

Hazard
(Edition No. 27)
June 1996

**Victorian Injury
Surveillance System
Monash University
Accident Research Centre**



VicHealth

Poisonings in early childhood

This edition of Hazard reports on Victoria's hospital admissions and emergency department presentations for poison ingestions by children less than 5 years of age. It also presents recommendations for prevention based on recent collaborative research between Monash University Accident Research Centre, the Royal Children's Hospital, Melbourne and the Victorian Department of Health and Human Services, funded by VicHealth. Esso Australia has funded an extension of that research and the development of a brochure reporting these findings for wide dissemination among parents of young children. The main focus for this edition is poisoning due to the ingestions of medications and edition 28 (September 1996) will cover domestic chemical ingestions.

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Summary

There were 4,608 cases of poisoning under 5 years of age admitted to hospital in Victoria over the 7 year period July 1987 to June 1994 (annual average of 658 cases) and poisoning was the second major cause of hospital admissions in this age group, after falls. Children under 5 make up 86% of both child poisoning admissions and VISS emergency department childhood poisoning presentations in Victoria.

Of the 4,608 poisoning admissions 74% could be attributed to medications. The most common agents were respiratory system/muscle relaxants, paracetamol and anti-histamines.

Of emergency department presentations 71% were medications and 45% of these cases were admitted. Major agents include paracetamol, vaporiser solutions/essential oils, asthma medications, benzodiazepines and cough/cold medications excluding paracetamol.

The remaining 29% of VISS cases relate to the ingestion of household

chemicals. Products such as pesticides, household cleaners, (bleaches, oven cleaners, automatic dishwasher detergents, volatile solvents) and cosmetics and plants make up much of the remainder. These cases will be examined in the next edition of Hazard (September 1996).

There is a peak of poisoning incidence at 2 years of age for medication ingestion and 1 year for chemical ingestions. The home, especially the victim's own, accounted for the majority of incidents (90%).



Introduction

Injuries caused by ingesting poisons range from relatively minor and short term effects to serious long term effects such as brain and liver damage and death. The majority of unintentional poisonings involve only short term anguish and uncertainty and are resolved within a few hours (Syron, 1994).

The principal sources of information accessed in this article were the Victorian Injury Surveillance System (VISS) and Victorian Inpatient Minimum Dataset (VIMD) databases, the Australian Bureau of Statistics 1992 Melbourne Household safety survey and the Monash University Accident Research Centre (MUARC) 'Childhood poisoning and research prevention project' draft report. Other important sources were the Victorian Coroner's database, the Australian Statistics on Medicines and MIMS publications, a New Zealand literature search and papers presented by MUARC researchers at injury conferences. Data sources not accessed, which are reported elsewhere, were those for the Poisons Information Centre and the Royal Children's Hospital intensive care unit.

In Victoria the annual poisoning hospitalisation rate for 1-4 year olds was 239/100,000 compared with 13/100,000 for 5-9 and 22/100,000 for 10-14 year olds over the years July 1987 to June 1993. (Watt, 1995). There were 4,608 cases of poisoning under 5 years of age admitted to hospital in Victoria over the 7 year period July 1987 to June 1994 (annual average of 658 cases) and poisoning was the second major cause of hospital admissions in this age group, after falls. Children under 5 make up 86% of both child poisoning admissions and VISS emergency department

childhood poisoning presentations in Victoria. Poisoning accounts for 16% of injury hospitalisations for this age group.

The poisoning cases in the 10-14 year age group were predominantly 13 and 14 year olds and they were more likely to be intentional than unintentional, as is the case for adults. Except where preventive measures overlap, intentional poisonings are out of the scope of this article.

Victoria's experience mirrors that of the western world but international data can only provide a rough comparison because of different legislation, product availability, prescribing habits, social environments and modes of treatment including hospital admission policies.

Dramatic reductions in child poisoning deaths and hospital admissions in the late 1970's and early 1980's followed the introduction of child resistant packaging (Walter, Corbett cited in Ozanne-Smith, 1992). The hospitalisation rate for poisons is relatively stable in recent years with little sign of improvement. The frequency of childhood poisoning

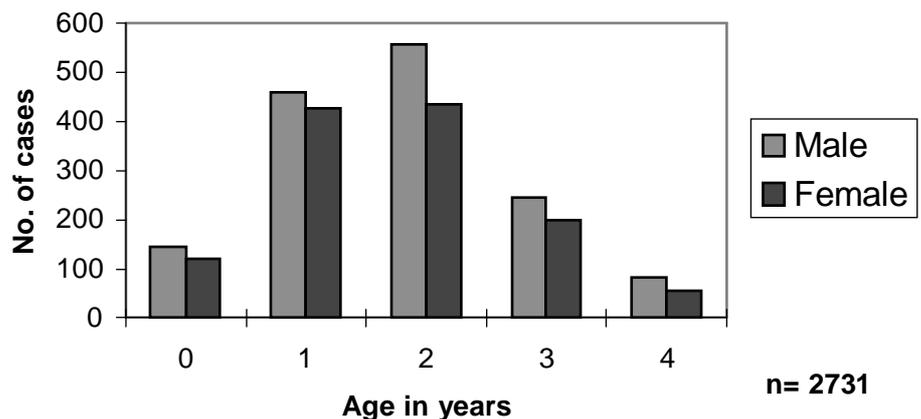
however is increasing, thereby increasing healthcare costs and numbers of families disrupted by the admission of a child to hospital. There is a peak of poisoning incidence at 2 years of age, a higher incidence for males at each age examined, and relatively short lengths of stay of usually one to two days (See figure 1). These are well documented characteristics of childhood poisoning. (MUARC, 1994)

The developmental stages of children at 1 to 3 years of age render them more susceptible to poisoning. Their increased mobility (walking and climbing), manual manipulation skills, curiosity and exploratory tendencies, with little understanding about what is unsafe, enable them to search out new objects and substances and put them in their mouths. The small body mass of children means that a small ingestion may be relatively more toxic compared with adults.

