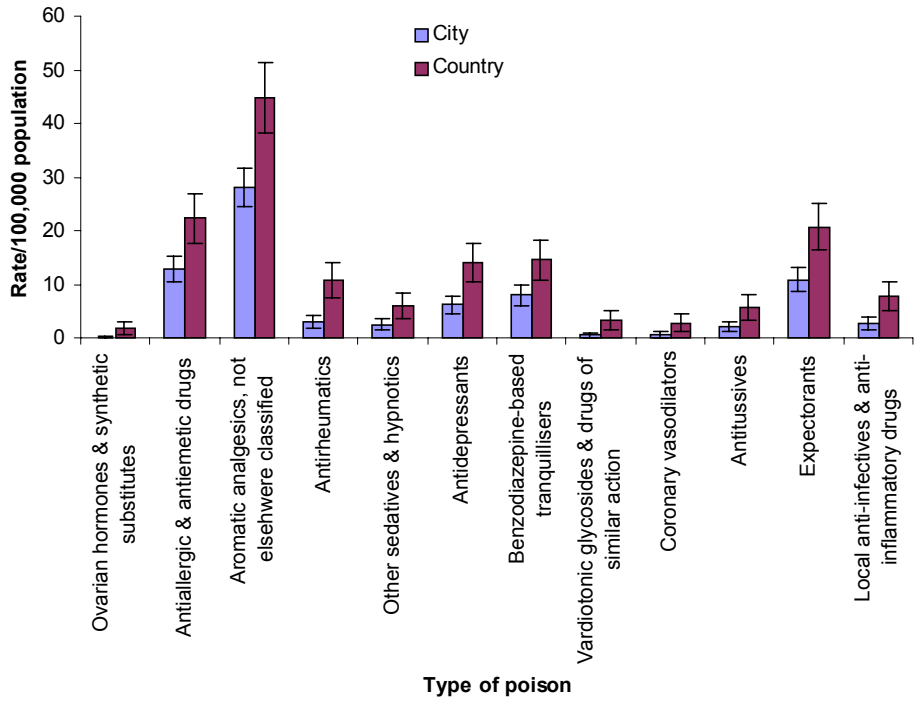

Figure 8: Estimated new incident cases of poisoning in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age). The substances selected are those showing a statistically significant difference in rates by place of residence

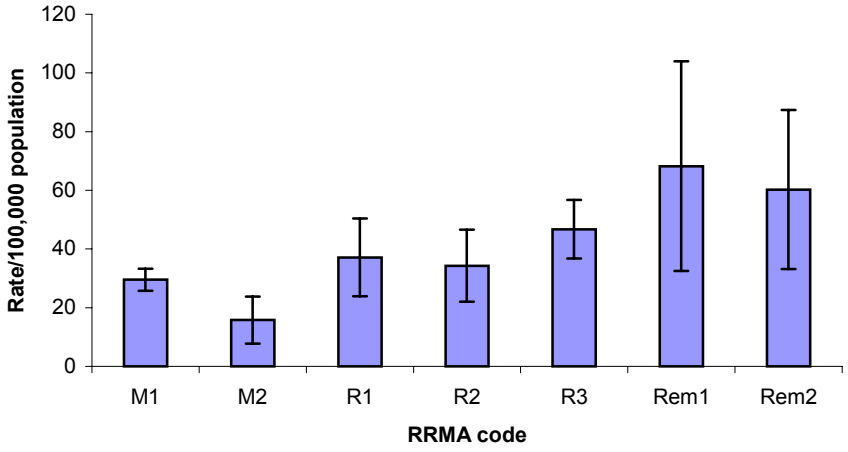

Figure 9: Estimated new incident cases of poisoning by 'aromatic analgesics, not elsewhere specified' in children aged 0–4 years (based on hospital separations data) by place of residence (RRMA code), Australia 1996–97 (crude rate for age)

Discussion

Poisoning of preschool children from medicinal substances is very rarely a cause of death in Australia and the total health burden, based on hospital admissions, is relatively small. Few cases require any surgical or other procedures and length of stay is almost always very short. This suggests that a high proportion of cases is admitted for observation following suspected ingestion of a harmful substance, rather than because of evidence of toxic effects (Moon et al., 1998). A Victorian study found that less than 2% of hospital Emergency Department attendances were due to medicinal poisoning in children aged 0–4 years (VISS, 1989). On the basis of the small current health burden that it represents, it is arguable whether poisoning from medicinal substances warrants inclusion in the NHPA indicators. This does not mean that such events are not important or that they should not be prevented, only that they may not constitute as high a priority as some other injuries for some other age groups. The low severity of medicinal poisoning's could reflect the effectiveness of the legislative controls on the availability of poisons in Australia, a matter that is at the heart of a recent review of drugs, poisons and controlled substances legislation (Galbally, 2000).

There has been no statistically significant increase or decrease in deaths of preschoolers from medicinal substances from 1979–1997. The time series hospitalisation data available nationally is too short to comment on long term trends. However, a study by Hoy et al. (1999) found that the hospitalisation rate did not decrease in Victoria between 1979 and 1991.

In Australia over the period 1979–1997, poisoning deaths in preschoolers from medicinal substances were most commonly caused by cardiovascular drugs. Pearn et al. (1984) have identified these agents as having the highest practical danger of any poisons to which children are exposed (based on case fatality ratio). Research elsewhere has suggested that access to these agents often occurs in the home of a grandparent (Wezorek et al., 1988).

Iron supplements have been identified as the cause of a substantial proportion of preschooler poisoning deaths in North America (Berkovitch et al., 1994; Morris, 2000; Morse et al., 1997). Berkovitch et al. (1994) attribute the substantial increase in the death rate from iron supplements in Canada from 1983–1991 to increased awareness of pregnancy-induced anaemia, abundant use of the substance and presentation of the supplements in a form resembling children's candy. In Australia, over the period 1979–1997, there were only four deaths from 'Agents primarily affecting blood constituents'. These may have been from iron supplements or anticoagulants. It is not known for sure because the external cause coding of deaths does not provide sufficient detail to determine the specific agent. There has not been a preschooler death in Australia from this type of agent since 1990, indicating that even if all preschooler deaths from 'Agents primarily affecting blood constituents' were due to iron supplements, the death rate is exceedingly small and we have largely avoided the epidemic apparent in North America. There were 37 cases of iron poisoning amongst those admitted to hospital in Australia in 1997, constituting only 1.5% of all medicinal poisoning's. Clearly, poisoning from iron supplements is less of a problem in Australia than has been reported overseas. The reasons for this are not clear, but could reflect differences in the packaging and presentation of the agent, or prescribing practices, amongst other things.

The circumstances of preschooler deaths from poisoning by opiates and related narcotics in Australia warrant further investigation even though the numbers are small. The ICD-9 external cause codes do not distinguish whether these poisonings were due to commonly available substances (e.g. codeine), or less commonly available licit, or illicit (e.g. heroin), drugs. Multiple cause coding of deaths by the Australian Bureau of Statistics from 1998 may provide further information on this subject in a future analysis of medicinal poisonings.

