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Safekids Aotearoa Position Paper:
CHILD POISONING PREVENTION

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Safekids Aotearoa
5th Floor, Cornwall Complex,
40 Claude Road, Epsom, Auckland 1023
PO Box 26488, Epsom, Auckland 1344
New Zealand
P. +64 9 630 9955 F. +64 9 630 9961

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If you have further queries, call the Safekids Aotearoa Information Service on +64 9 631 0724 or email Info@safekids.nz.

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Summary

Children are naturally inquisitive, and learning by exploring their environment is an integral and important part of a child's growth and development. They are uniquely vulnerable in their potential to experience unintentional poisoning, due to their changing developmental skills, and their bodies' inability to withstand the effects of toxins. Unfortunately children aged 0-14 years are too young to differentiate between safe and unsafe substances and can poison themselves through innocent exploration of their environment, with little concept of the potential danger to themselves. Consequently children are reliant on adults to ensure their safety and wellbeing.

The number of deaths from unintentional poisoning in children has reduced both nationally and internationally over time, and is attributed to multiple factors including education, identification of poisonous substances and products, product modification, the emergence of child resistant packaging, with associated packaging standard development, supportive legislative changes and the advent of poison control centres.

Despite this, poisoning remains one of the major causes of childhood injury in New Zealand. In the time period 2004-2011 a total of 13 children aged 0-14 years died as a result of unintentional poisonings. In the period 2006-2013 hospitalisations as a result of poisoning was the third most common reason children aged zero to four years were hospitalised due to an injury.

In New Zealand in the eight year period 2006-2013, in children aged 0-14 years:

- 2499 children were injured severely enough to be hospitalised due to unintentional poisoning
- Children aged between zero to four years accounted for the highest number of hospitalisations due to poisoning (82.5 percent), with children aged one to two years accounting for 71 percent of the hospitalisations in the zero to four year age group.

In New Zealand in the five year period 2008-2012:

- The National Poisons Centre received 71,818 phone enquires for children aged 0-14 years, which accounted for 41 percent of their overall enquiries.
- Poisoning enquiries regarding children aged exactly 24 months of age accounted for the highest overall percentage of calls (approximately 17 percent).

Safekids Aotearoa's recommendations

Safekids Aotearoa recommends that the following strategies are supported to reduce the risk of injury and death from poisoning for young children in particular:

- Always store toxic substances and medications (both children's and adults) out of children's sight and reach, in a high locked cupboard.
- The use of cupboard safety latches and locks to support the safe storage of medications, other hazardous substances, such as household cleaning products is advocated.
- All household medications (both children's and adults) and other toxic substances and products are immediately returned to their normal storage location after use.
- Guidance on poisoning prevention strategies to parents/caregivers in their home environment, during Well Child/Tamariki Ora visits is given. Information on children's upcoming developmental changes which may impact on children's ability to access toxic substances/poisons should be included.
- The provision of cupboard safety latches to parents/caregivers during such visits, and investigations on how to facilitate assistance to install them if required are undertaken.
- Comprehensive advice on medication dosage, storage requirements, disposal methods, and their toxicity levels to children is given to parents/caregivers in clinical and pharmacy settings. It is envisaged that such communications would be undertaken in an individualised manner facilitating their understanding and appropriate for their level of health literacy.
- Expansion of the range of medications, over-the-counter products, and hazardous substances or products that are known to be toxic to children that are required by law to have child-resistant packaging (CRP).
- In the interim, a subsidy is provided so that medication and over-the-counter therapeutic products can be dispensed with a child resistant cap and provided either free of charge or at a reduced cost to assist those who cannot afford to purchase this option otherwise.
- Ongoing public educational initiatives to reinforce the limitations of child resistant packaging are undertaken, notably they are CHILD RESISTANT NOT CHILD PROOF.
- Development of a conjoint Australian and New Zealand standard to guide child resistant packaging requirements in New Zealand.
- Continue research into new developments and refinements in product packaging/design that reduce the risk of children gaining access to poisonous substances.
- Monitoring of the levels of unused medications (including both prescribed and over the counter products) by health organisations and other authorities is advocated to guide future prescribing and dispensing practices.
- Information on how to safely dispose of toxic substances and products at a local community level is readily available, accessible and affordable to the general public. Specific targeting of education on safe disposal methods to caregivers, parents and extended family members is advocated.
- Contact the New Zealand National Poisons Centre in a suspected or known poisoning event – phone free of charge on 0800 POISON or 0800 764 766. Parents and caregivers of children are informed of this service during Well Child/Tamariki Ora visits and/or during contact with health professionals.

Remember to be S.A.F.E.

STORE all medicines, chemicals and cleaners in their original container and lock them in cupboards.

ASK your pharmacist for safety caps on medicines - there may be a small cost.

FOLLOW the dose instructions from your doctor or pharmacist when giving medicine to children.

ENSURE you read and follow safety instructions on medicines, chemicals and cleaners.

In case of a poisoning (24/7 in NZ) call: 0800-POISON.

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1. Introduction

A poison is any substance that can cause harmful effects to the body when ingested or swallowed, touched, sprayed or splashed onto skin or into the eye, or inhaled [1]. Poisons are commonly found in a solid or liquid form, but can also be inhaled via a spray, gases, and fumes or via smoke [1,2]. Poisonous substances can be manmade or occur naturally in the environment, as in the case of poisonous plants. Some of the most common and dangerous substances or products which can be toxic to children include: medicines and drugs, common household products and cleaners, personal care products or cosmetics, plants and environmental poisons such as lead paint or pesticides [1,3]. Poisoning events can occur due to acute or chronic exposure [1,4].

Developmental changes impact on children's cognitive and physical skills and their body's ability to withstand the effects of toxins alter as they age. These factors impact on the potential likelihood for and outcome of a poisoning event [1, 4, 5]. Unfortunately children are too young to differentiate between safe and unsafe substances and can poison themselves with little concept of the potential danger [4, 6, 7]. Children can be attracted to bright, nice smelling, attractively packaged items, and items in packaging resembling food items [1, 8, 9], or that they see others using in their immediate environment [6, 10]. Placing objects in their mouths (commonly referred to as mouthing) and tasting products and substances supports learning, and is frequently practiced by very young children, further increasing the risk of poisoning [4, 10].

Whilst caregivers engage in poison prevention efforts, some caregivers have been found to tailor safety efforts according to their child's interests and perceived abilities, rather than their potential activities [11]. Children's capabilities change rapidly as they grow and can quickly be able to access things where previously they have been unable to. During times of developmental transition in a child's physical (such as when progressing from crawling to walking) and cognitive development, a child is at an increased risk of accessing toxic substances [1, 7, 12, 13]. Children's motor skills develop prior to their capacity to reason that a substance or product may be dangerous to them [60]. It is important to know that children's progress through their developmental milestones can vary between children, so what a child of a certain age can access may be different for another child the same age [7]. Parents and caregivers may underestimate a child's determination, resourcefulness and abilities [10, 11, 13, 14]; conversely adults may overestimate a child's ability to follow instructions and to fully understand safety instructions [11, 13, 14].

Poisoning events can also be influenced by a multitude of factors such as a caregiver's lack of awareness about how toxic an item can be to a child, the level of adult supervision, and both the child's ease of access and opportunity to obtain the substance or product and how easy any packaging is to open [15, 16, 17].

The number of deaths from poisoning in children in developed countries has reduced both nationally and internationally over time [18, 19, 20, 21]. This reduction is attributed to poison prevention initiatives including education, identification of hazardous substances and products, product modification, and the emergence of child resistant packaging (CRP), with associated packaging standard development, supportive legislative changes, and the advent of poison control centres. Despite this, poisoning remains one of the major causes of unintentional childhood injury [1, 20, 22].

Further reduction in the number of poisonings in children requires a multifaceted and concerted effort from parents and caregivers, immediate and extended family members, key stakeholders including government and non-government agencies, industry representatives, and the wider community [1, 23, 24]. With continued emergence of new products and substances, and changes to the chemical compositions of common products such as household cleaners, vigilance and on-going enforcement is required to identify when such items have the potential to be toxic to children, or those that are found to not meet existing regulations [1, 25]. Surveillance and monitoring of new and existing products is crucial, in order to assess their potential toxicity risk to children. Key organisations such as the Ministry of Health (MoH) and the National Poisons Centre (NPC), NZ Customs, the Environmental Protection Authority (EPA), Medsafe, and the Ministry of Business and Innovation (MBIE) have a key role to play in this area.

This position paper aims to:

- Describe the epidemiology of unintentional poisoning among children in New Zealand
- Identify the policy and legislative context surrounding poisoning prevention in New Zealand
- Summarise key strategies to reduce unintentional child poisoning among children in New Zealand

2. Child poisoning

Child Poisoning in New Zealand

The data for children aged 0-14 years who were hospitalised due to unintentional poisoning in the eight year time period 2006-2013, and mortality data for the eight year time period 2004-2011 were sourced from Ministry of Health data collections, by the Injury Prevention Research Unit (IPRU), University of Otago, and analysed by Safekids New Zealand [26]. Poisoning is categorised as being either unintentional in nature, intentional, or undetermined (where the intention status is unclear or it cannot be determined if a lethal outcome was intended) [27]. Unintentional poison-related child hospitalisations were identified using ICD-10 external causes of morbidity and mortality codes for 'Accidental poisoning by and exposure to noxious substances' (X40-X49) [26] (See Appendix 2).