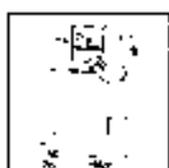
"Childproofing" has been found to be a key difference between injuries occurring and not occurring. This is matched to a parent's expectation of a child's abilities. However, often this may be underestimated as the child's

Unintentional poisonings to children age 0-4 by age and sex

Figure 1



Source: VISS - RCH, WH, PANCH 1989 to 1993, LRH July 1991 to June 1995



abilities change (Gaskin cited in Syrons, 1993). Anticipatory guidance on child development and associated risk through programs such as Kidsafe's Early Childhood Injury Intervention Program is designed to address this problem.

Compared to the number of hospitalisations there are a low number of deaths due to poisoning. There was one death over the years July 1988 to June 1992 in Victoria. A two year old child died from a drug overdose of anti-epileptic tablets which he found while playing. The only death in 1994 in Victoria was due to the ingestion of a poisonous plant (Consultative Council on Obstetric and Paediatric Mortality and Morbidity, 1994). The low number of deaths is mainly attributed to the fact that some of the most dangerous substances are now in child resistant packaging and to the effectiveness of medical treatment for most types of poisonings since the 1970's.

Childhood poisoning is related to a number of factors - substance, dose, environment, availability, accessibility, child's understanding and the behaviour of the child and caregiver. Further factors identified in a literature search undertaken by Safe Kids in New Zealand included regularity of use in the household, visibility of the substance, lack of parental awareness of toxicity, lack of supervision and absence of child resistant packaging.

In a case series study involving 6 poisonous agents, Ozanne-Smith et al, (1995) found that the agent was not in its normal storage place in 80% of cases. Of all cases, in 44% the agent was accessed when first purchased, before it was put away. Similarly, Beautrais et al (1981) found that 75% of poisonings in a cohort study of 1124 cases involved a substance not in its normal storage place.

Ranking of most frequent agents

Table 1

<i>Drugs and Medications</i>		<i>Household chemicals</i>	
VISS	Hospital Admissions	VISS	Hospital Admissions
Paracetamol	Respiratory systems /muscle relaxants	Pesticides	Insecticides including moth balls and ant bait
Vaporiser solutions, essential oils	Paracetamol	Cleaning agents	Corrosives, caustics
Asthma medication	Systemic agents including antihistamines	Soaps and detergents	Rodenticides
Benzodiazepines	Fluoride/camphor	Volatile solvents	Other solvents including turpentine
Cough/cold medicines	Cardiovascular	Cosmetics	Petroleum fuels including kerosene
Antihistamines	Benzodiazepines	Plants	Plants include. fungi

Source: VISS - RCH,WH,PANCH 1989 to 1993, LRH July 1991 to June 1995 AND VIMD July 1987 to June 1994.

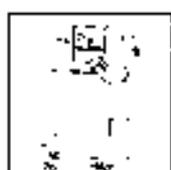
The types of poisons involved in childhood ingestions are clearly changing over the years as new products come onto the market. A comparison between poisons involved between 1956 and 1992 showed a shift from kerosene, pesticides and aspirin to benzodiazepines, paracetamol, iron and anticonvulsants as the dominant agents involved. This was found to directly reflect changes in the prevalence of these products in the average home over the 2 decades. (Gaskin cited in Syron, 1993). The major agents vary from country to country.

Of 2731 poisoning cases less than 5 years of age on the VISS database, 41% were admitted to hospital. The admission rate for medications (45%) was higher than for chemicals (31%). Medications represented 71% of the 2731 poisoning ingestions for under 5 year olds, chemicals 28% and plants 1%. Medications tended to involve an older age group than other chemicals (medications 2 years, chemicals 1 year). The most frequent agents involved are shown in Table 1

for hospital admissions and VISS presentations. A study of parental awareness of toxicity showed that most parents underrated the toxicity of medicines including aspirin, paracetamol, iron tablets, and cough medicines. (Peterson cited in Syron, 1994).

As part of the 1992 Australian Bureau of Statistics 'Safety in the Home' survey, data on the types of medicines, household cleaners and home maintenance products kept in households where a child aged under 5 years resided were collected. The survey involved interviewing residents of 4,000 households in the Melbourne Statistical Division and making estimates for all Melbourne households. Relevant results relating to children under 5 are summarised in table 2.

These figures provide important exposure information, which when combined with poisoning data would allow relative risks to be calculated. It also provides useful baseline data from which to monitor changes in exposure over time.



