ORIGINAL ARTICLE

Investigating Childhood and Adolescence Poisoning Exposures in New Zealand Reported to the National Poisons Centre during 2000-2009

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Abstract

Background: Poisoning incidents, in both children and adolescents, are known to occur in New Zealand but little is known about the agents implicated.
Methods: All the calls received over the ten years between 2000 and 2009, by the National Poison Centre in New Zealand, were retrospectively reviewed. Calls related to cases involving those less than 19 years were included. The data were analyzed according to age and gender of cases, the toxic agent implicated in the poisoning and the year of the incident.
Results: Most poisonings occurred in children less than five years of age (86%), with these being further concentrated in children aged one to two years (57%). The most frequently implicated agents were therapeutic agents (39%) and then household products (36%). In adolescents, an increase in drug misuse or abuse was seen from 12 years old – with those aged 13 and 18 years being most frequently exposed to agents with psychotropic properties.
Conclusion: This study showed that accidental (and intentional) ingestion is still an issue for children and adolescents in New Zealand. Specific strategies are needed to be targeted to the 1) products implicated in a high number of poisonings and 2) to children at the different ages.

Keywords: Poisoning; Children; Adolescent; Poison information centre

INTRODUCTION

Childhood poisonings still occur in New Zealand, despite it being a developed nation, and even with the advent of a National Poisons Centre (NPC). The NPC, set in Dunedin, runs a free 24 hour emergency telephone service, which receives approximately 30,000 calls per year, additionally; it operates a website that also provides emergency information on treating patients subjected to various poisons. While an NPC can provide information to help prevent poisonings from occurring the fundamental role is still to provide medical advice on the appropriate treatment of a patient post-exposure. However, the NPC is in an excellent position to collect, and subsequently analyse, data on poisoning incidents so as to establish strategies to prevent these incidents from occurring (1).

Worldwide unintentional poisonings in children and adolescents result in significant mortality and morbidity (2), and within New Zealand, thousands of hospitalisations are due to unintentional childhood poisonings (3-6). Some of these poisonings have resulted in significant morbidity and mortality, causing additional psychological and emotional stress on family and caregivers. In this regard, Yates reported that between 1993 and 1997, there were 7354 hospitalisations and 91 deaths of children from 0-12 years, in New Zealand resulting from accidental ingestions (3). Alatini reported 2707 hospital admissions of children 0-14 years in New Zealand during 2003-2007 (4). Reith et al. noted that although there was an improvement in the mortality rate from childhood poisoning in Queensland, Australia, over the past 50 years, there has been no change in the presentation rate of these poisonings (7).

The main types of agents implicated in poisonings in children were found to be household products and therapeutic agents, that is, prescription medicines, over-the-counter (OTC) medicines and complementary and alternative medicines (CAMs) including herbals, vitamins and mineral products (3). Chien et al. found that paracetamol, cough and cold preparations, aromatic oils, antihistamines and non-steroidal anti-inflammatory drugs (NSAIDs) were the most common therapeutic agents that resulted in toxicity in children aged less than 5 years (8). These latter products are commonly used and stocked in households where small children live since they are regularly used for the relief of common minor complaints.

Accidental poisonings can potentially be preventable if the common agents and reasons for the poisonings can be identified. Identification of the common agents implicated in poisonings which result in calls to the New Zealand

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Received 15 January 2013; Accepted 25 May 2013

National Poisons Centre (NPC), involving children and adolescents over the last decade, is the first step in developing nationwide prevention measures to reduce the adverse sequelae associated with poisonings.

The aim of this study was to identify the pattern of calls reported to the NPC involving children and adolescents 18 years and under, between 2000 and 2009.