To provide a picture of the community burden of poisoning beyond hospitalisations, data was also sourced from the National Poisons Centre (NPC). The NPC is New Zealand's Poison and Hazardous Substances Information Service and provides a 24 hour, seven day a week, free telephone service for poison-related emergencies and enquiries – both urgent and non-urgent [28]. NPC data on poison-related phone enquiries for the period 2008-2012, for children aged 0-14 years, were assessed to illustrate the circumstances surrounding the enquiries. This included information on where the poison event occurred, the outcome and the substances/ products involved [29].

Injury Prevention Research Unit (IPRU) mortality data

During the eight year period from 2004-2011 there were thirteen unintentional poison-related deaths. This included nine children aged 10-14 years, six of these deaths were due to 'other gases and vapours'. The remaining deaths occurred in children less than ten years old [26].

Injury Prevention Research Unit (IPRU) hospitalisation data 2006-2013

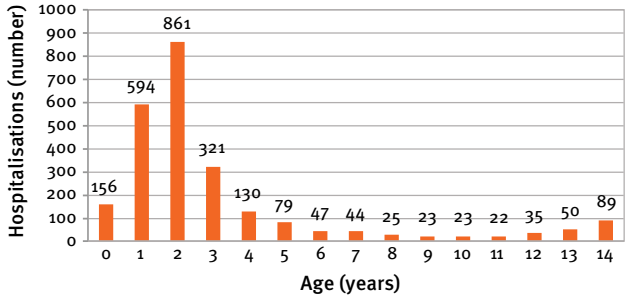
In the eight year period from 2006-2013 there were 2499 hospitalisations for unintentional child poisonings in New Zealand, for children aged 0-14 years. Children aged between zero to four years accounted for 82.5 percent of these hospitalisations, whilst children aged 5-9 and 10-14 years accounted for 8.7 percent and 8.8 percent respectively. When examined over different age groupings children aged one to two years of age accounted for 58 percent of all poison-related hospitalisations [26] (See Figure 1).

Males accounted for 55 percent of unintentional poisoning–related hospitalisations [26]. New Zealand European children aged between 0-14 years accounted for 54.3 percent of all unintentional poison-related hospitalisations between 2006-2013, Tamariki Māori for 31.1 percent, Pacific children for 8.3 percent, Asian children for 4.4 percent, and Other children for 1.9 percent [26].

In the time period 2006-2013 the overall crude hospitalisation rate for unintentional poisoning of New Zealand children aged 0-14 years were 34.6 per 100,000 persons per year. The greatest burden for hospitalisations occurred with children aged 0-4 years with 84.3 per 100,000 persons per year, 9.3 per 100,000 persons per year for children aged 5-9 years, and 9.0 per 100, 000 persons per year, for children aged 10-14 years [26]. Overall in children aged 0-14 years a general downward trend in poisoning related hospitalisations is evident. In 2006 there were 43 hospitalisations (per 100,000 persons), in comparison to 26.7 hospitalisations (per 100,000 persons) in 2013. [26].

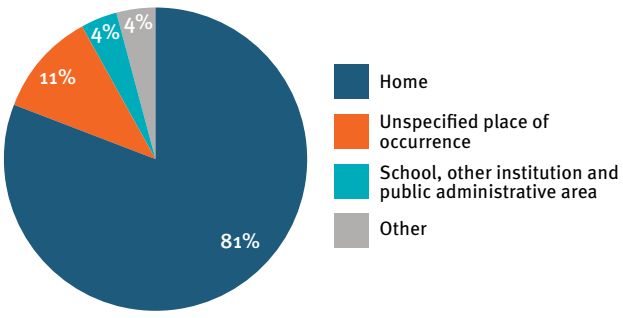
The majority of children were poisoned in a home environment. Overall 84 percent of all poison-related events leading to hospitalisations occurred in the home environment for children aged zero to four years, 78 percent for children aged five to nine years and 56 percent of hospitalisations for children aged 10-14 years [26] (See Figure 2 for overall 0-14 year old children's place of poisoning event).

Figure 1: National Child Poison-Related Hospitalisations by Age (2006-2013)



Source: IPRU, University of Otago [26].

Figure 2: Frequency of Child (0-14 years) Poison-Related Hospitalisation, by Place (2006-2013)

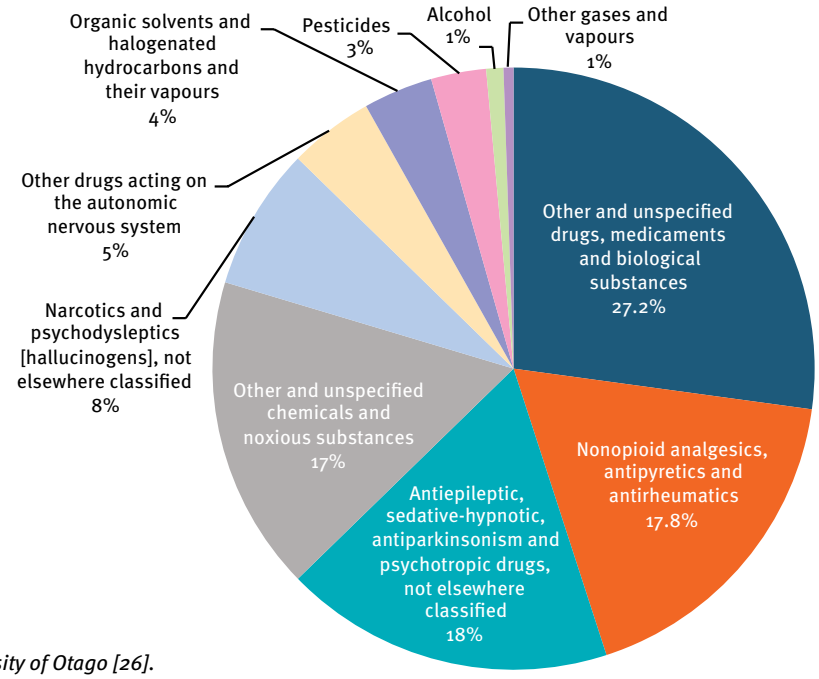


Source: IPRU, University of Otago [26]

The substances or products implicated in poisoning events were categorised using ICD 10 External Cause codes for 'Accidental Poisoning by and Exposure to Noxious Substances' (X40-X49). Overall hospitalisations due to medications predominate over all standard age groupings. Figure 3 shows hospitalisations of children aged 0-4 years by percentage over individual codes and Table 1 shows numbers of hospitalisations over standard age groupings. Appendix 2 provides a breakdown of substances in individual X40-X49 codes [26].

Children from all ethnic and socioeconomic groups are affected by unintentional poisoning; however the burden of unintentional poisoning is not evenly distributed. A review of poisoning hospitalisations for children aged 0-14 years (2006-2010) in New Zealand by Craig and colleagues found a socioeconomic gradient in poison-related hospitalisations. Hospital admission rates were significantly higher for children living in areas of average to higher deprivation (NZ Dep decile 5-10), also for males, and for NZ European children and Tamariki Māori in comparison to Pacific and Asian/Indian children [30].

Figure 3: Children Aged 0-4 Years Poison-Related Hospitalisations, by Substance/Product Type as Defined by ICD External Cause of Poisoning Codes (2006-2013)



Source: IPRU, University of Otago [26].

Table 1: Poison-Related Hospitalisations, by 5 Year Age Group (2006-2013)

ICD 10 External Cause Code Categories - Accidental Poisoning by and Exposure to	Age in Years			Total
	0-4 years	5-9 years	10-14 years	
Other and unspecified drugs, medicaments and biological substances	560	49	20	629
Nonopioid analgesics, antipyretics and antirheumatics	368	20	29	417
Antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified	365	59	52	476
Other and unspecified chemicals and noxious substances	349	58	39	446
Narcotics and psychodysleptics [hallucinogens], not elsewhere classified	158	10	17	185
Other drugs acting on the autonomic nervous system	94	6	<5	104
Organic solvents and halogenated hydrocarbons and their vapours	77	0	8	85
Pesticides	61	9	5	75
Alcohol	19	<5	30	53
Other gases and vapours	11	<5	15	29
Total	2062	218	219	2499

Source: IPRU [26].

National Poison Centre (NPC) call log data

During the five year period from 2008-2012, the NPC received an overall total of 173,963 poison-related phone enquiries, of which 41 percent (71,818) involved children aged 0-14 years. Fifty-three percent of calls regarded male children, in two percent of children the child's gender was unknown [29]. The NPC categorises poison-related phone calls into child exploratory poisoning, unintentional poisonings, therapeutic error and intentional poisonings events. Intentional poisonings are included within the NPC data accounting for one percent of all phone enquiries, but are not specifically identified as such in the following review of the data [29].

