Annual Hazardous Substances Injury Report 2013

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Executive Summary

The report presents data from the Hazardous Substances Surveillance System (HSSS), initiated in 2010 by the Centre for Public Health Research (CPHR) on the health effects of exposure to hazardous substances.

Deaths and injuries continue to occur from hazardous substance exposures that appear to be entirely preventable. The evidence available shows that a large proportion of incidents are caused by hazardous substances used in everyday domestic and workplace situations.

Following is a summary of key findings on the health effects of hazardous substances.

Key Findings

- Four percent of the injury-related health loss in New Zealand is due to poisoning
- The number of poisoning deaths and hospital discharges have decreased since 2006
- There were no reported poisoning deaths of children less than five years old from 2006 to 2010
- Butane inhalation was the leading cause of unintentional poisoning deaths in the 15-24 year age group
- Males account for the majority of fatal and non-fatal injuries due to hazardous substances exposure
- Children under five years old had the highest hospital discharge rates for poisoning
- Over 60 percent of hazardous substance-related calls made to the National Poison Centre were linked to children

Introduction

The Hazardous Substances Surveillance System (HSSS)

The HSSS was established in 2010 by the Centre for Public Health Research (CPHR), Massey University Wellington with funding from the Ministry of Health. The HSSS was developed as there is a legal requirement[1] for medical practitioners to notify injury caused by hazardous substances to a Medical Officer of Health. Separate legislation requires medical practitioners to notify elevated blood lead levels, and cases of poisoning arising from chemical contamination of the environment[2]. Although there is no legal requirement to report deaths, the HSSS includes deaths as they are the most severe form of hazardous substances injury.

The HSSS has four goals:

- To describe the distribution and characteristics of exposure to hazardous substances
- To describe the morbidity and mortality experienced by workers and the general public (including children) as a result of exposure to hazardous substances
- To provide high quality information on outcomes, exposures, and hazards for monitoring, policy development, measuring compliance and control
- To identify strategies that might reduce future morbidity and mortality resulting from exposure to hazardous substances

Degrees of injury severity

The HSSS incorporates data from several different data sources which are likely to capture poisoning injuries of different severity between them. These include:

- Mortality data
- Hospital discharges
- Lead absorption and poisoning arising from chemical contamination of the environment notifications
- Hazardous substance incident reports
- National Poison Centre calls
- Primary care notifications [3]

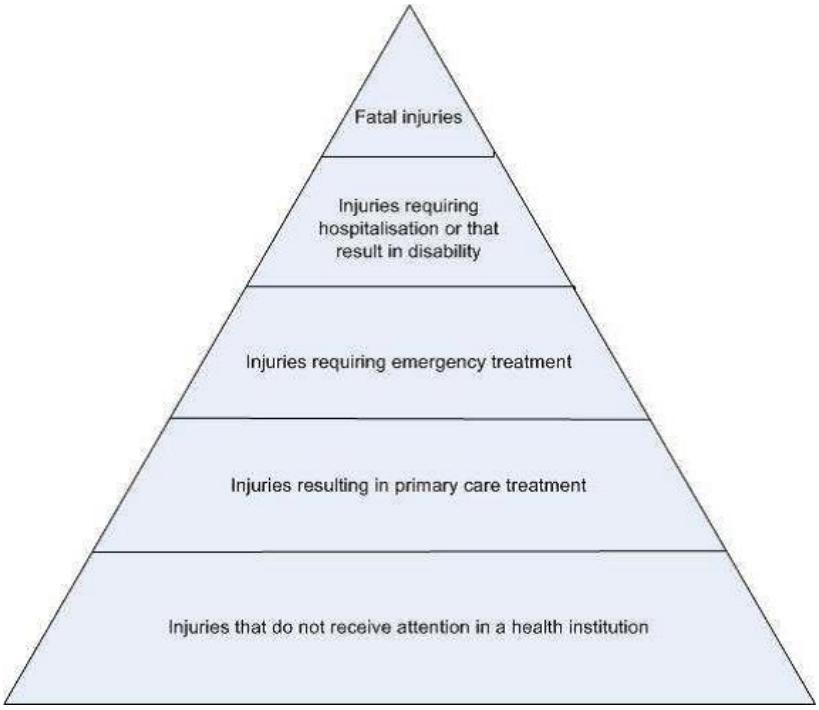
To obtain a robust and meaningful data on the incidence and prevalence of hazardous substance injuries, data capture has to be extended to all five levels of the 'injury pyramid' (Figure 1). The injury pyramid reflects the relationship between injury severity and the number of injuries that occur. Deaths are the most severe form of hazardous substances injury. They are fewer in number, but more easily ascertained. Conversely, the bottom of the pyramid represents injuries which do not require formal medical care. However, this is where the greatest number of injuries occur. Reviewing data from different levels of injury severity (mortality data, through to National Poisons Centre call logs) will enable more complete surveillance of hazardous substances injuries, and ultimately help to prevent future disease and injury.