METHODS

Inclusion and exclusion criteria

As a standard practice, all calls received by New Zealand's National Poisons Centre (NPC) are entered into an electronic database. Where possible a range of information is recorded. For this investigation, call information regarding human poison exposures from 1 Jan 2000 to 31 Dec 2009 inclusive were extracted. The variables used for analysis were year of exposure, patient age in years (0-18), gender and substance classification (as defined by the NPC recording categories). These categories included human poisonings from agricultural (e.g. pesticide and rodenticide), animal (e.g. spider bite), cosmetic (e.g. nail polish and perfume), fungus (e.g. toadstool), household (e.g. cleaning products), industrial (e.g. sulfuric acid), miscellaneous, plant and therapeutic (e.g. medications) agents. Excluded were calls relating to animals exposed to toxins, adults involved in poisonings, and events occurring outside the timeframe.

Data analysis

The number of calls received by the NPC relating to the exposures was plotted against year, both as the total and then separated according to gender. The number of calls related to each agent for each year, and the number of calls related to each age group were quantified. The combined therapeutic and household agents represented 75% of reported exposures and so further analysis was conducted to determine the specific types of these agents that were implicated in the poisonings. To determine if the implicated substances varied with patient age, all exposures were evaluated for each age group over the whole decade. The sub-categories of "therapeutic" and "household" classifications were then used to determine the top 10 subcategories for each age group, these were converted into the percent of all exposures for that age group over the decade, and analysed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA).

RESULTS

The total number of calls to the NPC involving cases with 18 years of age and under, between 2000 and 2009 was 129,241. The number of calls per year ranged from 10,923 in 2000 to a peak of 14,747 in 2009 as shown in Figure 1. Figure 1 also shows that in every year studied there were more calls relating to males than females. Age information was recorded for 96% of calls. Figure 2 shows the frequency of exposures with respect to age over the study period. 57% of exposures accounted for the cases aged one to two years, and 86% of exposures were reported for the cases aged less than 5 years in general. Among adolescent cases, those aged 13 and 18 years had the highest frequency. Table 1 shows the number of calls related to each substance type by year. When these data were collated for the 10 year period, the top three categories were "therapeutic" agents (50,387; 38.99%),