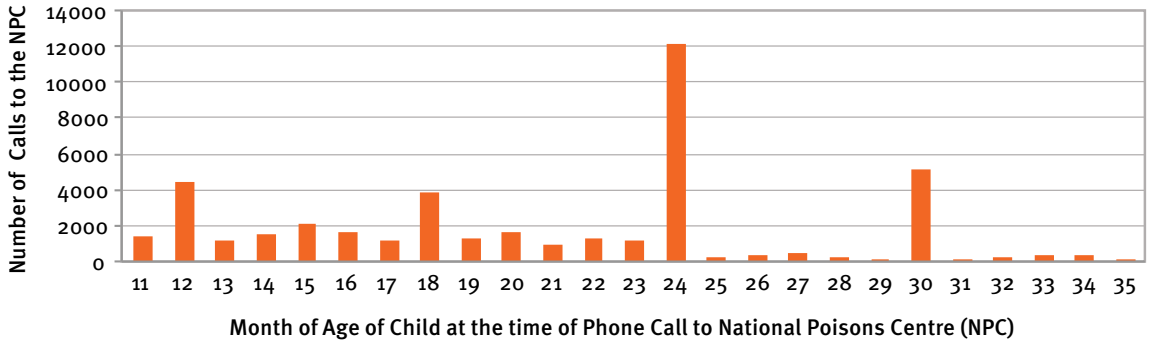
Figure 4 shows the frequency of poison-related phone enquiries to the NPC concerning children aged between 11-35 months of age, revealing the peak of age of children involved being 24 months [29]. Children aged zero to four years accounted for 89 percent of calls, five to nine years for seven percent, and children aged ten to fourteen years accounted for four percent (in the 96 percent of calls where age was identified) [Figure 5] [29].

Of the 71,818 child poisoning calls received, 83 percent were able to be managed with over-the-phone assistance from the NPC, and the remaining 17 percent were referred for medical assistance [29]. In 96 percent of the calls the event was reported to have occurred in the home environment. The most common routes of exposure to a poison/hazardous substance were ingestion/swallowing (92 percent), followed by contact with the eyes (3 percent), skin (2 percent), inhalation (1 percent), and via a bite or sting (0.4 percent) [29].

Figure 6 shows the proportions of categories of substances/ products related to enquiries. For more in-depth information on the categories of enquiries and particular substances/ products involved within each category, see Appendix 3.

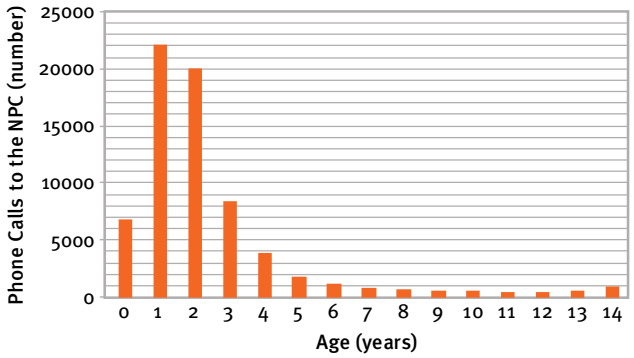
A 2013 annual review of calls to the NPC for children identified the top 24 individual substances implicated in reported poison events in order of most frequent as follows: Paracetamol, Ibuprofen, silica gel, toilet cleaner and sanitizer, black nightshade, glow sticks, mushrooms, Diclofenac, folic acid, dishwashing liquid, Codeine, unidentified plants, nappy rash/ antiseptic cream, Iodine tablets, Amoxicillin, Prednisone, bubble blowing mixture, foam hand wash, liquid ant killer, petrol, Zopiclone, tea tree oil, essential oil, and firelighters. [31].

Figure 4: Poison-Related Phone Calls to the National Poison Centre by Child's Month of Age at 11-35 months (2008-2012)



Source: NPC [29].

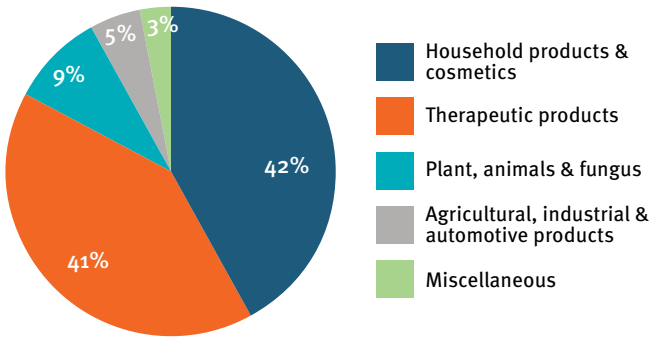
Figure 5: Frequency of Poison-Related Phone Calls to the National Poison Centre by Child's Year of Age (2008-2012)



Source: NPC [29]. Please note: includes the ninety-six percent of calls where the child's age was identified.

Figure 6: Poison-Related Phone Calls to the National Poison Centre by Substance Category (2008-2012)

Source: NPC [29].



International

comparisons

To prevent the greatest burden of child poisoning-related harm hospitalisations, discussion will focus on children aged zero to four years of age, however some of the information will have relevance for older children as well. For further guidance focusing on poisoning prevention for older children and youth, please see the 2013 report from the Child and Youth Mortality Review Committee [20].

Child poisoning patterns in New Zealand are similar to those found in other middle-high income countries [1]. A socioeconomic gradient in poisoning events is identified and is present both within and between lower and higher-income countries both for deaths and admissions [1,32]. Tyrrell and colleagues undertook a population based case control study of poisoning events in children aged below five years who attended primary care general practice facilities for a poisoning event. Children who lived in more disadvantaged communities, compared to more advantaged areas, were significantly more likely to experience both medicinal (P<0.001) and non-medicinal poisonings (P=0.001) [33], which was also found in an earlier United Kingdom study [34].

Circumstances surrounding a poisoning event

Agents involved

Common toxic substances implicated in poisoning may include [2, 3, 35, 36]:

- Children's and adult medications and over-the-counter (OTC) therapeutic products including Paracetamol, anti-inflammatory medications, codeine, cough and decongestant preparations, oral contraceptive pills, antibiotics, topical ointments, asthma medications, antihistamines, antidepressants and cardio vascular medications. Other miscellaneous therapeutic preparations are also implicated such as vitamin and iron tablets.
- Household cleaners including bleach, turpentine, general cleaning products such as disinfectant and toilet blocks, dish wash liquid and powder, washing powder, oven cleaner.
- Other household items including rodenticides (rat/mouse poisons), ant killer, petrochemicals, and essential oils, vapour treatments, turpentine, glue, drain unblocking products, alcohol (also contained in hand sanitizers, perfume etc.), anti-freeze.
- Personal care items such as mouthwash, hand sanitizers, cosmetics, perfumes and nail care items such as nail polish remover.
- Naturally occurring substances or items such as plants, berries and mushrooms, or poisonous bites from insects.
- Other products or substances such as herbicides, petrol, anti-freeze, slug/snail bait.

Age

The age of the child is a key risk factor in poisoning events [7, 33, 37]. Children under the age of five are identified as being most susceptible to poisoning, with those aged between one to four years of age at highest risk of [1, 20, 32]. Schemertmann and colleagues found children aged one, two, or three years old were significantly more likely to be hospitilised for unintentional poisoning (RR=4.0, 5.5 and 2.5 respecitvely), compared to children less than one year of age [7]. The highest numbers of child poisonings are commonly reported in those aged around two years of age [1, 7, 30, 38].

Young children are particularly susceptible to toxins as most substances increase in toxicity as the dose increases relative to body mass. Also as the child grows some toxins are naturally eliminated by enzyme systems in the body that develop as the child ages [1, 4]. Crawling infants and small children are at increased risk of toxins found at low levels such as rodenticide (used to kill rodents) and substances such as cleaning products which may be in use or stored at low levels [1, 4, 17].

Young children in particular access liquid substances more commonly than solid substances [1, 32]. New Zealand National Poisons Centre figures on 'unintentional' and 'child exploratory' enquiries regarding Paracetamol show between 2008-2012 sixty-nine percent of children aged between 0-16 years involved liquid Paracetamol (<5 aged over 15 years) [29]. Poisoning agents are commonly differentiated as either medicinal or non-medicinal [13, 33, 37]. A higher number of younger children are found to be poisoned from non-medicinal products in comparison to medicinal products [13, 17, 33]. This difference is attributed a child's changing developmental abilities influencing their ability to access different types of substances and products as they age [13].

A study undertaken in New South Wales of children aged zero to four years, found 83 percent of the children were admitted due to medicinal substances and 17 percent due to non-medicinal substances. Children aged 12-17 months were significantly more likely to be admitted for a non-medicinal substance, whist children aged 24-41 months were more likely to be admitted due to a medicinal substance [13]. The New Zealand National Poisons Centre report calls involving children aged 0-3 years are more likely to about chemicals and household products and that calls regarding children aged 4-6 years are more likely to be about medicines and cosmetics [39].

Gender

Generally boys have been reported to experience a poisoning event more often than females differing across age groups [1, 7, 13, 30, 32]. A retrospective review of hospitalisation of children aged one to three years, between 1994 to 2005 in New South Wales, found rates were significantly higher for boys than girls at three years of age(RR=1.46, 95% CI 1.31 to 1.62) [7]. A Queensland review of Emergency Department attendances for non-medicinal poisonings found boys accounted for slightly more presentations in comparison to girls (53 percent versus 47 percent respectively) [17].