Products identified in childhood poisonings kept by Melbourne households with children under 5 years of age

Table 2

Type of product	Estimate of no. of households which have product and a child under 5 years of age.	% of total households with product and child under 5 years
Medicines and medications		
Paracetamol		
- capsules/tablets/caplets	158 400	89
- mixture	109 800	62
Cough and cold medicines	135 700	76
Other prescription medicines	83 200	47
Eucalyptus oil/ti-tree oil	82 000	46
Aspirin	57 900	32
Iron tablets	41 500	23
Blood pressure/heart tablets	7 400	4
Tranquillisers/antidepressants	6 800	4
Household cleaners		
Disinfectants/antiseptics	161 400	90
Bleach	133 800	75
Oven cleaner	98 500	55
Automatic dishwasher detergent	71 700	40
Drain cleaner (caustic soda)	38 500	22
Home handyman products		
Petrol/motor fuel	118 900	67
Methylated spirits	102 600	58
Turpentine	89 400	50
Snail bait/slug pellets	74 100	42
Ant killer	51 000	29
Kerosene	38 200	21
Moth balls (naphthalene)	28 100	16
Mouse/rat bait	24 800	14
Camphor (block)	10 800	6
Total households with child under 5 years	178,300	100

Source: Australian Bureau of Statistics 'Safety in the Home' survey, Melbourne, November 1992

The trend in hospital admissions over this period for selected agent groups is shown in Figure 2. There has been a general increase in the frequency of poisoning with aromatic analgesics, assumed to be paracetamol, and also in medications for the respiratory system/muscle relaxants. The frequency of poisoning with benzodiazepines has declined from a peak in 1987/88 and is fairly constant at approximately 30 per year.

Despite being already more detailed than for many other products an extra digit would greatly enhance the utility of E-coded poisoning data for the targeting of prevention, monitoring of trends and evaluation of agent specific interventions. Such a coding system, implemented by the Royal Children's Hospital, has considerably enhanced the utility of its data. When introduced in 1998, ICD-10 E-code equivalents will identify a greater number of separate classes of drugs and individual agents, but will still fall short of the required specificity.

A more refined break-up is available for hospitalisations at the Royal Children's Hospital between 1988 and 1992. Eucalyptus oil, broncho-relaxants such as theophylline, terbutaline, salbutamol; camphor; decongestants; benzodiazepines and anticonvulsants especially carbamazepine were the agents responsible for the cases most frequently hospitalised. The Royal Children's Hospital however treats the more serious cases of poisoning in Victoria and its cases are therefore not necessarily typical.

Medications

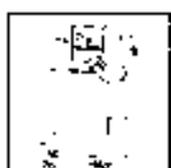
Hospital admissions (VIMD)

Three quarters of poisoning hospitalisations for Victoria were due to drugs,

medicinal substances and biological agents. There has been an upward trend in hospital admissions for these substances. The distribution of leading medications is shown in Table 3.

Emergency Department presentations (VISS)

The peak ages for hospital presentation were 2 years (40%) and 1 year (26%) and males were slightly over-represented at each age group

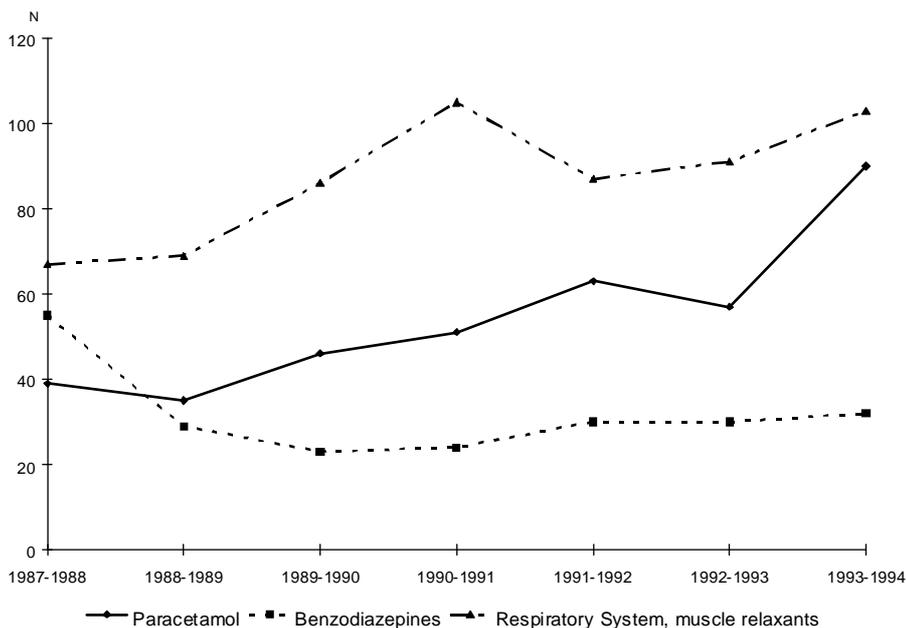


Annual average hospital admissions for medication poisoning under 5 years in Victoria 1987/94 **Table 3**

Agent	Annual average	%
Respiratory systems, muscle relaxants	60	12
Paracetamol	55	11
Systemic agents, includes antihistamines	45	9
Camphor, fluoride	38	8
Cardiovascular *	34	7
Benzodiazepines	32	7
Anticonvulsants	22	5
Iron preparations	18	4
Other sedatives & hypnotics	16	3
Tricyclic antidepressants	15	3
Oils (eucalyptus, ti-tree)	15	3
Urinary drugs	14	3
Hormones	14	3
Phenothiazine-based tranquilisers	12	3
Parasympatholytics	11	2
Gastro-intestinal	10	2
Other	75	15
Total	3391	100

* includes antimigraines, antihypertensives.
 Source: VIMD July 1987 to June 1994.

Selected Agents - Trend in Hospital Admissions **Figure 2**



Source: VIMD July 1987 to June 1994.

particularly 2 and 3 years. The home, especially the victim's own, accounted for the majority of incidents (90%). Forty-five percent of cases were admitted, a high proportion compared with the average of 21% for all injuries for this age group.