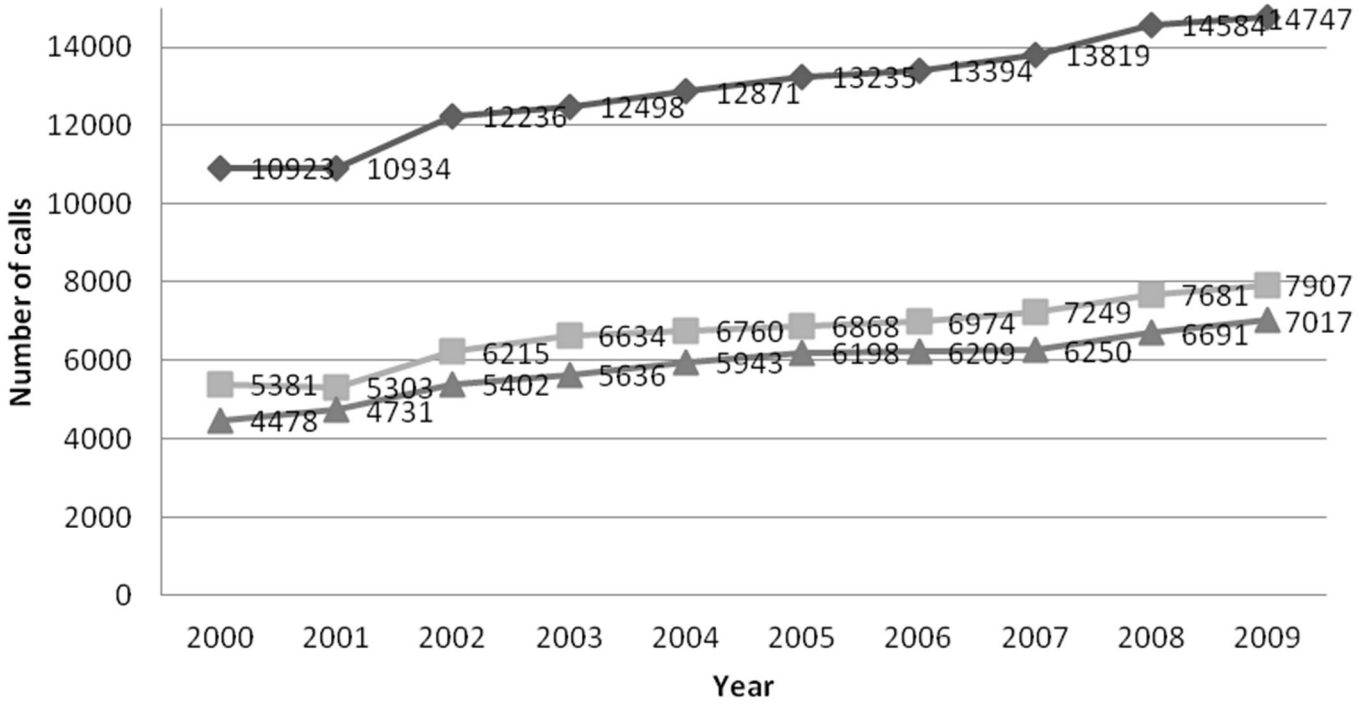

Figure 1. Total number of calls received by the New Zealand Poison Centre from 2000-2009 involving individuals less than 19 years. Data is shown as total calls (◆), males (■) and females (▲).

"household" agents (46,585; 36.05%) and "plant", (10,178; 7.88%). Therapeutic agents and household product exposures when combined represented 75% of all reported exposures.

When exposures were grouped over the whole period and then separated according to age, the more commonly implicated substances at each age band could be identified. Table 2 shows the top 10 subcategories according to age and the percentage that they represent. Within each age grouping, the top 10 agents accounted for 62.33% to 75.0% of exposures.

By plotting this data, trends can more clearly be seen as shown graphically in Figure 3a (therapeutic agents) and 3b (household agents). Within the therapeutic grouping, analgesics and anti-inflammatories poisoning were a significant category across all ages. It is interesting to note that antidepressants, hypnotics, opioids and antipsychotic medications were not implicated in poisonings until 13 years of age. Within the household agents, the cleaning products (detergents, cleaners and laundry products) and miscellaneous household groups were seen across all age groups. Nevertheless, ingestion of petrol was first seen in the 10 year age band, and was distributed through to 18 years.