Place/Location

Children commonly gain access to toxic substances within their home environment [38] particularly children under five years of age [3]. Ozanne-Smith and colleagues found 94 percent of calls to a Melbourne Poison Centre or Emergency Department visits were the result of a child gaining access to a toxic substance or product in their own home, or another home [40]. The Queensland Injury Surveillance Unit found 96 percent of exposures to medicinal products [2332] of children aged five years and below who attended emergency departments during 1999 to 2007 took place in a home environment. Of these thirty one percent of the children gained access to the product in the kitchen and twenty-nine percent in the bedroom [41]. Of non-medicinal ingestions [1884] during 1998-2004, 93 percent took place in a home environment, with the highest amount occurring in the kitchen (22%), with the bedroom and garden following (11% respectively) [17].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3. New Zealand legislative requirements and expectations

Legislation and standards contribute to the prevention of poisoning from medicines and hazardous substances in New Zealand. Relevant legislation largely relates to the use of packaging that is child resistant, and is appropriate given the toxic nature of the substance involved. Legislation includes: *the Hazardous Substances and New Organisms (HSNO) Act 1996, the Health Act 1956, the Food (Safety) Regulations 2002, the Medicines Regulations 1984, and the 1998 Code of Practice for Child Resistant Packaging and Toxic Substances*.

Hazardous Substances and New Organisms (HSNO) Act 1996

The Hazardous Substances and New Organisms (HSNO) Act 1996 makes provision for the identification of substances as hazardous, and outlines requirements for substances based on the hazardous substance group they are categorised in [42]. Group standards for a group of hazardous substances can contain a requirement for child resistant packaging to reduce the risk of harmful exposure. The Environmental Protection Authority (EPA) is mandated to address enforcement and compliance issues as guided within the Act. The Act requires all poisonings due to hazardous substances be reported to the Medical Officer of Health for follow-up and action. The *'Hazardous substances surveillance system (HSSS)' includes the 'Hazardous substances disease and injury reporting tool (HSDIRT)'* for primary health care clinicians. Both systems facilitate the reporting of cases to enhance the capacity of health authorities to monitor and react to potential safety concerns [43].

Health Act 1956

The *Health Act 1956* requires all poisonings due to lead poisoning or poisoning arising from chemical contamination of the environment to also be reported to the Medical Officer of Health [44].

Food (Safety) Regulations 2002

The *Food (Safety) Regulations 2002* have provisions to prevent the misuse of containers commonly used for food, and seeks to minimise the risk of unintentional poisoning by a person misinterpreting that the substance within a container is food. This regulation applies to organisations, commercial enterprises, as well as members of the general public, including parents and caregivers [45].

The regulations state that: "No person may put, keep, or sell any disinfectant, antiseptic, or detergent, or a substance that could cause poisoning, in any container or package that:

a. *Bears any brand, picture, word, mark, or statement*
   i. *indicating the presence in the container of any food; or*
   ii. *that is likely to mislead any person into believing that the contents of the container are intended for the purposes of human consumption; or*
b. *Is of a distinctive type in which articles of food have been commonly or are currently being sold, whether or not it bears any brand, picture, word, mark, or statement." [45, p.5.].*

Medicines Regulations 1984

The *Medicines Regulations 1984* require a number of medicines to be enclosed in a *'safety container'*, which is required to be *"reasonably resistant to attempts by young children to open it"* [46, p.9]. Notably under the regulations, blister packaging is classed as a safety container [46].

There is also provision within the regulations that an authorised prescriber can state the prescription is not to be dispensed in a safety container, or if the pharmacist deems that a safety container should not be used due to a recipient's age or infirmity, the pharmacist is also not obliged to supply the medicines in a safety container [46].

1998 Code of Practice for Child Resistant Packaging and Toxic Substances

The *1998 Code of Practice for Child Resistant Packaging and Toxic Substances*, produced by the Ministry of Health guides importers, manufacturers, packers and retailers of toxic and corrosive substances on what substances should be packaged in child resistant packaging. It lists 18 toxic chemicals that require CRPs [47]. These chemicals include: alkaline salts in dishwasher powder, gels or tablets, cineole, clove oil, eucalyptus oil and preparations containing 50 percent eucalyptus oil, eugenol, liquid hydrocarbons packaged as kerosene, lamp oil, mineral turpentine, thinners, reducers and white petroleum spirit or dry cleaning fluid, hydraulic acid, tea-tree oil, methylated spirit, methyl salicylate and preparations with 50 percent methyl salicylate, oil of turpentine, potassium hydroxide, sodium hydroxide, potassium or sodium hydroxide in oven, hot plate and drain cleaners, methyl alcohol at a concentration greater than or equal to two percent and dichloromethane at a concentration greater than or equal to one percent [47].

There is no current New Zealand standard to guide child resistant packaging.

New Zealand had an approved safety standard for child resistant packaging: *(NZS 5825:1991) Child Resistant Packages* until it was withdrawn in September 2014 [48]. This standard outlined product manufacturing and testing requirements to ensure a CRP was effective. The standard also covered medicinal packaging's that was closable and non-reclosable, and packaging for other products that were reclosable. Testing included assessing the percentage of large groups of children (aged between forty-two to fifty-one months of age) and adults that could open the package within a set time frame of five minutes. An effective reclosable CRP was defined by at least 85 percent of the children tested being unable to open the package without prior demonstration, and at least 80 percent of the children still being unable to open the package following a demonstration of how to disengage the cap, after previously trying [48].

4. Strategies to reduce child poisonings

Introduction

The recommendations in the following sections focus on the prevention of child unintentional positioning for children aged 0-4 years. These recommendations may also be applicable to children in older age groups.

Supervision of children and adjustments to the environments where children live, play and visit are crucial to reducing the risk of unintentional poisoning. Education of caregivers and extended family members therefore has a key role to play in the prevention of childhood poisoning [16, 25]. The safe design, packaging and provision/dispensing of products is identified as essential to support caregivers' efforts to minimise the risk of poisoning for their children. Design improvements to packaging should be supported by: regulation and education by government and industries producing and distributing toxic substances (including clear packaging, adult warning labels, community education, and actions to increase the accessibility and affordability of preventative methods to minimise barriers in the uptake of preventative measures) [1, 11]. International evidence in European countries demonstrates that countries with the least developed poisoning prevention initiatives and enforcement of evidence-based national policies, exhibited a forty percent greater risk of poisoning in children and adolescents [49]. A comprehensive multi-faceted approach is necessary to minimise the risk of childhood poisonings [1, 16].

A. Safer products, with supportive legislation

Child resistant packaging

Internationally the use of child resistant packaging (CRP) has reduced child poisoning-related hospitalisations, and deaths [18, 19]. However international evidence suggests that child-resistant packaging legislation should include a wider range of products including prescription and over-the-counter medications that may be toxic to children [1, 38]. Such packaging seeks to make it difficult for a child aged less than five years to open and obtain a toxic amount of a substance in a short period of time [3, 48, 50] and includes the use of child resistant caps (CRCs) and blister packaging. Child resistant caps require the combination of three actions to open, for example: 1) squeeze lids sides together, while 2) pushing down on lid and 3) twisting lid [41]. This combination of actions is intended to be too complex for the majority of young children to carry out, limiting the risk of young children quickly gaining access to the toxic contents within [3]. It must however be remembered that whilst child resistant packaging is an integral part of poisoning prevention initiatives, it is not a panacea for stopping all poisoning events. Child resistant caps ARE NOT CHILD PROOF – only CHILD RESISTANT! [3, 50].

Blister packaging in particular does not reduce the risk of poisoning to children. It may reduce the quantity of medication ingested, but many tablets used in blister packages are of sufficient toxicity to cause harm to a young child even if only one or two tablets are ingested. Blister packs are highly transportable, and are commonly implicated in poisoning events where they have been easily accessed in places such as handbags [1, 10, 41]. Barker and colleagues found that fifty-six percent of caregivers of eighty children aged below five years of age (who contacted the Queensland Poisons Centre) reported the children had gained access to medications via blister packs. Of note, in the 35 children where the medications involved were deemed to have a higher level of toxicity, 79 percent of these children accessed the medication from blister packs and six percent from multi-dose pharmacy packs [41].

The challenge of using child resistant caps by people with disabilities or the elderly has been acknowledged. This challenge has been found to impact on their appropriate use [10]. Some adults transfer the contents into another container, or leave the lid on but partially closed or off altogether. Increasing use of multi dose storage containers/pill boxes or dispensed blister packs put children at increased risk of accessing large amounts of different types of medication at any one time [1, 41]. A factor that can affect the ability for the lid rim of a CRP to work properly is a crust that can develop with a build-up of contents drying in the closure mechanism. Ensuring the lid mechanism is closed properly is crucial [38, 41].

A New Zealand study found that in 96 parent/caregivers questioned about over-the-counter liquid analgesics, over half thought that CRC's would 'never' be able to be opened by children. Hence revealing a considerable overestimation of the protective qualities that CRC's offer [51]; this aligns with similar findings in another study [11]. This is obviously of concern given that testing procedures allow for a percentage of children to be able to open the CRP's independently on a first try, and indeed after being shown how to open them [48]. It is crucial that adults are not lulled into a false sense of security by the presence of CRP's.