The most common agent of poisoning amongst preschoolers admitted to hospital in Australia was the group of aromatic analgesics including paracetamol. Paracetamol has been found to be one of the leading causes of preschooler poisoning overseas (Repetto, 1997; Penna and Buchanan, 1991) and in other Australasian studies (Hoy et al., 1999; Campbell and Oates, 1992; Syron, 1994). However, death and hepatotoxicity in young children from paracetamol poisoning is very rare (Fraser, 1980; Penna and Buchanan, 1991; Proudfoot, 1985). Penna and Buchanan (1991) have suggested that young children may be less prone to paracetamol hepatotoxicity because of developmental differences in the drug's metabolism and its pathways of detoxification. Paracetamol does not rank amongst the agents responsible for more significant health care burden (i.e. requiring admission for greater than one day), or death, in young children in Australia or overseas (Fraser, 1980; Penna and Buchanan, 1991). It is more significant, in terms of death and health care burden, amongst older children and teenagers. The number of high health burden cases was greatest, for young children in Australia, due to poisoning by anticoagulant medications, tranquillisers, barbiturates and antipsychotic and neuroepileptic medications.

A high proportion of those admitted to hospital for poisoning by medicinal substances were in their third year of life and the majority were poisoned at home. The older modal age of preschoolers poisoned by medicinal compared with nonmedicinal substances (O'Connor, 2000; Gillam et al., 1995), reflects in part the relative inaccessibility of medicinal substances. It has been shown that children have easier access to nonmedicinal substances, as they are commonly located at ground level in the home (O'Connor, 1978; Rogmans, 1985). As children age, their ability to climb and access poisons above ground level increases. Storage of medicinal substances above ground level is not a sufficient safety measure to prevent access by many children aged 2 years.

Medicinal poisoning hospitalisation rates were highest for preschoolers resident in rural and remote areas. The remote centre rate was about 2.7 times higher than the capital city rate. There was no significant difference, statistically, in the length of stay of residents of capital cities and remote centres. This result does not support the suggestion that the difference in the poisoning incidence rates of residents of these areas reflects a tendency for hospitals to be more likely to admit residents of remote areas due to the relatively greater distances that they must travel. The most substantial difference between country and city preschoolers poisoning rates was found for aromatic analgesics including paracetamol.

Risk factors

A literature review revealed the following risk factors for poisoning:

a) type of packaging (Chan, 1998; Petridou et al., 1996; Marchi et al., 1994);

b) storage and accessibility of poisons (Petridou et al., 1997, 1996; Rogmans, 1985);

c) decanting / switching of poisons to less safe packaging (Petridou et al., 1997);

d) disposal of medication after use (Petridou et al., 1996);

e) previous history of poisoning (Petridou et al., 1996);

f) mother aged less than 25 years (Beautrais et al., 1981; Azizi, et al., 1993);

g) maternal depression (McLennan and Kotelchuck, 2000);

h) mother reported a large number of problems with the child (Christen H et al., 1981; Deeths and Breedon, 1971), including behaviour problems (Brayden et al., 1993);

i) single parent family (Beautrais et al., 1981; Christen et al., 1981; Deeths and Breedon, 1971; Petridou et al., 1996);

j) education level and literacy of parent (Chan, 1998), especially as shown in their capacity to read labels (Mrvos et al., 1993);

k) quality of family functioning (Rivara and Aitken, 1998; Rogmans, 1985; Calnan, 1975);

l) family reported a large number of significant life events, including change of residence (Beautrais et al., 1981);

m) mother prescribed / using tranquillisers and / or anti-depressants (Beautrais et al., 1981; Goulding et al., 1978);

n) migrant worker parents (Christen et al., 1981);

o) resident in flats rather than free-standing homes (Nielsen et al., 1990);

p) residing at current residence for less than one year (Azizi et al., 1993);

q) lower social class or socio-economic status (Wiseman et al., 1987; Christen et al., 1981; Rivara and Aitken, 1998);

r) child described by parent as rough, aggressive, daring, active or stubborn (Deeths and Breeden, 1971; Basavaraj and Forster, 1982; Rogmans, 1985);

s) large family i.e. four or more children (Deeths and Breeden, 1971; Basavaraj and Forster, 1982);

t) quality of supervision (Petridou et al., 1997), including supervision by grandparents and care outside the child's own home as risk factors for more serious exposures (Wezorek et al., 1988); and

u) pregnancy as a risk factor for preschooler poisoning by iron tablets (Berkovitch et al., 1994).

Only one study was identified that assessed the extent of exposure to medications (measured in terms of number of agents) as a factor in poisoning of preschoolers. It was not found to be a risk factor (Rogmans, 1985).

Prevention

Most of the emphasis in the literature on the primary prevention of medicinal poisoning in preschoolers focuses on child resistant packing. The effectiveness of child resistant closures, strip and blister packaging, in preventing poisoning of preschoolers has been shown in a number of studies (Scherz, 1970; Sibert et al., 1977; Clark and Walton, 1979; Walton, 1982; Jackson, 1985; Wiseman et al., 1987; Rodgers, 1996). However, they are not 'silver bullets' for the prevention of all preschooler medicinal poisoning's. A number of authors have noted that 'child resistant' does not mean 'child proof' (Walton, 1982; Wiseman et al., 1987; Lovejoy et al., 1994). Lembersky et al. (1996) found that 20% of children attending hospital for poisoning accessed the agent by opening a properly closed child resistant closure. Morris (2000) found that children overdosed with iron obtained the substance by opening a Child

Resistant Closure (CRC) themselves, or from a CRC opened by another child or left unopened, or improperly closed, by an adult. These results suggest that safer packaging does not end the need for safe storage of poisons and adequate supervision of young children at risk from poisoning. There is no evidence that labelling deters young children (Lovejoy et al., 1994; Fergusson et al., 1982). A study evaluating 'Mr Yuk' stickers found that children were attracted to such labelled containers rather than repelled by them (Venberg et al., 1984). Bittering agents have also not been proven to deter young children (Rodgers and Tenenbein, 1994).

Poisons Information Centres (PIC) are the principal secondary prevention measure in Australia and in many other countries. In addition to providing poisons information over the phone, and advice on actions following exposures, the Centres are involved in public education programs. A significant measure in the past has been the recommendation that parents purchase Syrup of Ipecac, so that in the event of poisoning they can, on advice from the Centre, administer the agent at home. In the USA, between 50% and 70% of suburban homes and between 25% and 40% of city homes serviced by a PIC had Syrup of Ipecac available in the home (Marcus et al., 1984; Amatai et al., 1987). No comparative data is available for Australia. The availability of Syrup of Ipecac in the home, and home use on recommendation of a PIC, has not been found to decrease patient safety (Bond, 1995; Chaffee-Bahamon and Lovejoy, 1983), but reduces heath care costs (King and Palmisano, 1991). Recently however, the use of Syrup of Ipecac has undergone a rigorous re-evaluation, with many toxicologists discouraging its use in any circumstance, even for prompt decontamination of acute childhood poisonings for which emesis is not contraindicated (Quang and Woolf, 2000; Shannon, 2000). The American Academy of Clinical Toxicology (1997) had this to say about the use of the substance:

> Syrup of Ipecac should not be administered routinely in the management of poisoned patients. In experimental studies the amount of marker removed by Ipecac was highly variable and diminished with time. There is no evidence from clinical studies that Ipecac improves the outcome of poisoned patients and its routine administration in the emergency department should be abandoned. There are insufficient data to support or exclude Ipecac administration soon after poison ingestion. Ipecac may delay the administration or reduce the effectiveness of activated charcoal, oral antidotes, and whole bowel irrigation.

Home use of activated charcoal has been discussed (Nordt, 1999).