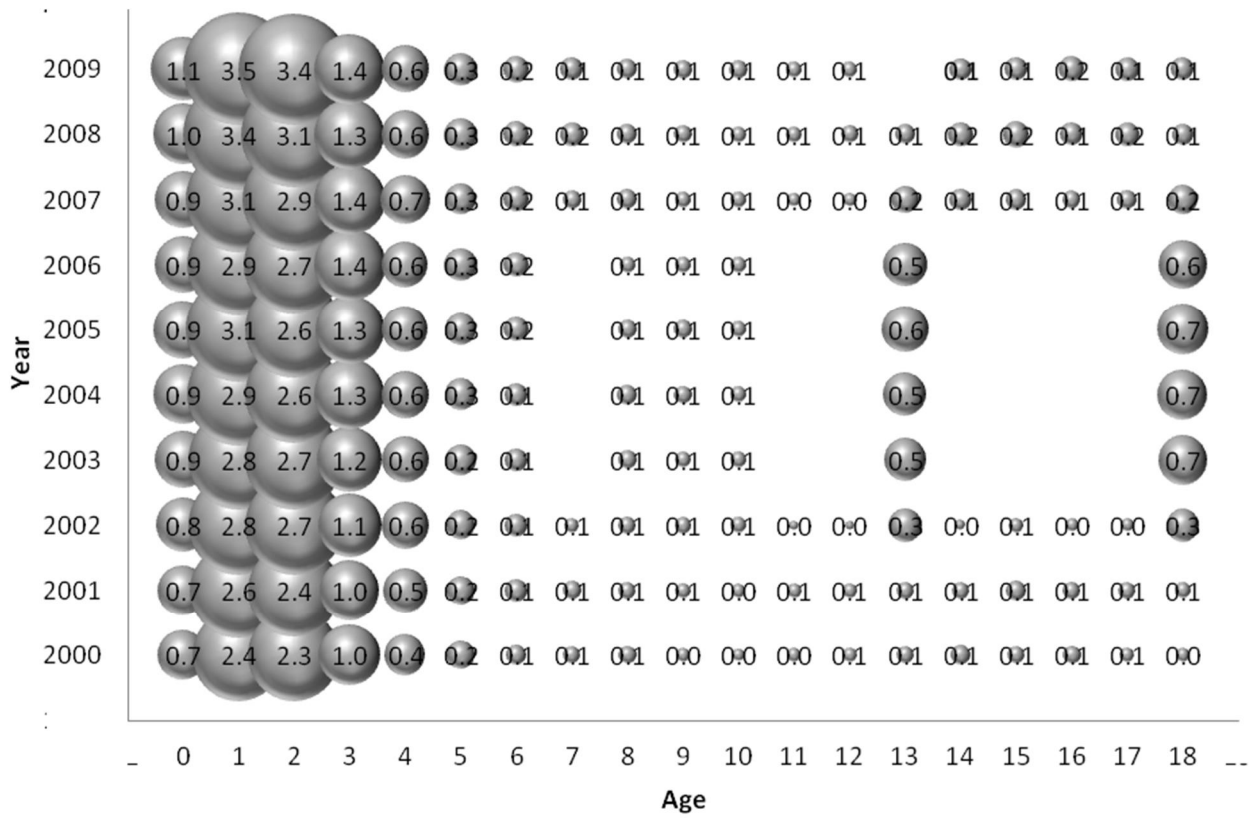

Figure 2. The percentage of calls in each year according to age. Bubble size represents the relative proportion.

Table 1. Substance categories involved in poisoning calls reported (shown as percentages for each year).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Agricultural	3.84	3.59	3.69	3.50	3.14	3.41	2.96	2.86	3.45	3.32	3.36
Animal	0.83	0.99	0.87	0.86	0.67	0.66	0.46	0.52	0.54	0.47	0.67
Cosmetic	6.99	7.25	7.71	7.58	7.32	7.22	6.87	7.02	7.54	8.71	7.44
Fungus	0.99	1.21	0.78	1.02	1.11	1.10	1.15	1.13	1.25	1.11	1.09
Household	38.22	38.02	36.90	37.06	36.58	35.87	35.16	35.51	33.82	34.58	36.05
Industrial	2.34	1.68	2.11	2.06	2.10	1.84	1.80	1.57	1.65	1.33	1.83
Miscellaneous	1.10	1.42	1.84	3.13	3.68	4.26	3.62	3.63	3.78	0.17	2.70
Plant	9.87	9.32	9.68	8.44	8.50	7.79	6.49	6.56	6.48	6.76	7.88
Therapeutic	35.81	36.52	36.43	36.34	36.90	37.85	41.48	41.21	41.48	43.55	38.99
(N=)	10923	10934	12236	12498	12871	13235	13394	13819	14584	14747	129241