A 2013 report by the Environmental Protection Authority (Te Mana Rauhi Taiao) found children aged between 0-4 accounted for the highest age group hospitalised for unintentional and unknown hazardous substance exposures during 2010-2011. Of concern is the fact that the most common substances implicated in the poison-related hospitalisations are sold with CRCs. It is necessary therefore to undertake other safety precautions including safe storage [36]. Ongoing education and initiatives raising awareness are imperative to dispel any misunderstandings regarding the protective qualities that child resistant packaging offers [38]. Parents have also been found to presume that substances without warning labels or CRC's are not toxic to children [11, 14].

Packaging appearance

New Zealand research has examined the similarities in appearance between common food items, such as milk and sweet drinks, and household detergents and cleaners [8, 52]. Many common household cleaners and detergents use similar shaped packaging, colours and labels to food items (See Figure 1).

The New Zealand Food (Safety) Regulations 2002 stipulate that the packaging of any non-consumable substance capable of causing poisoning must not mislead a consumer to think that the product is for human consumption. Packaging of non-consumable substances such as cleaners and chemicals should not resemble the packaging design of a food product [45]. For young children, differences in the appearance of food and chemical product packaging require language skills well beyond a young child's capacity, and are too subtle to detect [8, 52].

Continued research, refinement and development of new and innovative child resistant packaging designs are necessary in order to minimise the risk of unintentional poisoning from confusion between toxic substances and food items. Monitoring and enhancement of standard requirements and the expansion of mandatory requirements for child resistant packaging to a wider range of substances and products implicated in child poisoning events is advocated [1, 53].

B. Hazard awareness and education

Increasing awareness of the injury risk posed by toxic substances and products is necessary to reduce the risk of unintentional poisoning in children.

Home-based education

It is important that parents and caregivers understand the toxicity of items such as medications and common household products, and how their child might gain access to them. Parent/caregiver perceptions of the toxicity of a substance influences how immediately and safely they are stored [15, 16]. Home-based interventions involving education on poisoning hazards can increase child and parent/caregiver knowledge of poisons [54, 55, 56] and offer anticipatory guidance on children's upcoming developmental changes which may increase their risk of accessing toxic substances or products [5, 7, 13].

A study undertaken in the United Kingdom reported (in 763 caregivers of children aged between 12-35 months) medicines were stored at or above eye level more frequently than cleaning products. Parent reports revealed that dishwasher products, toilet cleaner, oven cleaner, oral contraceptives, essential oils and bleach were products most likely to be stored in an unsafe manner [15]. Parents who considered dishwasher tablets, essential oils, turpentine and ant/rat bait more harmful were found to store these products in a safer manner. Misconceptions about the toxicity level of some medications and household products was evident with both over and under estimation of toxicity levels found i.e. twenty percent of respondents did not realise that iron tablets were potentially toxic to children [15].

Home-based educational interventions to increase safe storage of medication and cleaning products have been found to be effective in increasing safe storage behaviour [54, 55, 56]. A review of 15 studies found families who received home safety interventions were significantly more likely to store cleaning products safely in comparison to control group families who did not receive home safety interventions (OR 1.55, 95% CI 1.22 to 1.96). Those who were provided with cupboard, drawer or cabinet locks, as well as education were found to be more likely to store cleaning products in a safer manner (OR 1.87, 95% CI 1.28 to 2.72), in comparison to those who received education only (OR 1.13, 95% CI 0.92 to 1.40). In relation to the safe storage of medicine, families who received home safety interventions were significantly more likely to store medicines safely in comparison to those who did not receive a home safety intervention [54].

Later research undertaken by Kendrick and colleagues undertook a systematic review focused specifically on the effects of education and the provision of safety equipment on poisoning-prevention practices. In total, eighty studies were reviewed and a meta-analysis of eighteen studies found that home safety interventions increased safe storage of medicines (OR1.57, 95% CI 1.22 to 2.02) and cleaning products (OR 1.63, 95% CI 1.84 to 7.33). Caregivers were also found to be more likely to have their local poison centre number accessible (OR, 3.67, 95% CI 1.84 to 7.33). However there was inconsistent evidence that the interventions impacted on poisoning rates [55]. This finding has been found in other studies and further research has been advocated to investigate if such interventions reduce poisonings in the long term [54, 56].

Figure 1: Similarities between packaging of household chemicals and food products.

Photo by Tulia Moss.

Importantly, Kendrick and colleagues found the interventions did not demonstrate different effects by the child's age, gender, or socio-economic status, concluding that such interventions were unlikely to widen inequalities between different groups of children. The overall conclusion was that home safety education and the provision of safety equipment improves preventative practices. It was also noted that an 'absence of evidence' rather than an 'absence of effect' in such interventions capacity to reduce child poisonings [55].

The inclusion of poisoning prevention messages by health care workers and within developmental assessments such as Well Child visits is required [37, 57, 58]. An evaluation report on the Taranaki Paracetamol Poisoning Prevention Project found that of 138 participants who were provided with poison prevention advice in GP clinics, including free provision of cupboard safety latches found 62 percent reported using or intending to use the latches [59]. Of those who had not already installed the latches one of the reasons cited was "baby still too young to need it", reinforcing the need for continuing focus on providing anticipatory proactive injury prevention guidance to caregivers [59].To support the delivery of poisoning prevention messages within the home setting, information should be provided in a style, language and cultural manner that is appropriate to the age and education level of the parent/ caregiver [14].

Safe and secure storage

The availability of poisoning agents has been found to be associated with an increased risk of poisoning events [1, 40]. Parental supervision is necessary, but enhanced protection is offered when combined with secure storage of toxic substances and products such as medications [1, 25]. It is recommended that toxic products and substances such as medicines, OTC products and household cleaning products are stored out of sight and reach of children in a high locked cupboard [1, 20, 33, 60]. The 'Growing up in New Zealand' cohort study found 72 percent of parents of children aged two, reported medicines and poisonous substances were stored locked out of reach [61]. However child poison-related events are frequently reported to occur when such substances are not stored in their usual location. Such scenarios include when toxic substances are in use or left out to use later, during changes of normal routines such as visitors staying or when moving house, when adults are distracted and attention diverted, and when parents are engaged with household duties or addressing to their personal needs [1, 10, 40, 62].

Accessibility

Access to toxic substances frequently occurs when the substance has been recently used or purchased, currently being used, or being stored in a different storage place at the time of the event [40]. Ozanne-Smith and colleagues in Melbourne in 1993, reviewed 523 cases of poisoning events where children under five years, who either attended an Emergency Department or contacted the Poisons Information Centre. The majority of products were either in use at the time or just purchased and not being stored in their usual place or in their original packaging (75 percent). The most frequent reason why the agent was not stored in its usual place was due to it just being purchased (43.6 percent), organising to use or in use previously (20.5 percent), or in a packaged bag for day use (4 percent) [40].

In approximately sixty two percent of the cases children were alone when they accessed the product. Of those where collateral information was available, (297) caregivers identified that 79.5 percent of the children gained access within five minutes. Caregivers reported undertaking the following activities when the child accessed the product, household duties (50.6%), attending to personal hygiene (8.3%), ten percent were involved in leisure activities, and in approximately eight percent of the time the caregiver was on the phone [40]. In 21.4 percent of the cases the child climbed to gain access to the product. Climbing to gain access to toxic substances including medication has also been reported in other studies [10, 63].

McFee and colleagues found in 200 cases reported to a Poison Control Centre, of children aged under six years who had accessed medications belonged to a grandparent, the child's ease of access was a significant contributing factor ($P<.0001$). Of note in 45 percent of the cases the medications were in CRC's. The average age of the Grandparent involved was 58.7 years and cardiovascular medications (45%), analgesics (42%), and psychotropic medications (16%) were all involved. Children most frequently accessed the medication on tables or countertops (46%) [10]. An American burns study which examined children's abilities to reach onto a kitchen bench, found that 54 children aged between twelve to twenty-four months could reach in at least 20.32 centimetres onto a 91.44 cm kitchen bench top. Children's ability to reach varied within children of the same age [64]. Children also accessed the medications from low shelves (29%), in handbags/purse (17%), in a cabinet or higher shelf (8%), and one percent of children either licked or sucked on grandparents transdermal medication patches whilst they were sitting on their grandparents lap [10].

A review of calls received by the New Zealand National Poisons Centre between 2003-2012 found in 0.75 percent of cases of exposure to chemicals was caused due to mislabelled or unlabelled chemicals not stored in their original container (757) [65]. Children aged below five years accounted for 32 percent, five to ten years for ten percent and adolescents for five percent of calls. The chemicals were more likely to be stored in drink bottles (including water, milk, soft drink and sports drink bottles). Millard and colleagues expressed concern that potentially hazardous household products are more readily available to children when transferred into another container, when there is a requirement for the product or substance to be initially sold with CRC's. The risk of children not being able to identify potential danger is magnified if the chemical colours resemble the colour of the drink normally contained in the bottle [65].