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Appendix 1

Table A1.1: City versus country rates (estimated new incident cases, based on hospital separations data, Australia 1996–97)

Substance	Diagnosis code	City				Country				Total
		n	Rate	CI+	CI-	n	Rate	CI+	CI-	
Penicillins	9600	0	0.00	0.00	0.00	5	1.25	2.34	0.15	5
Erythromycin & other macrolides	9603	5	0.56	1.05	0.07	2	0.50	1.19	-0.19	7
Tetracycline group	9604	2	0.22	0.54	-0.09	2	0.50	1.19	-0.19	4
Cephalosporin group	9605	4	0.45	0.89	0.01	1	0.25	0.74	-0.24	5
Other specified antibiotics	9608	2	0.22	0.54	-0.09	2	0.50	1.19	-0.19	4
Sulfonamides	9610	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Antimalarials & drugs acting on other blood protozoa	9614	9	1.01	1.67	0.35	9	2.25	3.72	0.78	18
Other antiprotozoal drugs	9615	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Anthelmintics	9616	4	0.45	0.89	0.01	6	1.50	2.70	0.30	10
Other & unspecified anti-infectives	9619	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Adrenal cortical steroids	9620	3	0.34	0.72	-0.04	0	0.00	0.00	0.00	3
Androgens & anabolic congeners	9621	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Ovarian hormones & synthetic substitutes	9622	1	0.11	0.33	-0.11	7	1.75	3.05	0.45	8
Insulins & antidiabetic agents	9623	23	2.58	3.64	1.53	13	3.25	5.01	1.48	36
Posterior pituitary hormones	9625	2	0.22	0.54	-0.09	0	0.00	0.00	0.00	2
Thyroid & thyroid derivatives	9627	22	2.47	3.50	1.44	11	2.75	4.37	1.12	33
Antithyroid agents	9628	1	0.11	0.33	-0.11	2	0.50	1.19	-0.19	3
Antiallergic & antiemetic grugs	9630	114	12.80	15.15	10.45	89	22.24	26.86	17.62	203
Antieoplastic & immunosuppressive drugs	9631	5	0.56	1.05	0.07	4	1.00	1.98	0.02	9
Alkalising agents	9633	1	0.11	0.33	-0.11	1	0.25	0.74	-0.24	2
Vitamins, not elsewhere classified	9635	5	0.56	1.05	0.07	1	0.25	0.74	-0.24	6
Other specified systemic agents	9638	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Unspecified systemic agent	9639	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Iron & its compounds	9640	22	2.47	3.50	1.44	15	3.75	5.65	1.85	37
Liver preparations & other antianaemic agents	9641	2	0.22	0.54	-0.09	0	0.00	0.00	0.00	2

continued

Table A1.1 (continued): City versus country rates (estimated new incident cases, based on hospital separations data, Australia 1996–97)

Substance	Diagnosis code	City				Country				Total
		n	Rate	CI+	CI-	n	Rate	CI+	CI-	
Anticoagulants	9642	11	1.24	1.97	0.51	13	3.25	5.01	1.48	24
Fibrinolysis-affecting drugs	9644	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Methadone	96502	8	0.90	1.52	0.28	1	0.25	0.74	-0.24	9
Other opiates & related narcotics	96509	21	2.36	3.37	1.35	16	4.00	5.96	2.04	37
Salicylates	9651	9	1.01	1.67	0.35	6	1.50	2.70	0.30	15
Aromatic analgesics, not elsewhere classified	9654	250	28.08	31.56	24.60	179	44.73	51.29	38.18	429
Antirheumatics	9656	27	3.03	4.18	1.89	43	10.75	13.96	7.53	70
Other non-narcotic analgesics	9657	5	0.56	1.05	0.07	0	0.00	0.00	0.00	5
Other specified analgesics & antipyretics	9658	10	1.12	1.82	0.43	6	1.50	2.70	0.30	16
Unspecified analgesic & antipyretic	9659	2	0.22	0.54	-0.09	7	1.75	3.05	0.45	9
Hydantoin derivatives	9661	1	0.11	0.33	-0.11	2	0.50	1.19	-0.19	3
Other & unspecified anticonvulsants	9663	38	4.27	5.62	2.91	28	7.00	9.59	4.41	66
Anti-Parkinsonism drugs	9664	3	0.34	0.72	-0.04	4	1.00	1.98	0.02	7
Barbiturates	9670	5	0.56	1.05	0.07	5	1.25	2.34	0.15	10
Chloral hydrate group	9671	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Bromine compounds	9673	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Other sedatives & hypnotics	9678	22	2.47	3.50	1.44	24	6.00	8.40	3.60	46
Unspecified sedative or hypnotic	9679	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Central nervous system muscle-tone depressants	9680	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Surface (topical0 & infiltration anaesthetics	9685	1	0.11	0.33	-0.11	1	0.25	0.74	-0.24	2
Antidepressants	9690	55	6.18	7.81	4.54	56	13.99	17.66	10.33	111
Phenothiazine-based tranquillisers	9691	35	3.93	5.23	2.63	16	4.00	5.96	2.04	51
Butyrophenone-based tranquillisers	9692	11	1.24	1.97	0.51	7	1.75	3.05	0.45	18
Other antipsychotics, neuroleptics, and major tranquillisers	9693	11	1.24	1.97	0.51	5	1.25	2.34	0.15	16
Benzodiazepine-based tranquillisers	9694	71	7.97	9.83	6.12	58	14.49	18.23	10.76	129
Psychodysleptics (hallucinogens)	9696	10	1.12	1.82	0.43	3	0.75	1.60	-0.10	13

continued

Table A1.1 (continued): City versus country rates (estimated new incident cases, based on hospital separations data, Australia 1996–97)

Substance	Diagnosis code	City				Country				Total
		n	Rate	CI+	CI-	n	Rate	CI+	CI-	
Psychostimulants	9697	20	2.25	3.23	1.26	14	3.50	5.33	1.67	34
Other specified psychotropic agents	9698	3	0.34	0.72	-0.04	2	0.50	1.19	-0.19	5
Unspecified central nervous system stimulants	9709	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Parasympathomimetics	9710	7	0.79	1.37	0.20	4	1.00	1.98	0.02	11
Parasympatholytics	9711	38	4.27	5.62	2.91	22	5.50	7.80	3.20	60
sympathomimetics	9712	66	7.41	9.20	5.62	32	8.00	10.77	5.23	98
Sympatholytics	9713	13	1.46	2.25	0.67	4	1.00	1.98	0.02	17
Cardiac rhythm regulators	9720	16	1.80	2.68	0.92	15	3.75	5.65	1.85	31
Vardiotonic glycosides & drugs of similar action	9721	4	0.45	0.89	0.01	13	3.25	5.01	1.48	17
Antilipemic & antiarteriosclerotic drugs	9722	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Coronary vasodilators	9724	5	0.56	1.05	0.07	11	2.75	4.37	1.12	16
Other vasodilators	9725	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Other antihypertensive agents	9726	74	8.31	10.20	6.42	48	12.00	15.39	8.60	122
Other & unspecified agents primarily affecting cardiovascular system	9729	18	2.02	2.96	1.09	9	2.25	3.72	0.78	27
Antacids & antigastric secretion drugs	9730	8	0.90	1.52	0.28	3	0.75	1.60	-0.10	11
Irritant cathartics	9731	1	0.11	0.33	-0.11	3	0.75	1.60	-0.10	4
Emollient cathartics	9732	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Other cathartics, including intestinal atonia drugs	9733	5	0.56	1.05	0.07	5	1.25	2.34	0.15	10
Digestants	9734	0	0.00	0.00	0.00	2	0.50	1.19	-0.19	2
Antidiarrhoeal drugs	9735	29	3.26	4.44	2.07	12	3.00	4.70	1.30	41
Emetics	9736	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Other specified agents primarily affecting gastrointenstinal system	9738	9	1.01	1.67	0.35	4	1.00	1.98	0.02	13
Unspecified agent primarily affecting gastrointestinal system	9739	1	0.11	0.33	-0.11	1	0.25	0.74	-0.24	2
Purine derivative diuretics	9741	8	0.90	1.52	0.28	2	0.50	1.19	-0.19	10
Carbonic acid anhydrase inhibitors	9742	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1

continued

Table A1.1 (continued): City versus country rates (estimated new incident cases, based on hospital separations data, Australia 1996–97)