The leading medications by frequency of presentation and severity are shown in Table 4.

High admission rates occurred for antipsychotics (87%), hypoglycaemics (83%), anticonvulsants (76%), tricyclic antidepressants (67%), alcohol (65%), asthma medications (62%), diet medication (60%), vaporiser solutions and essential oils (58%), antispasmodics (50%), benzodiazepines (56%) and iron (54%). Lower admission rates for other agents cannot be interpreted as these agents necessarily being less dangerous. Agents such as paracetamol, which are highly toxic in substantial overdose, are generally screened by blood test in the emergency department and many other presentations for highly toxic agents involve minimal or no actual ingestion and do not require admission.

Items involved in medication poisoning

Poisoning results from a chain of events which may involve other factors in addition to the poison itself. Other factors associated with poisoning were cabinets and shelves (13% of poisoning cases), bags (3%), refrigerators (3%), chairs (2%) and tables and benches (2%). Another child was a factor in 3% of cases. The age did not differ greatly for each factor and was most commonly 2 years. The incidents involving each of these factors were investigated:



Most common agents involved in Emergency Department presentations by frequency and severity **Table 4**

Agent	No. of presentations	No. of admissions	% of cases admitted
Paracetamol	455	115	25
Vaporiser solutions, essential oils	177	102	58
Asthma medication	146	91	62
Benzodiazepines	134	75	56
Cough/cold medicines (excl. paracetamol)	99	35	35
Antihistamines	76	41	54
Cardiovascular (excl. migraine, antihypertensives)	60	31	52
Antiinflammatories	57	15	27
Anticonvulsants	50	38	76
Antibiotics	47	11	24
Tricyclic antidepressants	43	29	67
Contraceptives	43	8	19
Iron preparations	41	22	54
Antipsychotics	38	33	87
Migraine	38	17	50
Tobacco	30	16	53
Antispasmodics	30	15	50
Antinauseants	25	9	36
Antihypertensives	24	11	46
Antidiarrhoeals/laxatives	23	12	52
Diet medication	20	12	60
Hypoglycaemics	18	15	83
Aspirin	18	9	50
Alcohol	17	11	65
Other (NEC, NS)	266	122	49
Total *	1975	895	45

Source: VISS - RCH,WH,PANCH 1989 to 1993, LRH July 1991 to June 1995
 * Up to 2 agents can be noted per case.

Cabinets and shelves (n=243)

One quarter of these 243 incidents involved climbing and another quarter obtaining medicine from a medicine cabinet. 3% involved a child other than the victim. It was rarely mentioned whether the medicine cabinets were locked.

Bags (n=64)

Access from bags was mostly from the mother's handbag (n=16), a visitor's or grandparent's bag (n=14) or a nappy bag (n=6). They mostly occurred while the child was playing.



Fridges (n=53)

Liquid drugs were over-represented here. Forty-three percent of poisons accessed from fridges were liquid compared with 17% liquids for all medications. A few victims reached medicine on top of the fridge but most accessed it from the interior.

Benches and tables (n= 43)

Medications were relatively easily taken from these places, especially from coffee tables (n=5). Only 6 medications accessed from benches and tables involved climbing.

Chairs (n=41)

These incidents involved climbing onto a chair to reach the medicine in cupboards, medicine cabinets and shelves.

Generally the more difficult the access, the higher the admission rate eg of those using chairs 46% were admitted, benches and tables 36%. This may reflect an attempt to store the more poisonous medications out of reach. There were 124 children (6%) who climbed to reach the medication. Two year old boys were the group highly over-represented here (36% of all climbing cases v 22% of all medication poisoning cases). They predominantly climbed



onto chairs but also used benches, tables and cupboard shelves to reach their target.

Other Factors

Child resistant packaging (n=172)

Of the medications listed in Table 1, antihistamines, tricyclic antidepressants, aspirin, paracetamol, cardiac medication, some antidiarrhoeals, carbamazepines (an anticonvulsant) and iron compounds must have a child resistant closure (CRC) or be packaged in a strip pack. Paracetamol liquid, eucalyptus oil, ti-tree oil and preparations containing more than 250mg of iron, as sold only in pharmacies, must also comply (Therapeutic Goods Order No.20, Child Resistant Containers). There have been no changes to the Therapeutic Goods Act in regard to child resistant packaging since 1989 despite many new medications and some agents being introduced onto the market.

Of the 1,929 VISS poisoning cases involving medications there were 172 cases where CRCs were specifically noted in case narratives. There were very few cases where it was noted that the lid was not on securely or did not work correctly. Paracetamol cases were over-represented, especially those in a liquid form (45% paracetamol for CRC cases v 18% for all cases), as were preparations containing iron salts (10% CRC v 2% all cases). Investigation is required to determine the extent to which CRC's actually fail.

Mistaken doses (n=92)

These children were younger than other poisoning medication victims (60% mistaken doses aged under one year v 9% all cases). Almost all were liquid medications eg paracetamol, cough mixture. They were pre-

dominantly cases of overdose (n=65). At least 17% of these overdose cases involved the misreading of a decimal point, eg. "Mum gave infant drops, baby restless, gave 3 mls, correct dose 0.3mls". The wrong medication was given in 22% of mistaken dose incidents. Over half (56%) of these wrong medication cases involved the administration of oils and solutions used in vaporisers in preference to the prescribed medication eg. "Mother woke up to give patient dose of asthma medication, patient swallowed vaporiser fluid".