[1] Hazardous Substances and New Organisms Act 1996, s 143.

[2] Health Act 1956, Schedule 2.

[3] Data from primary care notifications will be available in the next annual report.

Figure 1: Injury Pyramid



Source: Adapted from (Espitia-Hardeman and Paulozzi, 2005)

Poisoning: a major public health problem

Poisoning continues to be an important public health problem. It accounts for a global burden of disease of approximately 1.2 million deaths which corresponds to two percent of the total deaths and 1.7 percent of the total burden of disease globally (Pruss-Ustun, Vickers et al. 2011). The New Zealand Burden of Disease Study reported that 2709 years of healthy life were lost as a result of poisoning, accounting for 4 percent of the injury-related health loss in New Zealand (Ministry of Health, 2013). The study also showed ethnic inequalities in the burden of injury. For example, Māori females experienced more than twice the level of of health loss through poisoning compared to non- Māori females.

Previous studies in New Zealand have also shown the annual rate of poisoning fatalities to be comparable to other industrialised countries (McDowell, Fowles et al. 2005). However, deaths due to unintentional poisoning were lower (Yates 2003).

Hazardous substances have the potential to cause considerable harm, hence there is legislation in New Zealand which aims to protect both people and the environment from harm. It is important to know the size of the problem and who is affected, so this information can be directed to those who can take preventive action.

The majority of poisonings are considered acute rather than chronic events. Chronic harm from hazardous substances is hard to measure because it is often difficult to determine what caused the harm, and is a major data gap.

What's in this report?

The report provides evidence for agencies (eg, government departrments) involved in policy development and decision making about hazardous substances, and provides information for researchers, regional and community organisations, and the wider public. It presents findings about poisoning-related injuries from the following data sources:

- National Mortality Collection
- Coronial Services Office (CSO)
- National Minimum Dataset (NMDS)
- EpiSurv
- Environmental Protection Authority (EPA)
- National Poisons Centre (NPC)

Results are presented to answer three guiding questions from each source.

- What is the current level in the population?
- How has it changed?
- Who are the vulnerable groups?

This report contains key statistical information through graphs and tables, with short comments about the noteworthy results. Trends over time are presented where possible.

Definitions and Methods

What is a hazardous substance?

The Hazardous Substances and New Organisms Act 1996 (HSNO Act) regulates all substances that are classified as hazardous in New Zealand. In HSNO terms, a substance is considered hazardous if it triggers any one of the threshold levels for any of the following properties:

- explosiveness
- flammability
- oxidising capacity
- corrosiveness
- toxicity
- ecotoxicity

Hazardous substances can however have more than one hazardous property such as methylated spirits and petrol which are both toxic and flammable. A substance is also considered hazardous if it generates a substance with any or more of these hazardous properties when it comes into contact with air or water.

The report therefore only includes injuries by hazardous substances as defined in the HSNO Act. It excludes poisonings from medicines in fixed dose form, alcohol, drugs, and cases where the substance was carbon monoxide and the source was not from combustion of gas from a cylinder.

The HSNO Act was designed to protect people from the everyday use of hazardous substances, therefore does not manage suicide (EPA 2013). However, intentional harm has been included in this report as it is an important cause of poisoning deaths in New Zealand.

National Minimum Dataset

The HSSS hospital discharge data are provided by calendar year from 2006-2012. A 'hospital discharge' is defined as a person that has remained in hospital for more than 24hours, and does not include those who have been discharged home directly from the emergency department.

It is important to note that hospital events recorded in the NMDS represent individual events rather than individual people. The number of events will be higher than the number of people, because one person can contribute numerous unique hospital

events to the dataset.

Readmissions for the same injury event have been excluded from the data set. A 'readmission' is defined as the unintended acute readmission of a patient within 30 days of discharge.

Further information on the NMDS and the National Mortality Collection can be found in Appendix 1.

Causes of injury were assigned using the external-cause and nature-of-injury codes. A full list of external-cause (E code) and diagnosis/nature-of-injury codes is provided in Appendix 2.