Table 2. 10 most frequent "substances" involved in reports based on age.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H MIS 19.13	H DET 17.90	T ANA 8.95	T ANA 11.74	H MIS 12.84	H MIS 17.35	H MIS 20.96	H MIS 19.54	H MIS 24.44	H MIS 19.46	H MIS 19.78	H MIS 22.64	H MIS 13.14	T ANA 17.43	T ANA 19.04	T ANA 22.35	T ANA 20.07	T ANA 20.59	T ANA 15.95
2	T TOP 14.16	H CLE 13.34	H MIS 8.09	H MIS 8.53	T ANA 11.61	T ANA 9.63	T SUP 6.79	T ANA 9.98	T ANA 8.70	T ANA 9.53	H CLE 9.67	T ANA 7.08	T ANA 7.63	T INFL 8.74	T INFL 7.74	T INFL 13.31	T INFL 13.81	T INFL 9.83	T DEP 11.44
3	H DET 8.96	H MIS 9.81	T INFL 7.84	T SUP 8.06	T SUP 9.19	T SUP 8.06	T ANA 6.70	T TOP 5.82	H CLE 7.20	H CLE 7.20	T MIS 5.93	T MIS 6.60	T HIS 6.36	H MIS 7.72	T MIS 7.74	T MIS 8.02	T DEP 9.94	T DEP 8.16	T INFL 9.19
4	H CLE 8.35	T TOP 8.89	H CLE 7.51	T INFL 7.96	T INF 6.30	T TOP 6.05	T TOP 5.58	H CLE 5.20	T TOP 6.15	T TOP 6.23	T TOP 5.27	T TOP 6.13	H CLE 6.36	T DEP 6.61	T DEP 7.32	T DEP 7.68	T MIS 9.02	H SPI 6.12	H SPI 5.82
5	T ANA 6.91	T ANA 4.77	T TOP 7.12	T INF 6.26	T INFL 6.03	T INF 5.34	T INFL 5.07	H INS 4.99	T HIS 4.65	T SUP 5.45	T HIS 5.27	T HIS 5.19	H PET 6.36	T MIS 5.71	H MIS 6.90	H SPI 3.75	T INF 4.60	H MIS 5.01	H CLE 5.72
6	H INS 4.91	H INF 3.87	H DET 6.75	H CLE 5.00	T HIS 4.99	H CLE 4.72	H CLE 4.64	T INFL 4.78	T MIS 4.50	T INFL 5.45	T ANA 5.05	H PAI 5.19	H PAI 5.93	H CLE 4.52	T INF 5.65	T INF 3.58	H PET 4.24	H PET 3.71	T MIS 4.22
7	T MIS 4.27	H LAU 3.73	T SUP 3.18	T TOP 4.78	T TOP 4.49	T INFL 4.67	H DET 4.12	T SUP 4.57	T SUP 3.60	T INF 4.67	T INFL 4.84	H CLE 4.72	H INS 5.93	T HIS 4.09	H CLE 5.44	H MIS 3.24	H MIS 3.68	T MIS 3.53	T PSY 4.00
8	H PAI 3.37	T INFL 3.69	T INF 4.77	T MIS 4.45	H CLE 3.85	H DET 3.96	T MIS 4.04	T HIS 3.95	T INFL 3.45	T MIS 4.47	H PET 3.74	H INS 4.72	T INFL 5.93	H PET 3.36	H SPI 4.39	H CLE 3.24	H CLE 3.50	T PSY 3.34	T INF 3.44
9	H INF 2.88	H PAI 3.21	T MIS 4.94	T OC 4.14	T OC 3.76	T HIS 3.62	T INF 3.87	H DET 3.74	T INF 3.45	T HIS 4.28	H PAI 3.74	H PET 3.77	T MIS 5.51	T INF 3.20	T HIS 3.35	T OPI 3.07	T HYP 3.31	T HYP 3.15	H PET 3.31
10	H LAU 2.56	H INS 3.05	T HIS 3.18	T HIS 4.11	H DET 3.58	T OC 2.91	T HIS 3.61	T MIS 3.12	H DET 3.30	H INS 2.72	H INF 3.74	H INF 3.30	H INF 4.66	H SPI 3.20	T PSY 3.72	T HYP 2.73	T OPI 3.13	H CLE 2.97	T HYP 3.13
Total %	75.50	72.62	62.33	65.03	66.64	66.31	65.38	65.69	69.44	69.46	67.03	69.34	67.81	64.59	71.29	70.97	75.30	66.41	66.22