Recommendations

- Oils and solutions used in vaporisers should be stored separately from oral medications, especially when in use.
- Fractions and ml should be used in labelling in preference to decimal points and mg to ensure consistency and a lesser likelihood of misreading.
- Doses should be prescribed by age not weight, where appropriate, to minimise calculations required of the carer and the possibility of error.

Involvement of older children (n=49)

These were cases where an older child, usually a sibling located and administered to or shared medication with the younger child - most commonly one year old, eg. "Sister got asthma medication out of the cabinet, gave some to brother to drink". The ingestions were of both liquid and tablet form and accessed from a variety of places. There was no particular pattern of agents involved.

Specific Agents

These were selected for their frequency of VISS emergency department presentations and admissions to hospital. Information, other than that provided by VISS data has been taken principally from the Monash University Accident Research Centre 'Child Poisoning and Prevention Project' draft report, 1994 and related journal publications.

Paracetamol (acetaminophen) (n = 455)

This was the leading single agent cause of both presentations (VISS) and admissions to hospital. Poisonings more frequently occurred from the liquid form (54%), 45% from standard mixtures and 9% infant drops, than from the tablet or capsule (22%). It is used widely as a mild analgesic and antipyretic and there are dozens of preparations on the market containing this agent.

Paracetamol is one of the few cases of poisoning where antidotes (acetylcysteine and methionine) are available and early treatment can prevent the liver damage which can result (Neal, 1987:62). If methionine were included in paracetamol medication child poisonings and harmful adult overdoses could be prevented. However to be effective all paracetamol products on the market would have to incorporate the antidote. In the US and UK only some paracetamol products contain this antidote and since they are relatively expensive and perhaps little known they have not been widely used. In Australia there is current debate on reducing poisonings versus incorporating an additive which benefits relatively few and may have taste implications in its liquid form.



A concerning development is a move by drug companies towards marketing 200ml bottles of 120mg/5ml strength paracetamol mixture. This volume would significantly increase the risk associated with paracetamol mixtures.

Given the already high rate of presentations and admissions to hospitals and the widespread use of paracetamol in Victorian households, marketing bottles of paracetamol of 120mg/5ml concentration may not be in the community's best interest.

There is good potential to reduce the rate of hospital admissions for paracetamol ingestions, and for other agents, by means of the development of clear protocols for case management. The potentially toxic dose of paracetamol is well known for specified body weights and a reliable blood test is available, at least in metropolitan hospitals, for borderline doses or where the amount is unknown or potentially toxic. Admission, with its associated costs, should not occur in the absence of a proven toxic dose.

Recommendations

- Investigate crusting around closure on liquid medications and effect on CRC's.
- Restrict the allowable volume of paracetamol mixtures to 100ml (for 120mg/5ml) and 50ml (for 250mg/5ml and 240mg/5ml).
- CRC closures on droppers for infant preparations.
- Include methionine in paracetamol preparations.
- Strengthen foil backing on bubble packs.

Vaporiser solutions and essential oils (n = 177)

This grouping includes agents which appear in a range of forms.

In the VISS database over 40% of victims ingesting inhalational and related products were aged 1 year. Almost one third of cases related to the ingestion of eucalyptus oil, another 30% were from the ingestion of vaporiser solutions, 24% involved camphor, 11% other oils and 4% involved rubs containing agents such as menthol, camphor, eucalyptus oil and turpentine oil.

Almost one third of cases (54) relate to eucalyptus oil as a discrete product ie, not part of a vaporiser solution. Another 30% (53 cases) relate to vaporiser solutions which include eucalyptus oils, whether they be in their original container or in the vaporiser at the time of ingestion.

Eucalyptus oil (n = 54)

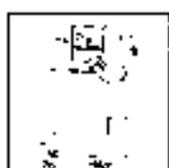
In Australia eucalyptus oil is marketed as a discrete product and also a component of other products including inhalant solutions, ointments and some cleaning products. The discrete product has a higher toxicity than vaporiser solutions. Fatal toxicity has been reported from greatly varying

volumes of eucalyptus oil ingested. Death has occurred with 4 to 480ml ingested and survival with 21 to 30ml in an 8 year old. The uncertainty associated with the levels of toxicity may be a cause of the high admission rates associated with eucalyptus oil.

Apart from the 31% of total cases where it was ingested in vaporiser solutions, it was most often being used for cleaning (13% of cases). The remaining narratives were unclear as to the purpose of use. Case narratives showed the most common access location for these cases to be a cabinet or cupboard (8 cases), bench or dresser (5), basket (2) and medicine cabinet (1). In 4 cases the eucalyptus oil was wrongly administered by a parent. The admission rate for these types of incidents was very high at 69%.

Vaporiser solutions (n = 53)

Analysis of the contents of 5 popular brands of vaporiser solution currently available show that they contain between 10% and 23% eucalyptus oil. Other ingredients include camphor (0.5 to 5%), menthol (1.4 to 10%) and methyl salicylate (0.5 to 2%) in a propylene glycol base. Victims ingesting vaporiser solutions were younger than those accessing the full strength oil (used for cleaning),



38% were aged 1 year, with a lower admission rate (49% vs 69%), possibly due to the amounts and strengths available from each source. Thirty-six percent of victims accessed the solution from the vaporiser itself, 19% were wrongly given the solution orally by a care-giver and 15% accessed the solution directly from the bottle.

Following a telephone survey (Day et al, 1996), which confirmed the above VISS findings, a workshop was held with manufacturers and other interested parties. The following recommendations arose from discussions at this workshop.