An American study estimated that children aged three to five years presenting to emergency departments (compared to children aged ≤ two years) were found to be 2.87 times more likely to be exposed to a household cleaning product stored in a food or drink container, than from other containers. Interestingly products in spray bottles resulted in a child being eighteen times (95% CI: 13.95-23.92) more likely to have contact with the cleaning product, indicating that spray bottles provide easy access to their content for children [9].

Influences on safe storage behaviour

Environmental, personal and structural barriers to undertaking recommendations for safe storage have been identified in research, including limitations to modifying rental accommodation, socio-economic status restricting ability to purchase safety equipment, education and health literacy levels, and lack of awareness of toxicity levels for children of commonly used substances or products [14, 61].

Caregiver's perception of the toxicity of a substance has been identified to influence their perceptions on how to safely store a substance or product [1, 11, 66]. Conroy and colleagues study explored the use of over-the-counter medicines in children (range 2 months to 11 years), in the United Kingdom. They found that in 424 caregivers, as a child's age increased, the perception of medication storage security in the home significantly decreased ($P<0.001$). A significant number reported safe storage practices despite only seven percent of the storage locations found to consist of a childproof or locked cupboard [66]. A total of 34% of the parents supplied a description of medications stored in a kitchen, bathroom, or the parents' bedroom. No further details were provided to how exactly the medications were stored in these areas [66].

Reliance on the perception of 'child resistant packaging 'being' child proof' further impacts on safe storage. Gibb and colleagues study in Australia aptly highlighted this issue, a caregiver of pre-schoolers stated "If I've got any products down low I make sure they've got a safety cap and if they haven't I put them up high" [11, pg. 375]. Clear labelling and instructions to inform parents of both the limitations of child resistant packaging, the potential toxicity of a substance or product, and clear instructions on use is important, to all parents including those with English as a second language [24, 25]. It is important for caregivers to recognize the limitation of children's understanding of warning labels as they may not be able to read, misinterpret or not comprehend the significance of such labels (even those that include visual cues) [1].

Safe practices when using medications or over-the-counter therapeutic products

Imitation

A key and crucial aspect of early childhood development is that children learn by observing others and copying their behaviour. This has obvious implications in relation to children observing both adults and their siblings ingesting medication [6, 10]. Rodgers and colleagues found that there was a significant increase in the relative likelihood of oral drug poisonings in Emergency Department attendances in the United States commencing at the onset of complicated imitative behaviours being undertaken by children at 20-23 months of age. They estimated that as many as 30 percent of poisonings in children aged 20-59 months could be attributed to the issue of imitation. One must understand that imitative behaviour does still exist in younger children but their restricted mobility, dexterity and cognitive capacities may restrict their ability to mimic the actions they see around them. They concluded that adults should never ingest medications in front of children [6], a conclusion which is also supported in other literature [10].

Dosing errors

Child poisoning can be the result of unintentional errors in dosing by a parent/caregiver [41, 67, 68]. A review of American Emergency Department attendance in children aged 0-5 years found in 95 percent of medication overdoses the child was unsupervised at the time of ingestions, and that less than an estimated five percent of the cases were as a result of errors made by a caregiver – the majority of which were due to incorrect dosing [22]. Similarly Ozanne-Smith and colleagues Australian study found medication was incorrectly administered by a caregiver in five percent of cases [40].

Paracetamol is one of the most common cause of poisoning in young children, primarily as the drug is commonly used [3, 38, 66, 69]. There are two strengths of Paracetamol available in New Zealand, both requiring different doses according to a child's weight. It is vital that caregivers read the instructions on dosage each and every time a medicine is used [70]. Studies have also shown that parents report administering commonly used medications such as Paracetamol and Ibuprofen more frequently than prescribed [51, 71]. Poisoning can occur as a result of chronic exposure over one or more days or due to excessive dosages being given [1]. In a study in the United Kingdom, Conroy and colleagues [66] found that of 424 parents of children under twelve years, twelve percent admitted giving Paracetamol to children more frequently than four hourly as prescribed, and four percent of parents exceeded the recommend maximum number of doses per day. The authors noted that education is also necessary to inform parents of the presence of Paracetamol in OTC products, where it might not be immediately obvious to unsuspecting caregivers, due to the potential for over medicating a child by using such products [66].

A conjoint New Zealand and Australian study of children suffering acute liver failure and treated in liver transplant units due to Paracetamol toxicity, found out of fourteen cases, at least ten were due to medication error, with children under 5 years of age found to be at highest risk (approximately eighty-six percent of the cases) [69]. Dosing errors can occur due to children receiving Paracetamol too frequently or in excess of the recommended daily dose, receiving an extra (double) dose, receiving other medicines that contained Paracetamol or being administered Paracetamol for too long a period [69]. Factors that can contribute to dosing errors include an inability to read and comprehend the labelled dosing instructions, inadequate measuring instruments, the use of a different strength/concentration to the one prescribed and a lack of knowledge that Paracetamol is present in other cough/cold preparations [69]. The use of inappropriate equipment for measuring liquid medications and OTC products has been identified as a reason why dosing errors occur [66, 67, 68]. Caregivers report using kitchen teaspoons which vary in relation to their size and shape, so are inappropriate to use when measuring medications and OTC products [66, 72].

Inappropriate use of medication (including over-the-counter medication such as Paracetamol) has been reported frequently, with concern expressed regarding the potential toxic effects of such practices [71, 73, 74]. Allotey and colleagues found parents reported using products such as Paracetamol to calm and facilitate sleep in children. They also reported using medication early to avoid sickness developing, rather than

using medication for its intended purpose [73]. Medsafe New Zealand state that health professionals need to be proactive at informing caregivers and reinforcing that Paracetamol is only to be used for pain and fever, and that the correct amount is given at the appropriate frequency [75].

Safekids Aotearoa recommends that parents/caregivers be provided with comprehensive advice on medication and over-the-counter products on dosing and storage requirements, and the toxicity levels to children of such medications, and information on safe disposal methods. Health professionals, including pharmacy staff, are integral in the provision of such guidance , in a manner facilitating parents/caregivers understanding and appropriate for their level of health literacy and English language skills. Providing parents/caregivers with clear written and verbal information on appropriate dosing and advice on a suitable device to measure any liquid medicines, at both the point of diagnosis, and also on collection of the prescription is crucial to support the safe administration of medications, [24, 59, 70].

Safe distribution of toxic substances and products

Reducing the toxicity of substances available can limit the severity of child poisoning [58]. The effectiveness of such an initiative was demonstrated when legislation was introduced to require all New Zealand dishwashing powder to have a PH level below 12.5, to minimise the risk of severe injuries, following advocacy from Safekids Aotearoa and the Ministry of Health [76, 77]. Calls to the National Poisons Centre for dishwashing powder poisonings declined sharply following the introduction of the new regulation in 2007, with serious exposures requiring referral for medical follow up reducing from thirty-six in 2006 to six in 2007, and remaining low in the following years reviewed [78].

Similarly, reducing the quantity of a toxic substance that can be sold or dispensed at any one time may limit the severity of poisoning by reducing the available quantity of a substance or product that is available to children if they access it [1, 20]. A recent study in the United Kingdom found that 73 percent of parents kept medication for the next time it might be needed [66]. This medication may then be used for children of varying ages and weights in the family, and no individual dosing information is therefore available to support the family in safely administering such medication. Medsafe New Zealand recommends Paracetamol be prescribed in small volumes for each specific child, rather than providing a bulk amount for the entire family to use [75].

Safe disposal of toxic substances and products

Safe disposal of hazardous substances such as medications reduces the risk that children will inadvertently gain access to them [58]. In a study conducted in the United Kingdom, Conroy and colleagues found 30 percent of parents with children less than twelve years of age disposed of unused medications in the home dustbin, and only five percent were returned to a pharmacy for disposal. The authors concluded that pharmacists have a key role to play in advising caregivers of safe disposal methods [66]. An example of the need for such guidance by pharmacists is illustrated in the case 'transdermal patches', where medications are delivered through the skin (including those used for smoking cessation). Whilst children have been poisoned by touching and mouth contact with transdermal patches whilst on the skin of an adult, they also have the capacity to be toxic when discarded. Therefore care must be taken that young children cannot access them in rubbish bins [10].

Medsafe New Zealand recommends medicines (including OTC products) are not to be kept for future use if unfinished, and states medicines should not be flushed down the toilet or put out in the rubbish. They recommend such items should be taken to a pharmacy (including over-the-counter therapeutic products) [20, 79]. The New Zealand Child and Youth Mortality Review Committee advocates a targeted approach to support safe disposal practices and therefore minimising the risk of poisoning in homes where there is for a possibility that large amounts of unused medications may be stored, such as in the homes of mental health service clientele [20]. The Ministry for the Environment and the Environmental Protection Authority provide guidance on safe disposal of hazardous substances [80, 81]. Regional councils and the NPC also can provide information on disposal options for chemicals and other household products that may be hazardous to children.

C. Provision of the National Poisons Centre (NPC)

The NPC is available 24 hours a day, seven days a week, and provides callers with expert specialist advice on managing acute and suspected poisoning events. This service is available to parents/caregivers and to health professionals. Data is collected and monitored to identify trends and emerging issues, and action is undertaken to highlight such issues to facilitate public health action.