Substance	Diagnosis code	City				Country				Total
		n	Rate	CI+	CI-	n	Rate	CI+	CI-	
Other diuretics	9744	6	0.67	1.21	0.13	10	2.50	4.05	0.95	16
Electrolytic, caloric, and water balance agents	9745	6	0.67	1.21	0.13	0	0.00	0.00	0.00	6
Uric acid metabolism drugs	9747	7	0.79	1.37	0.20	5	1.25	2.34	0.15	12
Oxytocic agents	9750	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Smooth muscle relaxants	9751	5	0.56	1.05	0.07	0	0.00	0.00	0.00	5
Skeletal muscle relaxants	9752	1	0.11	0.33	-0.11	2	0.50	1.19	-0.19	3
Other & unspecified drugs acting on muscles	9753	2	0.22	0.54	-0.09	1	0.25	0.74	-0.24	3
Antiussives	9754	18	2.02	2.96	1.09	23	5.75	8.10	3.40	41
Expectorants	9755	97	10.89	13.06	8.73	83	20.74	25.20	16.28	180
Anti-common cold drugs	9756	1	0.11	0.33	-0.11	1	0.25	0.74	-0.24	2
Antiasthmatics	9757	15	1.68	2.54	0.83	12	3.00	4.70	1.30	27
Other & unspecified respiratory drugs	9758	2	0.22	0.54	-0.09	7	1.75	3.05	0.45	9
Local anti-infectives & anti-inflammatory drugs	9760	24	2.70	3.77	1.62	31	7.75	10.47	5.02	55
Antipruritics	9761	20	2.25	3.23	1.26	20	5.00	7.19	2.81	40
Local astringents & local detergents	9762	2	0.22	0.54	-0.09	2	0.50	1.19	-0.19	4
Emollients, demulcents, and protectants	9763	4	0.45	0.89	0.01	6	1.50	2.70	0.30	10
Keratolytics, keratoplastics, other hair treatment drugs & preparations	9764	9	1.01	1.67	0.35	5	1.25	2.34	0.15	14
Eye anti-infectives & other eye drugs	9765	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Anti-infectives & other drugs & preparations for ear, nose, and throat	9766	0	0.00	0.00	0.00	3	0.75	1.60	-0.10	3
Dental drugs topically applied	9767	4	0.45	0.89	0.01	1	0.25	0.74	-0.24	5
Other agents primarily affecting skin & mucous membrane	9768	4	0.45	0.89	0.01	2	0.50	1.19	-0.19	6
Dietetics	9770	16	1.80	2.68	0.92	10	2.50	4.05	0.95	26
Lipotropic drugs	9771	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1
Alcohol deterrents	9773	0	0.00	0.00	0.00	1	0.25	0.74	-0.24	1

continued

Table A1.1 (continued): City versus country rates (estimated new incident cases, based on hospital separations data, Australia 1996–97).

Substance	Diagnosis code	City				Country				Total
		n	Rate	CI+	CI-	n	Rate	CI+	CI-	
Other specified drugs & medicinal substances	9778	6	0.67	1.21	0.13	3	0.75	1.60	-0.10	9
Unspecified drug or medicinal substances	9779	9	1.01	1.67	0.35	9	2.25	3.72	0.78	18
Pertussis vaccine, including combinations with pertussis component	9786	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Other & unspecified bacterial vaccines	9788	1	0.11	0.33	-0.11	0	0.00	0.00	0.00	1
Other injury and poisoning code (not medicinal)	Other	3	0.34	0.72	-0.04	6	1.50	2.70	0.30	9
Total		**1,429**	**160.50**	**168.82**	**152.17**	**1,111**	**277.65**	**293.98**	**261.32**	**2,540**

Notes:

1. City population based on RRMA areas M1 plus M2 is 890370.

2. Country population based on RRMA areas R1, R2, R3, Rem1 plus Rem2 is 400146.

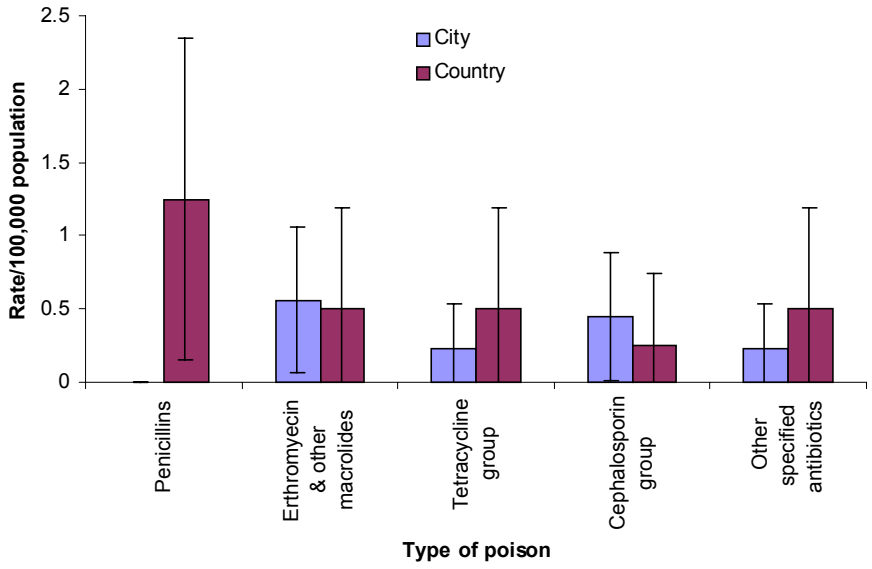

Figure A1.1: Estimated new incident cases of poisoning by 'antibiotics' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

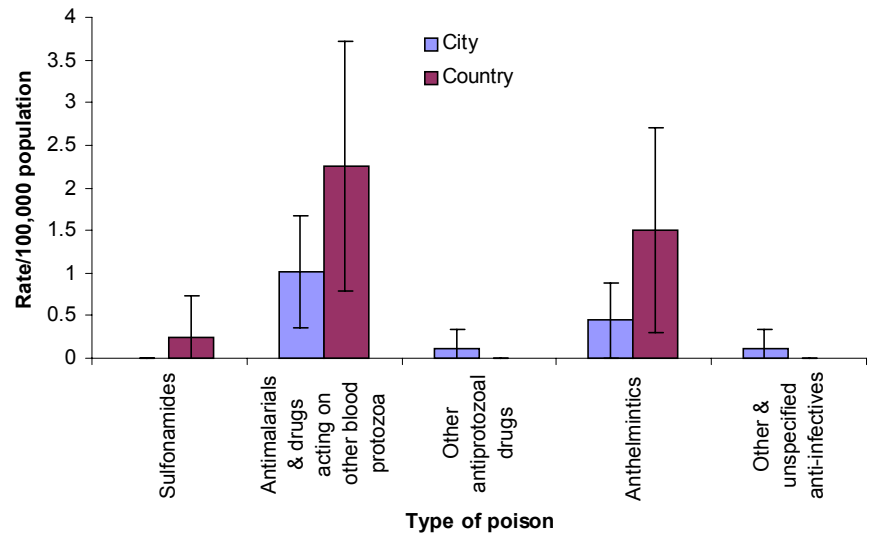

Figure A1.2: Estimated new incident cases of poisoning by 'anti-infectives' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