Recommendations

- Confirmation of the claimed non-toxicity of vaporiser-well residues.
- Removal of the economic barriers to product re-registration which exist following safety modifications to the product.
- Improvement of child resistant closures and ensure such products are kept in child resistant storage.
- Discouragement of use of vaporiser solutions for respiratory infections in young children.
- Increase public awareness of the potential toxicity of eucalyptus oil.

Camphor (n = 42)

Death from camphor can occur with the ingestion from as little as 5ml of camphorated oil or 1 gram of camphor. Of the 42 cases of camphor ingestion recorded by VISS, all related to the ingestion of camphor cubes or blocks. Fifty-five percent of the victims were aged one year; 64% of victims required admission to hospital and unlike other agents, victims ingesting camphor

were more likely to be female (64%). Access to the camphor blocks was most often from a cupboard, drawer or wardrobe.

Recommendation

- Sell camphor blocks only in protective plastic packaging as available for mothballs.

Asthma medications (n = 146)

These had a very high admission rate (62%) and 59% of ingestions were in liquid form. Child resistant closures are not legally required on these medications. Aerosol puffers rarely cause poisonings though they may cause adverse effects. Current paediatric practice is to limit oral therapy. This should have the effect of reducing poisoning in the future.

Theophyllines are potentially very serious in overdose and these agents accounted for 12% of VISS anti-asthmatic cases. They have been used for more than 50 years to reverse bronchospasm associated with asthma, and more recently for the treatment of bronchitis and chronic obstructive pulmonary disease. Many toxic effects are relatively mild

(nausea, tachycardia), but others can require treatment or be life-threatening (seizures, shock, ventricular arrhythmias). The mortality for patients with theophylline toxicity is estimated to be 10%. Overdose has long been recognised as difficult to treat. (MUARC,1994)

Recommendation

- Limit oral administration of asthma medication.

Benzodiazepines, tricyclic antidepressants and antipsychotics

Poisoning tends to occur where there is high stress and multi-problems in families. Benzodiazepines, tricyclics and antipsychotics are prescribed in such situations and therefore extra care must be exerted when prescribing since these medications then carry a risk above the product itself.

Benzodiazepines (n = 134)

These drugs are used for their anxiolytic, hypnotic, muscle relaxant or anticonvulsant actions. About 10 million prescriptions are dispensed each year in Australia. In overdose

Benzodiazepines - comparison of scripts dispensed in Australia in 1994 and VISS cases **Table 5**

Agents	Scripts	%	VISS	%
Temazepam	3,032,739	37	28	23
Oxazepam	2,010,423	24	28	23
Diazepam	1,679,459	20	22	18
Nitrazepam	1,071,111	13	3	2
Flunitrazepam	260,879	3	12	10
Clonazepam	178,858	2	27	22
Bromazepam	71,759	1	3	2
Total	8,305,228	100	123	100

Commonwealth Department of Human Services & Health, 1994; VISS: RCH,WH,PANCH (5 yrs), LRH (4 yrs)



they can cause respiratory or circulatory collapse although this is uncommon when this is the only class of drugs ingested.

Since 1991 the number of scripts has reduced for benzodiazepine agents overall by 18%. The reduction has occurred for all agents with the exception of clonazepam which has increased by 46%. The reduction has been greatest for oxazepam and nitrazepam.

There is some over-representation by flunitrazepam (3% scripts, 10% VISS) and clonazepam in particular (2% scripts, 22% VISS). This over-representation is concerning since the latter is the only benzodiazepine increasing in frequency of scripts. Clonazepam's over-representation may be partially explained by its more frequent use for children (for epilepsy) than other benzodiazepines

Clonazepam (n=27)

Clonazepam differs from other benzodiazepines in three ways: its indications for use, quantity of supply and packaging. Its most common use is as an anticonvulsant and it is supplied in quantities of 200 tablets. The drug is imported directly already packed in an amber coloured glass bottle with a plastic screw top, without a CRC. The conspicuous over-representation of this agent may be attributable to its relative ease of access in this screw-top bottle, compared to the difficulty of access from the blister packs used for other benzodiazepines. It is either a pale orange tablet (0.5mg), a white tablet (2mg) or more rarely oral paediatric drops. It may be also that clonazepam's status as an anticonvulsant leads to underestimation of its toxicity. Its unusually large pack size in the tablet form and the need to take it several times a day continuously for epilepsy

may undermine vigilance about safety. There is a strong case for those drugs subject to poisoning ingestions to be supplied in child resistant packs (MUARC, 1994).

In a MUARC telephone survey relating to access of benzodiazepines by children under 5 years most commonly the product was not in its usual storage place at the time. Slightly more than half the cases accessed the product at either ground or table level, with an additional one third reporting that the child had climbed to a higher level to obtain access. Approximately equal numbers were packaged in bottles and packets.

Tricyclic antidepressants (n = 43)

Tricyclic antidepressants (TCA's) have been noted as a leading cause of childhood poisoning admission often to intensive care (MUARC, 1994).

These drugs act as antidepressants and sedatives. They are used to treat endogenous depression, depression accompanied by anxiety and enuresis in childhood. They are particularly dangerous in overdose in young children because of their cardiotoxic and neurotoxic effects and their action on the autonomic nervous system.