Such collected data identified increasing levels of young children being exposed to toxic nicotine replacement therapy products such as gum and lozenges which are sold in non-reclosable blister packaging. Phone enquiries were found to be disproportionally higher between 2003 and 2011, than the accompanying increase in sales levels over this time period. Given the assertive targeting to reduce the incidence and prevalence of smoking in New Zealand, it is anticipated such events will increase as the availability of these products within New Zealand household's increases. The identification of a mean age of children aged twenty nine months (SD + 13, range 2 months to 6 years) facilitates the targeting of future preventative measures to minimise the risk to this identified group in the New Zealand context [82].

Poison control centres can prevent a considerable amount of medical expenditure, when the public is well informed about their service and how to utilize them [25, 83-85]. For instance, American research estimates cost savings of $13.39 for every $1 spent on poison control centres, as a large number of poisoning cases can be resolved via expert phone consultation. Thus revealing the cost effective nature of such a service [85]. In New Zealand, a survey found that 92 percent of callers would seek health care alternatives (ambulance, general practitioners and emergency departments) if the NPC was not available to assist them [86]. The European Child Safety Alliance (EuroSafe) advocates the general public needs to be well informed about this service to enhance its effectiveness [25]. Safekids Aotearoa advocates that both health professionals and Well Child Providers ensure that parents and caregivers are aware of the service.

2006 Safekids Aotearoa campaign photo featuring TV personality Pio Terei.

5. Summary of poison prevention recommendations

Key Points to Remember

1. Always store medications (both children's and adults), cleaning products and other toxic products and substances out of the reach and sight of children, in a locked high cupboard.
2. Use child resistant catches on cupboard doors.
3. Always remember child resistant packaging (including child resistant caps on medication) is not child proof, only child resistant!
4. Remember poisonings commonly happen when the product or substance is in use, or just purchased.
5. Store toxic products and substances in their original packaging, ensuring lids or closure mechanisms are well secured - never put chemicals or other toxic substances into old food or drink containers/bottles.
6. Ensure you read and follow safety and disposal instructions on medicines, chemicals, cleaners and other toxic products and substances.
7. Follow medication dose instructions from your doctor or pharmacist.

Safe and Secure Storage

- Always store medications, vitamins, household cleaning products and gardening products such as pesticide, rat poisons, paints or varnishes, and other toxic products or substances out of the reach and sight of children, in a locked high cupboard. Use child resistant catches on cupboard doors. Importantly, this includes products or substances in child resistant packaging, including those with child resistant caps as well [3, 17, 20, 60, 87].
- Do not underestimate a child's ability to climb on furniture to gain access to toxic substances or products, and reach things [3, 5, 40, 62, 63, 87].
- Always keep medicines, cleaning products and chemicals in their original container. Never place poisonous substances such as pesticides, methylated spirits, or cleaning products in a container the item did not originally come in, particularly old food or drink containers [3, 58, 60, 81, 87].
- Always put medication and other toxic substances such as cleaning products immediately away between each use – do not be tempted to leave them out or close at hand [3, 23, 60].
- If medication needs refrigerating, ensure it is out of sight and reach as well, where possible in a locked storage unit in the fridge [62].
- Be aware of medications that might be left in handbags, coat pockets, or in glove boxes in the car [3, 62, 87].
- Do not store medications or hazardous substances such as chemicals or pesticides in the same storage area as food or medications [3, 81].
- Do not leave poisonous products or substances, such as cleaning products unattended. Avoid distractions like the phone ringing when using such items [87]. If you have to answer the door take the items with you.
- Replace lids and put products away straight after use [3, 60].
- Ensure closures (lids) are closed tightly (correctly fastened) [60]. Remember to remove any crust that forms in the lid of CRC's containing liquid preparations to ensure they can close properly [38, 58].
- Do not leave paint brushes soaking in turpentine [62].
- Clean up ashtrays and left over alcoholic drinks promptly.
- Be mindful when returning from shopping to store toxic products/substances safely away immediately [40].

Safe practices when using medications or over-the-counter therapeutic products

- Ask for a child-resistant cap when getting medication at the chemist – there may be a small cost associated [3, 20, 35].
- Be aware children learn by observing – they may try and mimic what they see others doing, so avoid taking medicines in front of children [3, 6, 10, 33].
- To support someone remembering to take or administer medicine – suggest setting their phone or watch alarm, email themselves, or leave a note [6, 23].
- If multiple caregivers are giving medicine – try taping a note of the time and dose given each time on the container to alert the person administering the next dose to when the previous one was given [23].
- Caregivers can establish a double checking system when administering medication to children to ensure no double dosing occurs [62].
- Be aware of how you describe medications – e.g. 'nice tasting'… never refer to them as lollies or soft drinks [3, 35, 58, 62].
- Only give medication to the child it was prescribed for and for its intended purpose [35, 71, 73, 75].
- Each time you use a medicine always follow the instructions on the label – if they are unclear ask for advice. Care should be taken when giving medicine to children to ensure it is the correct dosage [3, 35]. For example Paracetamol is available in two strengths in New Zealand, subsequently the dosage recommendations for a child differs between the different strengths.
- Always supervise children when taking medication [35].
- Ensure you do not give a child multiple medicines, including over-the-counter medicines that contain the same active ingredient i.e. Paracetamol is commonly found in over-the-counter medications, so using such products in conjunction with Paracetamol can result in poisoning – for further advice please discuss with a pharmacist or health care professional [3, 66].
- Use appropriate tools for measuring liquid medicines; do not use a kitchen teaspoon. Seek guidance from a health professional, including a chemist [72, 75].

General

- Buy products with child resistant packaging or request where possible [60, 87].
- "Do not underestimate a child's ability to climb and reach things" [3, 5, 40, 62-64].
- Be especially vigilant when changes occur to usual routines such as whilst on holiday, or when visitors are in the house [20, 106].
- Encourage awareness among friends and families whom you visit or who visit your home about the dangers of toxic substances to children, including common household products, not just medicine [10, 67].
- Check your home and make sure others who care for your child such as grandparents do as well, reading product labels to identify what might be hazardous to children [62, 87].
- Be especially vigilant with substances or products labels that use the words "Danger, Warning, Harmful, Caution" [81].
- Be aware that children can mistake medicine or cleaning products for toys, sweets or drinks [8, 52].
- Be alert to the possibility of other children either giving or administering a toxic substance to another child (in particular medicines) [40].
- Check for lead paint on old furniture or for the presence of peeled paint in older houses, as this can poison infants and children. Contact your local council or public health unit for advice if preparing surfaces to paint that might have lead paint [3].
- Check for the presence of residual dishwasher powder when the cycle has finished, use a childproof lock on the dishwasher [3, 60, 76, 88].
- Chemicals – if uncertain about how to use or store contact the manufacturer or the Environmental Protection Authority.
- Be vigilant with spray bottles, due to children's ability to be able to lever them open [9].
- Keep the National Poisons Centre phone line number in a handy location such as next to the phone or put the number on speed dial [58].

In the garden

- Discourage children from putting plant parts in their mouth [3, 35].
- Be aware of the plants in your garden. Keep poisonous plants out of reach of young children [3].
- Choose plants carefully [3].
- When you buy plants for your garden, keep the tags so if you child ingests a part of the plant and you need to contact the National Poisons centre – you will be able to state the botanical name of the plant [3].
- Always be vigilant in mushroom and toadstool season. Scan your garden and environments where your children are playing and remove any fungi found [3].

Safe disposal of toxic substances

- Dispose of unused or medications past their expiry date safely [3, 20, 50, 58].
- Unused or out dated medicine should not be flushed down the toilet or put out in the rubbish. Return them to a pharmacy for safe disposal [3, 20, 79].
- In relation to unwanted chemicals and house cleaners do not flush them down the toilet or tip in the garden or down drains. Contact the local council for disposal advice [3].
- Be aware that burning some plants can produce poisonous fumes i.e. oleander [3].

Appendix 1: Position paper literature review and referencing methods

The literature review involved searching online databases using various combinations of the following terms: poison; hazard; medication; chemical; cleaning; plant; child; unintentional; wounds; injury; safety; prevention; accident; play; development.

Articles and reports were included in the position paper if published from 2000 onwards, or earlier if seminal references, or New Zealand research. Reference lists of key papers were also searched to identify further documents of relevance.

Articles and reports were assessed in regards to their:

- Currency – how the document could build on, and support existing information held by Safekids Aotearoa.
- Source – potential sources of information were identified and prioritised, including academic databases, and sources of unpublished literature.
- Reliability and validity – all materials collected were critically reviewed, ensuring they were obtained from credible sources, and were appropriate to the project's purpose .
- Coverage and relevance – ensured by assessing that materials included in the review were appropriate to the project's aims and purpose.

Documents were excluded that did not include children. Priority was given to literature from countries with similar policy contexts to New Zealand, such as Australia, Canada, UK and USA.

Please note due to the multiplicity of information used in the document from the New Zealand National Poisons Centre website, a URL address is provided to the section of the website to guide readers to individual factsheets pertinent to the topic being discussed.

Appendix 2: Data analysis methods

Injury Prevention Research Unit (IPRU) data

Poisoning hospitalisation data for the period 2006-2013, and mortality data for the period 2004-2011 for children aged 0-14 were sourced from the Injury Prevention Research Unit (IPRU), University of Otago [26], and analysed by Safekids Aotearoa.