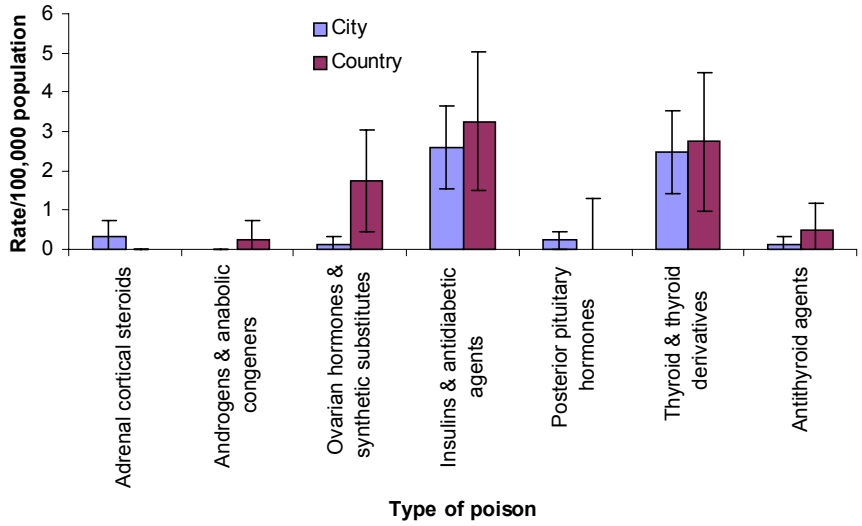

Figure A1.3: Estimated new incident cases of poisoning by 'hormones and synthetic substitutes' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

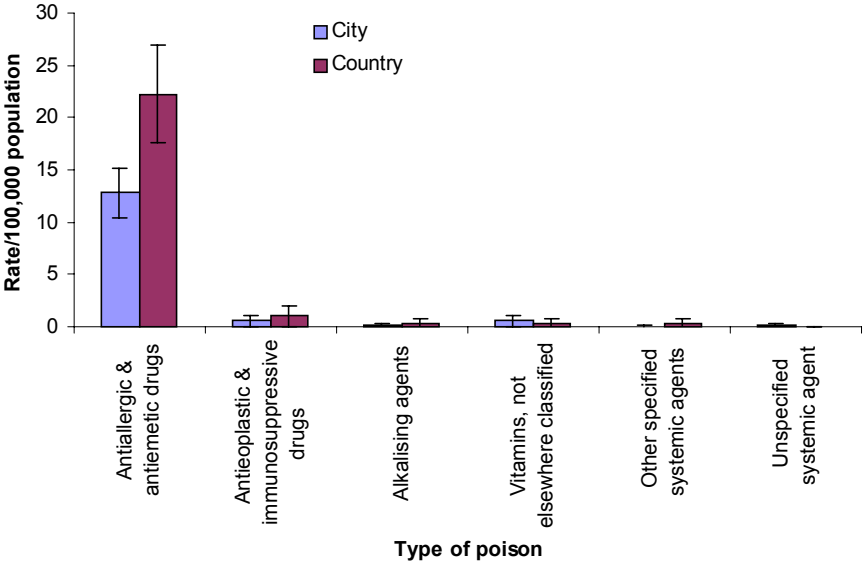

Figure A1.4: Estimated new incident cases of poisoning by 'primarily systemic agents' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

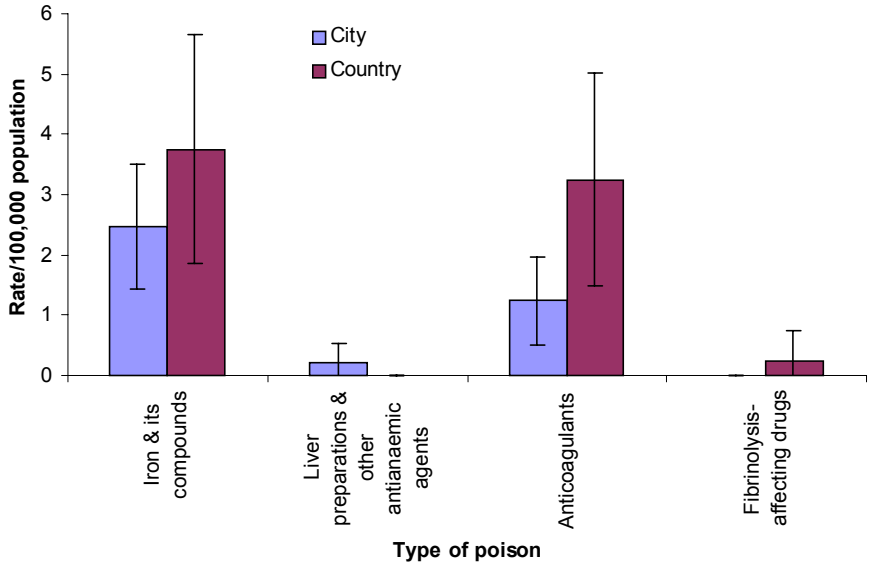

Figure A1.5: Estimated new incident cases of poisoning by 'agents primarily affecting blood constituents' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

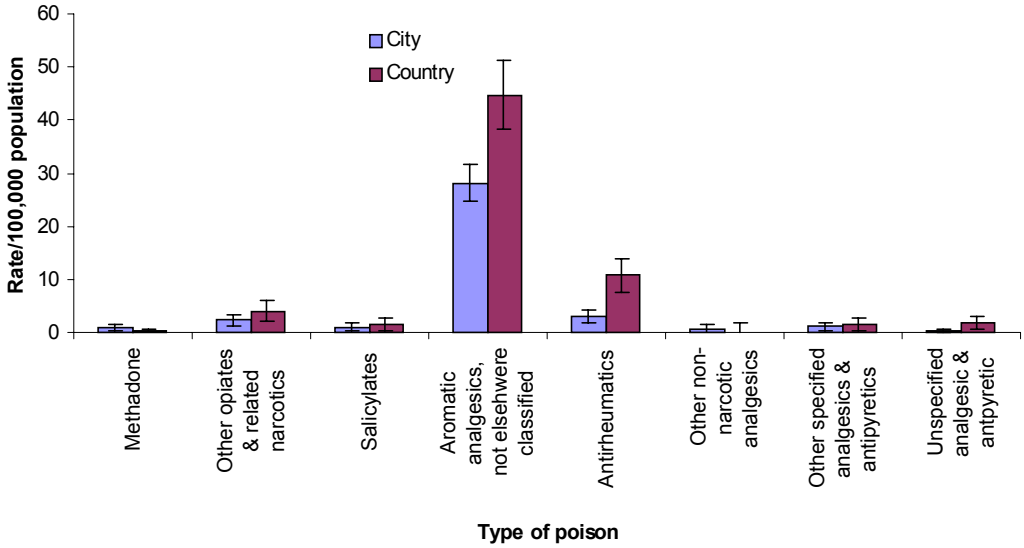

Figure A1.6: Estimated new incident cases of poisoning by 'analgesics, antipyretics and antirheumatics' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