TCA overdose is responsible for a disproportionate share of both intensive care unit (ICU) admissions and mortality compared to other drug ingestions and probably represents the most common life-threatening drug ingestion worldwide. A review of deaths due to accidental poisoning of children aged under 5 years in England and Wales found that TCA's caused 26 of the 69 deaths attributed to poisoning with medicines. They are usually supplied in blister or foil strip packs, to slow an impulsive ingestion of large numbers of the tablet in suicidal patients. The most common presenting symptoms include drowsiness, confusion, agitation, complex neurological signs reflecting autonomic dysfunction and seizures. (MUARC, 1994)

In the MUARC telephone survey previously noted the patterns of access for tricyclic antidepressants were similar to those for benzodiazepines. Almost all of the cases involved medication in packets.

There were 43 cases of tricyclic antidepressant ingestions. Access to these was very pronounced in the months of June (29%) and September (20%). Sixty-seven percent of cases were admitted to hospital or transferred.

Tricyclic antidepressants - comparison of scripts dispensed in Australia in 1994 and VISS cases Table 6

Agents	Scripts	%	VISS	%
Dothiepin	1,439,486	35	23	54
Amitriptyline	965,594	24	5	12
Doxepin	946,604	23	10	23
Imipramine	550,107	14	4	9
Clomipramine	153,783	4	1	2
Total	4,055,574	100	43	100

Commonwealth Department of Human Services & Health, 1994; VISS: RCH,WH,PANCH (5 yrs), LRH (4 yrs)



Between 1991 and 1994 there was a 6% reduction overall in TCA scripts. However there were increases for dothiepin and clomipramine. Dothiepin were largely over-represented in VISS and Poisons Information Centre data. It is predominantly a brown and red capsule packaged in blister packs. These are inherently attractive to children and one capsule gives a potentially toxic dose (Parsons, 1996 personal communication).

There is a strong case for not using imipramine for enuresis because of its toxicity and the availability of new safer agents. If prescribed, the associated danger must be clearly explained to parents.

Antipsychotics (n=38)

These had an extremely high admission rate (87%). They were predominantly chlorpromazine (9), thioridazine (9), haloperidol (8), and trifluorperazine (6).

This high admission rate relates to the distressing neurological effects induced by toxic doses of this group of medications, including behavioural changes, depression of consciousness and muscle spasms. Some of these responses can be diminished by appropriate treatment in hospital

Cough/cold medicines (excluding paracetamol)

(n = 99)

Seventy-seven percent of these were liquid medications. Very few are required to have CRC's. The range of ingredients is very wide. Children can be sensitive to the effects of some ingredients eg decongestants, antihistamines and 35% of emergency department presentations required hospital admission.

Antihistamines (n = 76)

In overdose, symptoms such as

restlessness and excitability and even hallucinations may occur. These agents should be in a strip form or have a child resistant cap if in a bottle. The victims here were typically 2 year old boys. Both tablets and liquid medication were frequently involved. There was no particular pattern in accessing this type of medication. The non-sedating antihistamines are now widely used and rarely cause serious problems (Syron, 1994).

Anticonvulsants (n = 50)

These had an extremely high admission rate (76%) and the one medication death was from these tablets. One description of an overdose is 'after drinking this mixture she went 'red, hot, shaky with glassy eyes''. They are sold in both tablet and liquid form and, from where it could be determined, they were mostly consumed in tablet form (85%). A detailed analysis of VISS narratives highlighted cases of carbamazepine. Overdoses increase respiration rate, provoke ataxia and confusion, followed by convulsions and possibly death from respiratory failure (Bensley, 1963). Since 1989 they have been required to have child resistant packaging in all forms. There were also 27 cases involving the anticonvulsant clonazepam which has been included under benzodiazepines in this analysis.

Contraceptives (n = 43)

One third of these ingestions were by 2 year old girls. They were accessed fairly easily - in bags, in the bedroom and bathroom. A large single dose has no long term effects. Victims may become nauseated and vomit several hours later.

Iron preparations (n = 41)

These medications were relatively easily accessed in bags and kitchen

cupboards according to the VISS narratives. They have child resistant packaging in both tablet and liquid form if the package contains more than 250mg iron. In the USA, between 1985 and 1990, they were the leading cause of pharmaceutical unintentional ingestion fatality (30% fatalities) (Litovitz and Manoguerra, 1992). Children are very sensitive to iron toxicity and can be killed by the ingestion of as few as 10 tablets. They are used in iron deficiency often due to blood loss, pregnancy, abnormalities of the gut or premature birth. Overdoses cause abdominal pain, vomiting and shock. These may be followed by acidosis, coma or death (Neal, 1987).

Antispasmodics (n = 30)

These cases were almost entirely under 2 years of age. The 14 younger cases, under one year arose from parents administering the incorrect dosage of a syrup, particularly 4ml rather than 0.4 ml. The 16 older cases involved children accessing tablets while playing.

Diet medications (n = 20)

Poisonings from diet pills were most common in October, November and January, presumably the dieting months. They were almost entirely one brand and were in tablet or capsule form without child resistant packaging. Some contain stimulant or antidepressant chemicals. These in overdose may cause restlessness and irritability. Other brands may contain fibre or bulking agents and can cause problems if not taken with plenty of water (Dauncey, 1994). Five were mentioned as being accessed in handbags. Climbing and medicine cabinets were each involved in only one case suggesting this medication was easily accessed from ground level. The admission rate was 60%.