Key: H=Household T=Therapeutic

ANA = analgesic
CLE = cleaning
DEP = antidepressant
DET=detergent
HIS=antihistamine
HYP=hypnotic
INS=insecticide
INF=antiinfective
INFL=anti-inflammatory
LAU=laundry
MIS=miscellaneous
OC=oral contraceptive
OPI=opioid
PAI=paint
PET=petrol
PSY=antipsychotic
SPI=spirit
SUP=supplements
TOP=topical

Table 3. Age and recorded reason for ingestion (shown as a percentage of all ingestions per age group).

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Abuse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	2.5	0.4	5.9	4.4	3.1	4.6	0.5	0.1
Exploratory	80.7	96.4	97.3	96.0	91.6	80.9	69.7	54.1	49.8	42.4	40.0	7.6	5.1	8.4	1.7	0.7	0.6	0.4	0.1	85.0
Intentional	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.4	1.4	1.8	3.3	8.0	16.5	46.5	50.4	59.6	63.2	54.7	62.5	4.7
Accidental	19.1	3.6	2.7	3.9	8.3	19.0	29.6	45.1	47.5	54.3	55.4	80.7	71.6	41.8	38.1	31.1	29.9	36.0	34.9	9.9
Unknown	0.1	0.0	0.0	0.0	0.0	0.1	0.3	0.4	1.1	1.6	1.3	3.8	4.2	3.0	4.0	4.3	3.3	4.3	2.1	0.3

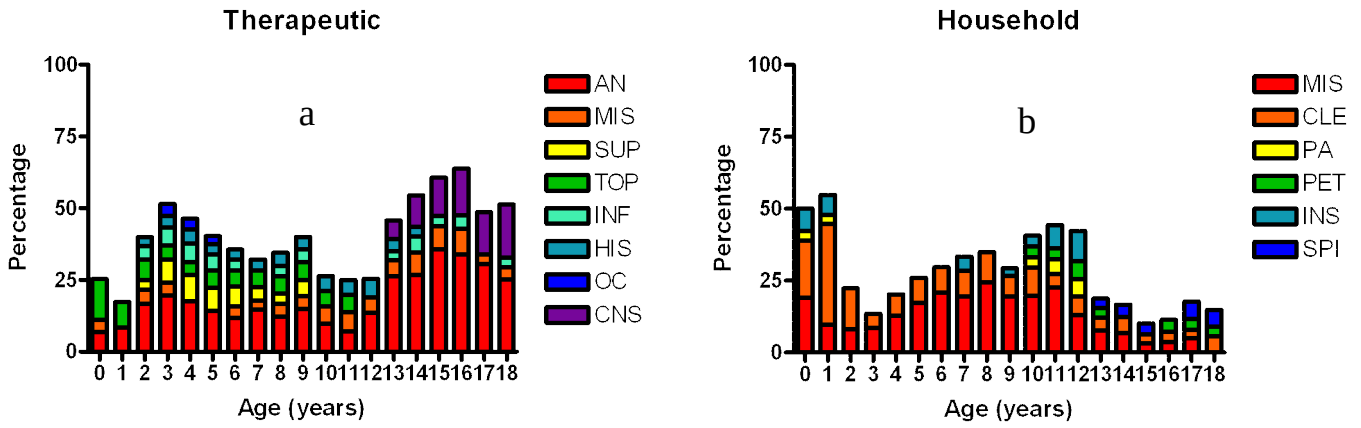

Figure 3. The percentage of agents representing ingestions at each of the age groups (totals summed over all study years)
a) Therapeutic agents. AN = analgsics and antiinflammatories, MIS = miscellaneous, SUP = supplements, TOP = topical products, INF = antiinfectives, HIS=antihistamines, OC=oral contraceptives, CNS=antidepressants, hypnotics and antipsychotics.
b) Household agents. MIS=miscellaneous, CLE=cleaning products, PAI=paint, PET=petrol, INS=insecticides, SPI=spirits.