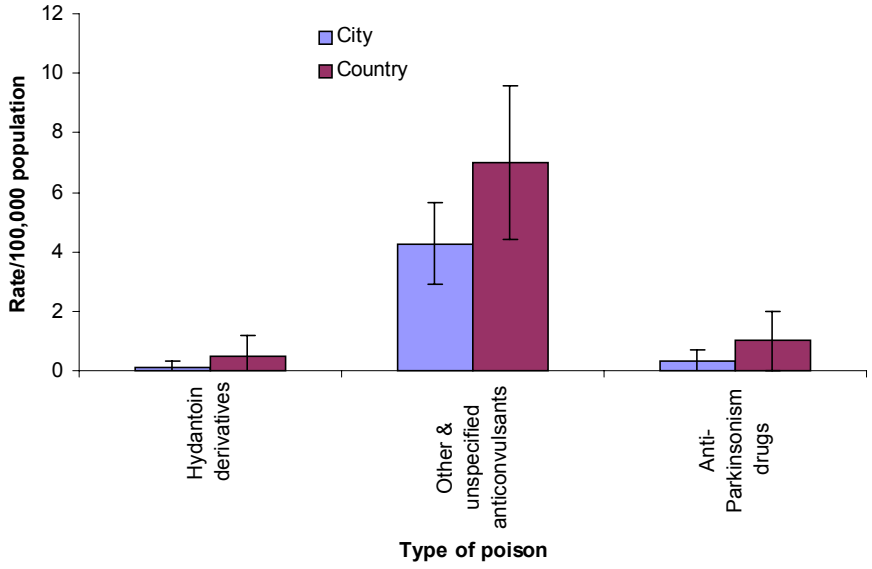

Figure A1.7: Estimated new incident cases of poisoning by 'anti-convulsants and anti-Parkinsonism drugs' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

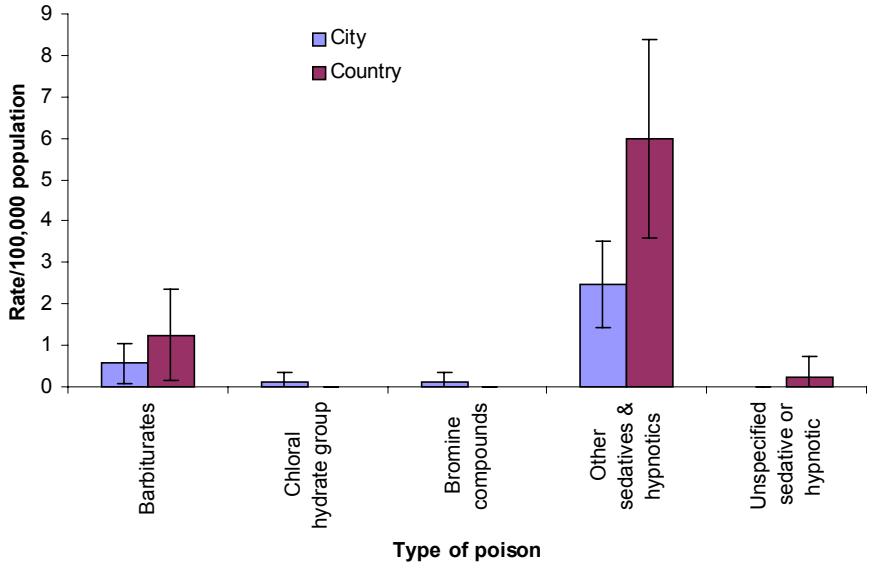

Figure A1.8: Estimated new incident cases of poisoning by 'sedatives and hypnotics' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

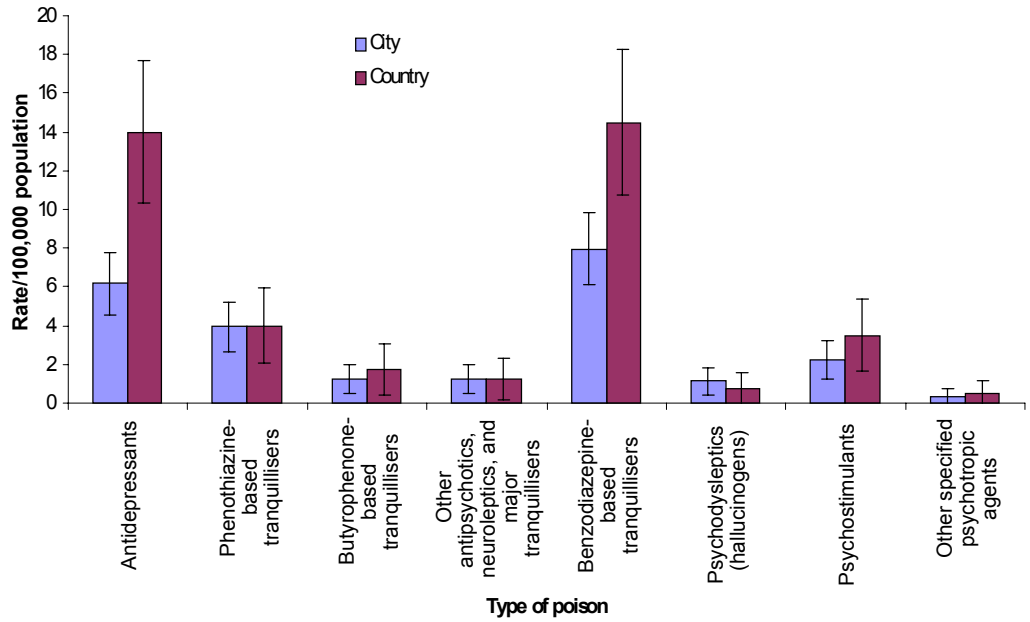

Figure A1.9: Estimated new incident cases of poisoning by 'psychotropic agents' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

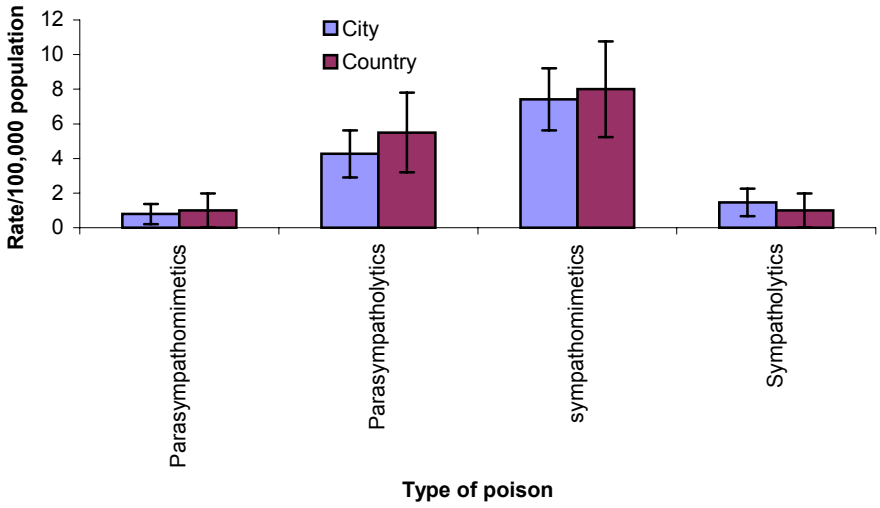

Figure A1.10: Estimated new incident cases of poisoning by 'drugs primarily affecting the autonomic nervous system' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