Poisoning hospitalisation data were filtered as follows:

Includes:

- Primary diagnosis of injury
- Children aged 0-14 years
- Poisoning-related hospitalisation's with unintentional intent between 2006-2013
- ICD10-AM external cause of morbidity code for 'Accidental poisoning by and exposure to noxious substances' (X40-X49) were used to identify cases
- First admissions only
- Length of stay › 0 nights
- Children discharged alive [26]

Excludes:

- Day patients
- Readmissions for the same incident
- Patients discharged dead [26]

Data were then categorised by age, gender, ethnicity, place of poisoning and substance type.

Mortality data were filtered as follows:

Includes:

- Deaths registered between 2004-2011
- Children aged 0-14 years
- Poisoning deaths of unintentional intent
- Includes deaths on the NZ Coronial Register
- Identifying as occurring due to poisoning events due to poisoning events and/or coded as ICD10-AM external cause of mortality codes for 'Accidental poisoning by and exposure to noxious substances' (X40-X49) [26].

ICD 10 External Causes of Accidental Injury Codes - Accidental Poisoning by and Exposure to Noxious Substances (X40-X49)

Includes: accidental overdose of drug, wrong drug given or taken in error, and drug taken inadvertently, accidents in the use of drugs, medicaments and biological substances in medical and surgical procedures

Excludes: administration with suicidal or homicidal intent, or intent to harm, or in other circumstances classifiable to X60-X69, X85-X90, Y10-Y19 correct drug properly administered in therapeutic or prophylactic dosage as the cause of any adverse effect (Y40-Y59)

X40 **Accidental poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics**. Includes: 4-aminophenol derivatives, nonsteroidal anti-inflammatory drugs [NSAID], pyrazolone derivatives, salicylates.

X41 **Accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified.** Includes: antidepressants, barbiturates, hydantoin derivatives, iminostilbenes, methaqualone compounds, neuroleptics, psychostimulants, succinimides and oxazolidinediones, tranquillizers.

X42 **Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified.** Includes: cannabis (derivatives), cocaine, codeine, heroin, lysergide [LSD], mescaline, methadone, morphine, opium (alkaloids).

X43 **Accidental poisoning by and exposure to other drugs acting on the autonomic nervous system.** Includes: parasympatholytics [anticholinergics and antimuscarinics] and spasmolytics, parasympathomimetics [cholinergics], sympatholytics [antiadrenergics], sympathomimetics [adrenergics].

X44 **Accidental poisoning by and exposure to other and unspecified drugs, medicaments and biological substances.** Includes agents primarily acting on smooth and skeletal muscles and the respiratory system, anaesthetics (general)(local), anti-infectives, drugs affecting the: *cardiovascular system and gastrointestinal system, hormones and synthetic substitutes, systemic and haematological agents, systemic antibiotics and other anti-infectives, therapeutic gases, topical preparations, vaccines, water-balance agents and drugs affecting mineral and uric acid metabolism.

X45 **Accidental poisoning by and exposure to alcohol. Includes alcohol:** *NOS, *butyl [1-butanol], *ethyl [ethanol], *isopropyl [2-propanol], *methyl [methanol], *propyl [1-propanol], and fusel oil.

X46 **Accidental poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours.** Includes benzene and homologues, carbon tetrachloride [tetrachloromethane], chlorofluorocarbons, petroleum (derivatives).

X47 **Accidental poisoning by and exposure to other gases and vapours.** Includes motor (vehicle) exhaust gas, LPG, other specified utility gas, other specified gas and vapours: *carbon monoxide, *lacrimogenic gas [tear gas], *nitrogen oxides, *sulfur dioxide, and unspecified gas and vapours. Excludes: metal fumes and vapours (X49).

X48 **Accidental poisoning by and exposure to pesticides.** Includes: fumigants, fungicides, herbicides, insecticides, rodenticides, wood preservatives. Excludes: plant foods and fertilizers (X49).

X49 **Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances.** Includes: corrosive aromatics, acids and caustic alkalis, glues and adhesives, metals including fumes and vapours, paints and dyes, plant foods and fertilizers, poisoning NOS, poisonous foodstuffs and poisonous plants, soaps and detergents. Excludes: contact with venomous animals and plants (X20-X29).

Source – IPRU [26].

Please note the poisoning code X40 listed above contains unintentional posionings due to the commonly used child medications – Paracetomol and Ibruprofen, as well as other medications.

National Poison Centre (NPC) data

National Poison Centre poisoning call log data for the period 2008-2012 were provided by the National Poison Centre [29], and analysed by Safekids Aotearoa.

Data were categorised by child's age, gender, the type of event, route of exposure and place where the exposure occurred, the toxic substance or product involved and if further treatment was required. Please note one percent of the calls included in the data included poisoning events that were intentional in nature and are not separated in the statistics presented.

Appendix 3: National Poison Centre Supplementary Information

NPC Poisoning Types 2008-2012

Poisoning type	Description of poisoning type	Number and Percentage
Child exploratory poisoning	Children coming into contact with medicines and cleaners during play and exploration.	63,738 (88.7%)
Therapeutic error	Including events such as medicines being given incorrectly, in the wrong quantity, or too regularly.	3,954 (5.5%)
Unintentional poisonings	Unintended contact with a poison, for example following drinking from a cup that has dishwashing powder residue in it. This category also includes a substance being used correctly but poisoning results from an unintended exposure.	3,349 (4.7%)
Intentional poisoning	Involves deliberate harm to the child, for example by the child ingesting poisons to cause deliberate self-harm.	635 (0.9%)
Unknown	No details of incident.	142 (0.2%)
Total		71,818

Source: NPC [29].

Top Ten NPC enquiries by individual product/ substance descriptions and percentage of overall poison- related calls for children aged 0-14 years (2008-2012)

Ranking	Substance/Product	Percentage of overall calls
1	Household Miscellaneous	8.6%
2	Cosmetics	8.1%
3	Household Cleaner	7.2%
4	Plants	6.8%
5	Therapeutic Analgesic (Pain Relievers)	6.6%
6	Therapeutic Topical Application (Creams and Ointments)	5.9%
7	Household Detergent	5.3%
8	Therapeutic Anti-Inflammatory	5.1%
9	Therapeutic Supplement	3.7%
10	Therapeutic Anti-Infective	3.6%
Total		60.1%

Source: New Zealand National Poisons Centre [29].

Key:

	Household Products and Cosmetics
	Therapeutic Products (medications, supplements and ointments)
	Plant, fungi and animals

Supplementary information on Product/Substance categories

Household products and cosmetics

Cosmetics, household miscellaneous products and household cleaning detergents products accounted for 69 percent of this category. Other items included in this category included anti-infective products, insecticides, laundry products, petrol, paint, and air fresheners [29].

Therapeutic products (medications, supplement and ointments)

The most common therapeutic products involved in enquiries were therapeutic analgesic (pain relievers), therapeutic topical applications (topical creams and ointments), therapeutic anti-inflammatories, therapeutic anti-infective (antibiotics), therapeutic supplements, and therapeutic miscellaneous; combined these accounted for 68 percent of all therapeutic product related calls and accounted for 28 percent of all child-related calls to the NPC during 2008-2012 [29].

Plant, fungi and animal

The majority of calls in this category regarded plants (79 percent), followed by fungus (15 percent), and animals (6 percent) [29].

Agricultural, industrial and automotive

Industrial substances/products, agricultural rodenticide, agricultural animal remedies and herbicides accounted for 62 percent of calls in this category. Other product related calls in this category included agricultural fertilisers, insecticides, fertilisers, and automotive products [29].

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BIG LEAP FOR JOSHUA!

Joshua Ward and mum Lara were the faces of a 2007 Safekids Campaign which resulted in the removal of caustic detergents (pH higher than 12.5) from supermarket shelves in New Zealand.

There have been no serious caustic detergent ingestion injury admission similar to Joshua's since then.

Joshua was just 19 months old when he swallowed dish washing powder, which left him with terrible injuries. At 5 years old he had already undergone almost 50 operations to remove scar tissue from his throat, was fed through a tube and needed 24-hour care.

Joshua is 11 years old now. His tracheotomy tube was removed 2 years ago, and Lara sent us a photo of Joshua's first swimming experience in 2012.

"Wow he put his head under water, eight years worth! He cupped my face with both hands and whispered 'Mum, you have to let me go now!' It wasn't easy, but I did!" Lara said.

"He has such a wonderful team up at Starship, and we would like to thank Safekids Aotearoa from the bottom of my heart, for being there in those early dark days."

Thanks Joshua and Lara for being a part of the Safekids Campaign.

Joshua and Lara (top photo) at the Safekids Campaign in 2007, launching Australasia's first poisoning prevention website.

safekids Aotearoa

5th Floor, Cornwall Complex
40 Claude Road, Epsom, Auckland 1023
PO Box 26488, Epsom, Auckland 1344
New Zealand

P +64 9 630 9955
F +64 9 630 9961
Info@safekids.nz
www.safekids.nz

Safekids Aotearoa's mission is to reduce the incidence and severity of unintentional injuries to children in New Zealand aged 0-14 years.