The "household miscellaneous" category appeared in all age groups, which this category included silica gel, pen ink, aromatherapy oils and other products found, often with easy access, in almost every home. Another significant category was the "therapeutic analgesics", which for the younger age groups; this comprised of mostly liquid formulations, whereas for the older age groups this is mostly solid dosage forms (including cases of intentional overdose). "Therapeutic topical" products are also well represented in many age groups, types of products here included aqueous cream and other creams that may be found easily, but are generally not of high toxicity.

As shown in Table 3, the reason for poisoning showed trends with respect to age. While there were documented intentional exposures through all age groups, its frequency did not become greater than 2% until age of 10 and peaked at 63.2% at age 16. An increase in drug abuse/misuse was also seen from cases with 12 years of age and older.

DISCUSSION

A large number of calls involving children and adolescents are received by the NPC annually, and over the study period (2000-2009) this showed an increasing trend. The relative proportion of males and females remained constant over the period with males being overrepresented in every year investigated. This finding is in contrast with studies conducted in Australia and Norway (9,10). In this respect, Lam showed that that males were more likely to be involved in poisonings at ages under 10 years and females more likely to be involved over the age of 10 years in New South Wales (9), while; Rajka et al. showed that in cases under 8 years of age more males were implicated in poisonings while and females were more implicated above that age group in Oslo (10).

Consistent with other international research, children under five represented the majority of exposures (3,11,12). Two other age-groups (13-years and 18-years) showed an increased risk in this study. This may be explained by the increase in risk taking behaviour displayed by adolescents and the role of alcohol and drugs (13). However, the low number of calls seen among adolescents between 14 and 17 years of age should be clarified in further studies.

The increase in poisonings from antidepressants/ antipsychotics/hypnotics and opioids associated with higher ages in this study which is similar to an Australian study that showed psychotrophic drugs were more likely to be associated with poisonings in the 15-19 year age group (9). The drivers for this shift may be change in access to products and change of intention. In this regard, younger children may access "common" items such as cleaning products and vitamins whereas older children may access petrol and solid dose formulations (13). Moreover, younger children are more likely to have exploratory ingestions whereas older children are known to ingest agents for specific reasons (14), such as intentional ingestions or abuse/misuse as shown in Table 3.

The high number of incidents involving analgesics does not necessarily mean that these products are more problematic. It may simply because they are more widely available. In New Zealand, liquid paracetamol must be issued with a child resistant closure (CRC), this has been shown to be effective in reducing poisonings (15), however, there is evidence that parents overestimate the protection given by a CRC (15), and so precautions surrounding storage and administration are still important. The increased uses of CRCs have previously been shown to reduce, but not eliminate, poisoning risks (9,15).

LIMITATIONS

There are some limitations to this study. The data used in this study was collected during exposure calls to the NPC (whose primary function is to provide advice). For this reason, not all of the study variables were present for each call logged. A further limitation is that the severity of the exposure was not recorded. Moreover, data regarding hospital admission or further outcomes was not collected. These issues are discussed in detail by Hoffman (16).

CONCLUSION

This study showed that accidental (and intentional) ingestion is still an issue for children and adolescents in New Zealand. Specific strategies are needed to be targeted to the 1) products implicated in a high number of poisonings and 2) to children at the different ages. Specifically with the younger age groups, when poisonings are most prominent, analgesics featured significantly due to easy access. Hence, as these medications are commonly available in many households, caregivers need to be reminded about the storage and care during use. In contrast, psychotropic agents were more commonly implicated with older children, as part of risk taking behavior, which is of concern given their potency.

ACKNOWLEDGMENT

We would like to acknowledge Vicky McLeod (research assistant) for her assistance with data accuracy checks and figures.

Conflict of Interest: None to be declared.

Funding and Support: The research was supported by the Pharmacy School, University of Otago.

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