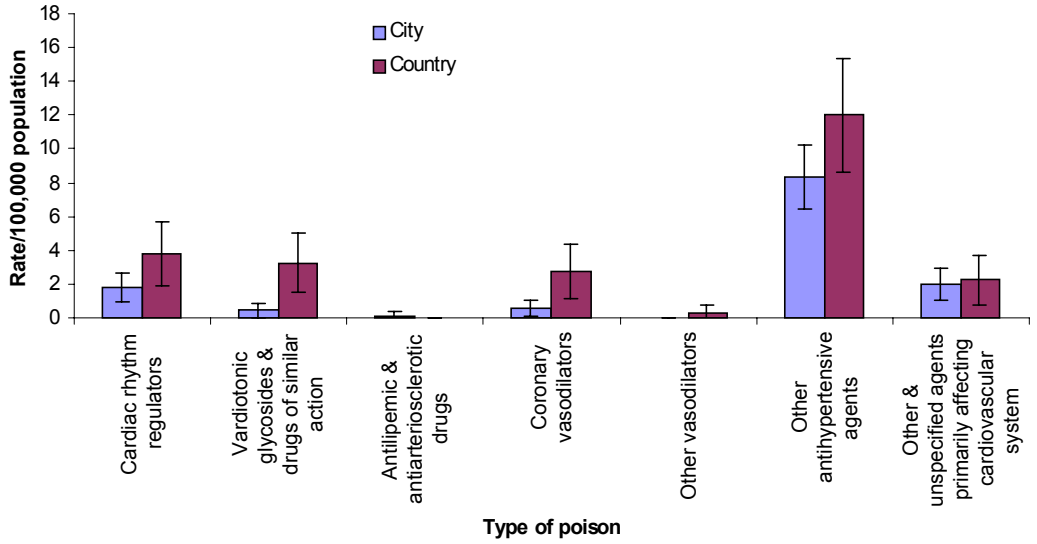

Figure A1.11: Estimated new incident cases of poisoning by 'agents primarily affecting the cardiovascular system' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

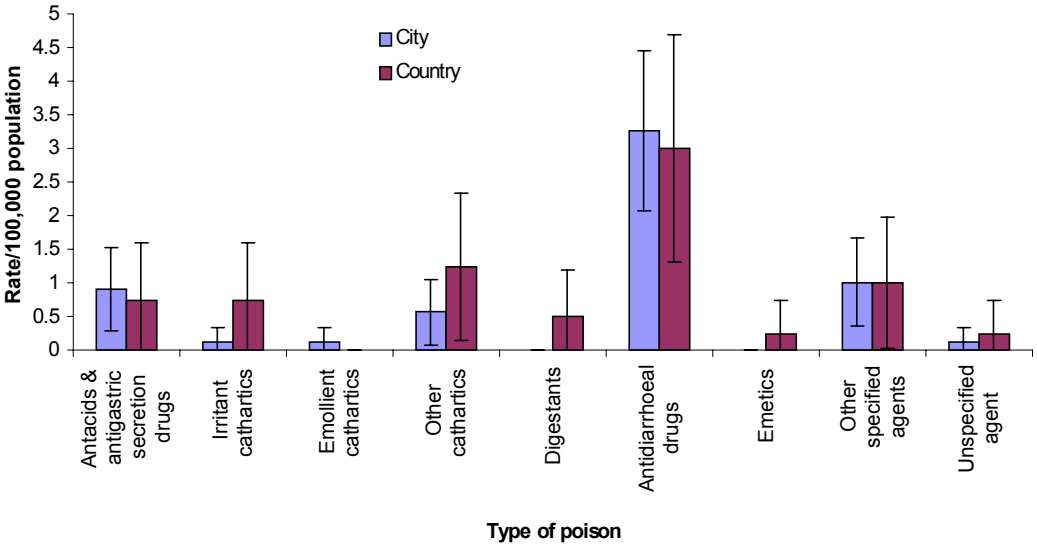

Figure A1.12: Estimated new incident cases of poisoning by 'agents primarily affecting the gastrointestinal system' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

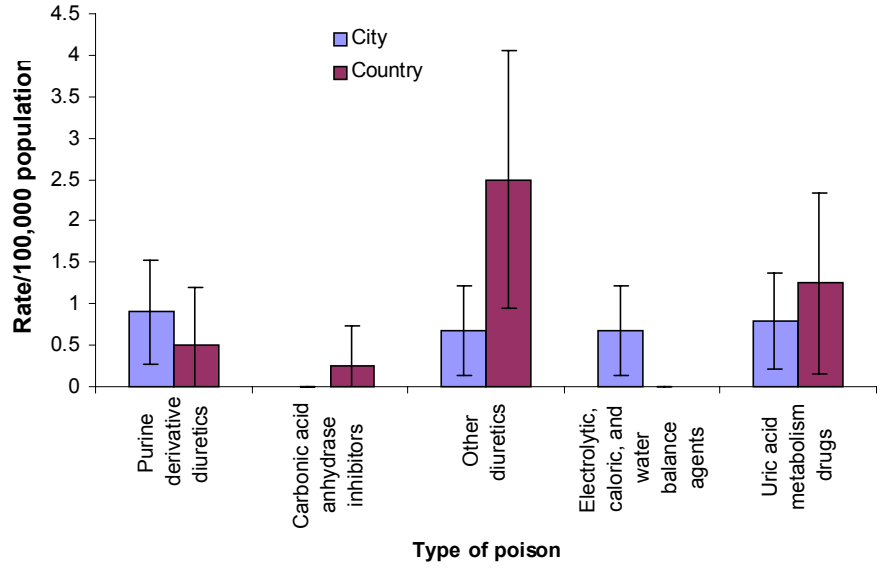

Figure A1.13: Estimated new incident cases of poisoning by 'water, mineral, and uric acid metabolism drugs' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

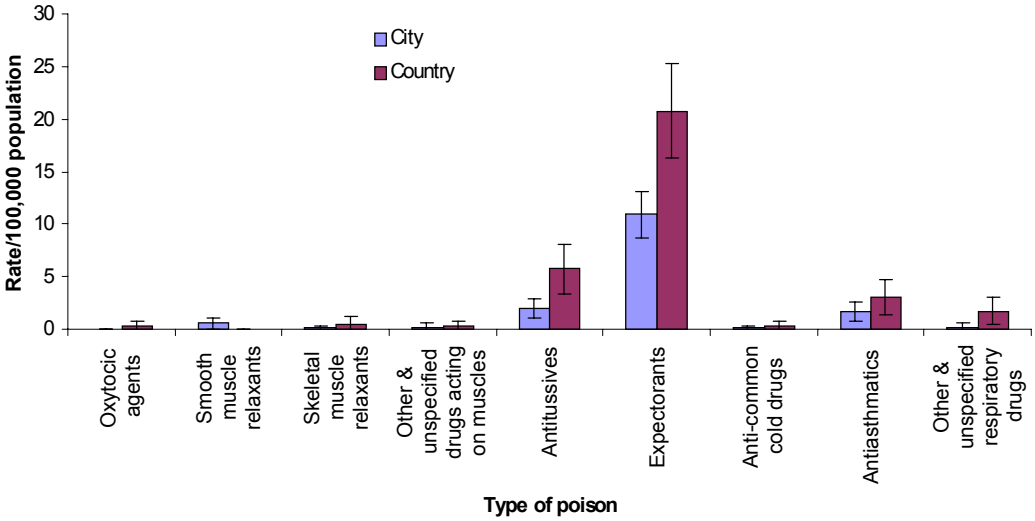

Figure A1.14: Estimated new incident cases of poisoning by 'agents primarily acting on smooth and skeletal muscles and the respiratory system' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