General recommendations

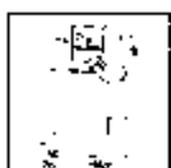
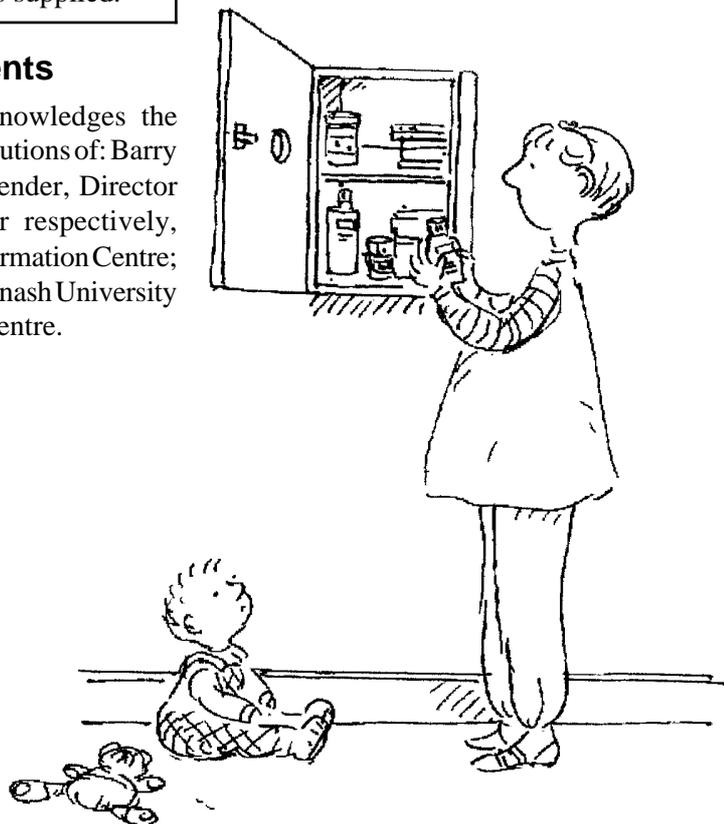
- Explore regulating for child resistant packaging for all prescription medications where there is a potential poisoning problem.
- Improve CRC design (failsafe and explore cognitive rather than mechanical methods).
- Develop safe bench-top storage.
- Remove cost disincentives for improving product safety.
- Develop protocols to determine hospital admission policy.
- Improve data specificity for medications.
- Ongoing surveillance and monitoring of progress.
- Study required regarding world best practice since it is difficult to compare medications, packaging and poisoning countermeasures worldwide.
- A lead agency is required to address the issue of childhood poisoning.
- The Australia-wide phone number for all Poisons Information Centres should be on the labels of all potentially poisonous products.
Ph: 131126
- Review the thickness of foil on strip packs. Some less toxic medications eg contraceptives would benefit from easier access from thinner foil, conversely toxic substances from thick foil.
- Develop effective methods to inform medical practitioners of newer, safer medications.
- Regulate to limit the volume of common poisoning agents supplied.

Conclusion

The only prevention strategy reported to have been demonstrated to be effective is child resistant packaging. It remains unclear as to whether health education in clinical settings, aversive bittering agents and storage practices are effective childhood poisoning prevention strategies. Studies of the effectiveness of public media campaigns, community based programs and poison warning stickers on labels have not been able to demonstrate success. (MUARC, 1994).

Acknowledgments

VISS gratefully acknowledges the comments and contributions of: Barry Parsons, Elizabeth Hender, Director and Deputy Director respectively, Victorian Poisons Information Centre; Dr Anne Altmann, Monash University Accident Research Centre.



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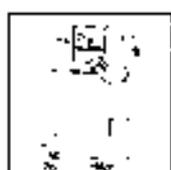
ESSO in the Community



Esso has supported the development of a brochure to update information on childhood poisoning prevention in the community. Esso has also contributed towards supporting the research under-pinning this edition of Hazard. The company's commitment to employee safety extends beyond the workplace to the promotion of home and family safety.

It is important to Esso that the company contributes to the prevention of injuries by supporting the work of the Monash University Accident Research Centre.

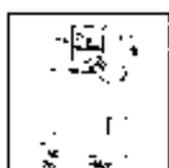
Esso's most important contribution to Australia is as the operating company responsible for the production of a significant proportion of the oil needed by the country every day and virtually all of Victoria's natural gas.



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General

Acknowledgements

Participating Hospitals

The contributions to the collection of VISS data by the director, nurse administrators and staff of the Emergency Departments of these hospitals, other participating clinicians, Information Systems departments and ward staff are all gratefully acknowledged. The surveillance system could not exist without their help and co-operation.

Coronial Services

Access to coronial data and links with the development of the Coronial Service's statistical database are valued by VISS.

National Injury Surveillance Unit

The advice and technical back-up provided by NISU is of fundamental importance to VISS.

How to Access VISS Data:

VISS collects and tabulates information on injury problems in order to lead to the development of prevention strategies and their implementation. VISS analyses are publicly available for teaching, research and prevention purposes. Requests for information should be directed to the VISS Co-ordinator or the Director by contacting them at the VISS office.

VISS is located at:

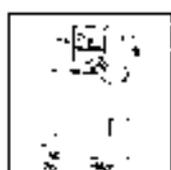
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Project Funded by Victorian Health Promotion Foundation

VISS is a project of the Monash University Accident Research Centre.



*Hazard was produced by the Victorian Injury Surveillance System
with the layout assistance of Glenda Cairns, Monash University Accident Research Centre.
Illustrations by Jocelyn Bell, Education Resource Centre, Royal Children's Hospital.*

ISSN-1320-0593

Printed by Sands and McDougall Printing Pty. Ltd., North Melbourne