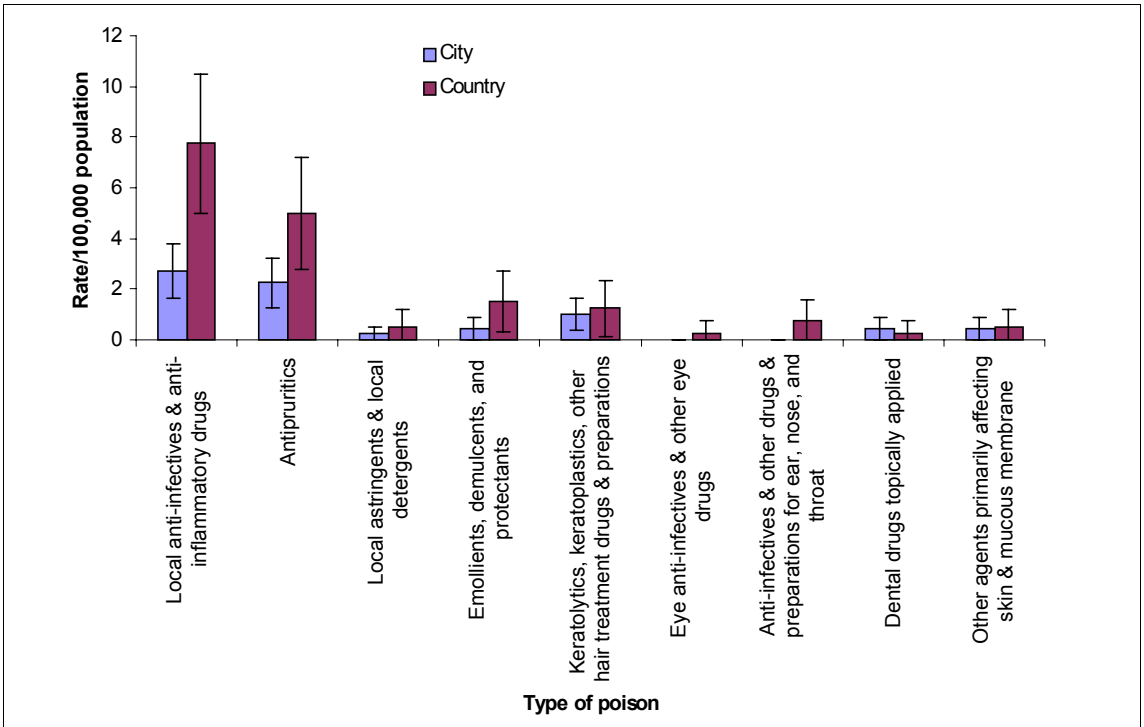

Figure A1.15: Estimated new incident cases of poisoning by 'agents primarily affecting skin and mucous membrane, ophthalmological, otorhinolaryngological, and dental drugs' in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

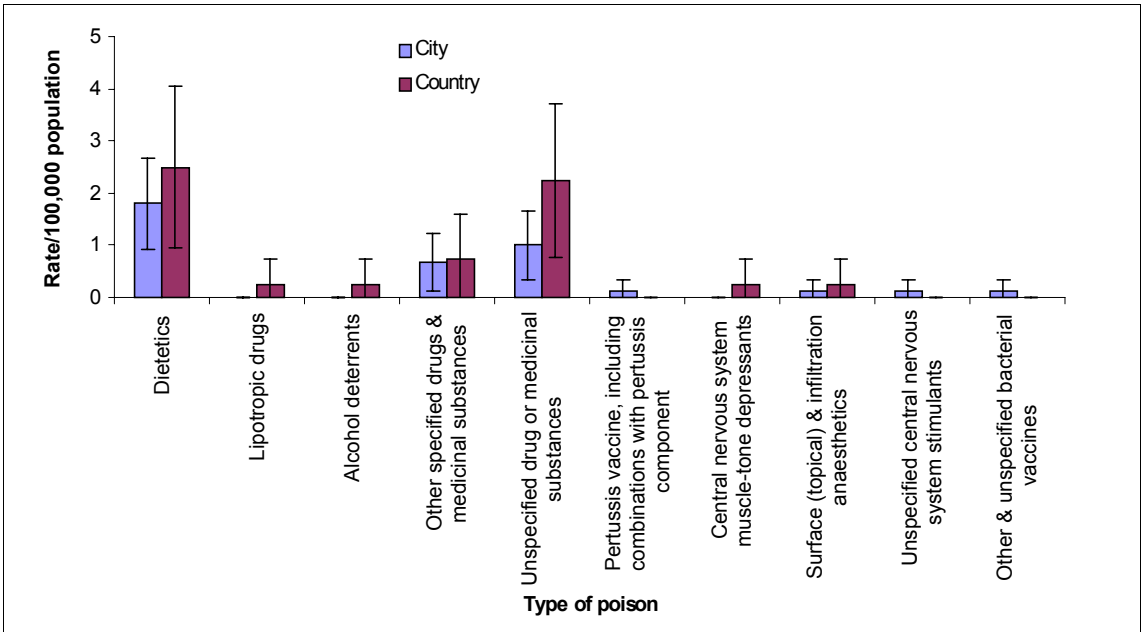

Figure A1.16: Estimated new incident cases of poisoning by miscellaneous agents in children aged 0–4 years (based on hospital separations data) by place of residence (city versus country), Australia 1996–97 (crude rate for age)

Appendix 2

Table A2.1: RRMA rate differences for 'aromatic analgesics, not elsewhere specified' (estimated new incident cases, based on hospital separations data, Australia 1996–97).

RRMA	N	Population 0–4 yrs.	Rate/100,000	CI	CI+	CI-
M1	235	795,313	29.5	3.8	33.3	25.8
M2	15	95,057	15.8	8.0	23.8	7.8
R1	30	80,787	37.1	13.3	50.4	23.8
R2	30	87,461	34.3	12.3	46.6	22.0
R3	84	179,846	46.7	10.0	56.7	36.7
Rem1	14	20,521	68.2	35.7	104.0	32.5
Rem2	19	31,531	60.3	27.1	87.4	33.2
Total	**427**	**1,290,516**				

Notes:

1. RRMA was not specified for two cases.
2. CI refers to the 95% confidence interval based on a Poisson probability distribution (see Methods).
3. CI+ is the upper bound of the CI.
4. CI- is the lower bound of the CI.

Appendix 3

Glossary

Preschool child: a child aged less than five years.

Bed days: the number of days that the case occupied a hospital bed.

Length of stay: the number of days that the case occupied a hospital bed.

Procedure: mode of therapy, surgery, radiology, laboratory and other diagnostic treatment of the patient.

Medicinal poisoning: poisoning classified to ICD-9 external cause category E860–869 and/or 960–979.

Hospital separation: a patient admitted for an episode of care.

New incident case: a patient admitted for the first time for this injury this year.

Incidence: the number of new incident cases.

Country (residence): categories R1, R2, R3, Rem1 and Rem2 of the RRMA codes are collectively referred to as country residents.

City (residence): categories M1 and M2 of the RRMA codes are collectively referred to as city residents.

Statistically significant: Where case numbers are small, the effect of chance variation on rates can be large. Confidence intervals (95%, based on a Poisson assumption about the number of cases in a time period) have been placed around rates, where relevant, as a guide to the size of this variation. A difference between two rates is said to be statistically significant if the 95% confidence intervals do not overlap. Chance variation alone would be expected to lead to a rate outside the interval only once out of 20 occasions.

INJURY RESEARCH & STATISTICS

The most common agent of poisoning amongst preschoolers admitted to hospital in Australia was the group of aromatic analgesics including paracetamol. However, the more important agents, in terms of health burden, were anticoagulant medications, tranquillisers, barbiturates and antipsychotic and neuroepileptic medications. Thankfully, very few preschoolers die from medicinal poisoning in Australia. The low severity of medicinal poisoning's could reflect the effectiveness of the legislative controls on the availability of poisons in Australia.

The hospitalisation rate of preschoolers from medicinal poisoning was higher in rural and remote areas than in urban areas. This result does not seem to reflect differential hospital admission practices, because there were no significant differences in the length of stay distributions by area. It is likely to reflect a higher incidence of poisoning in rural and remote areas.