National Mortality Collection (2006-2010)

This section provides key findings on poisoning deaths from the National Mortality Collection. This is maintained by the Ministry of Health. For mortality, the delay in finalising the mortality data is due primarily to waiting for the coroners reports.

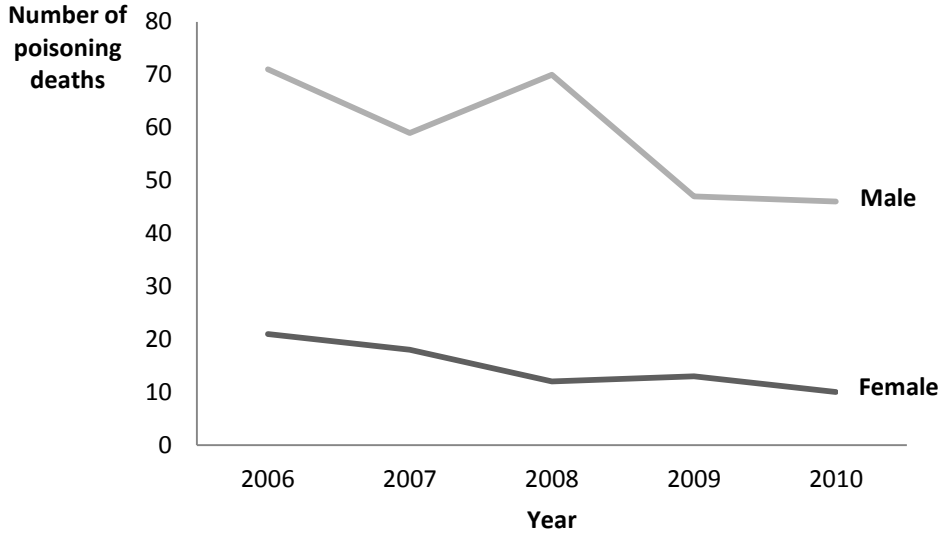
Key findings

- Over 70 people die from poisonings each year.
- In 2010, there were 56 deaths due to poisoning, the lowest since 2006.
- 82 percent of deaths were male.
- There were no deaths of children less than five years old from 2006 to 2010.
- Carbon monoxide was the main substance causing death.

Over 70 people die from poisonings each year

During the five-year period reviewed (2006 to 2010), there were 367 deaths attributed to acute poisoning, an average of 73 deaths per year. Since 2006, the number of poisoning deaths has decreased and in 2010 there were 56 deaths; the lowest over this five-year period (Figure 2).

Figure 2: Number of poisoning deaths by gender, 2006-2010



Males account for the majority of poisoning deaths

Between 2006 and 2010, males account for nearly 80 percent of all poisoning deaths in New Zealand.

Carbon monoxide and toxic gases are the leading causes of poisoning deaths

In most cases, the substance causing injury is unknown, however the diagnostic categories indicate the major group of substances involved (Table 1). Except the 5-14 year age group, carbon monoxide was the most common substance causing death in all age groups, the majority of these being intentional poisoning. Gases, fumes, and vapors were also common for those less than 25 years old. These toxic gases were the leading cause of unintentional poisonings deaths (n=19) in the 15-24 year age group. Where substance was recorded, 17 of the 19 deaths were due to butane inhalation.

The Child and Youth Mortality Review Committee has also reported this trend (CYMRC 2013). Butane is readily and cheapily available, and most of the other substances used are household items, so access to the substances cannot easily be controlled.

There were no poisoning deaths of children less than five years old

While children less than five years old had the highest hospitalisation rates for unintentional poisoning (see section on Hospital Discharges), there were no deaths in this age group. A New Zealand study also found children were at less risk of dying than adults (Yates 2003). Despite this, children still remain one of the high risk groups when it comes to unintentional poisoning.

Table 1: Number of poisoning deaths, by age group and diagnostic group, 2006-2010

Diagnostic Group	Age Group (years)					
	5-14	15-24	25-44	45-64	65+	Total
Carbon monoxide		31	110	96	40	277
Gases, fumes and vapours	4	20	4	4	6	38
Solvents, hydrocarbons and corrosive substances	1	4	6	4		15
Pesticides		2		6	3	11
Burns	2	2		1	4	9
Other toxic substances			5	2	1	8
Unknown		2	3	4		9
Total	7	61	128	117	54	367

Coronial Services Office data (2007-2011)

This section summarises key findings about poisoning deaths from the Coronial Services Office (CSO). Coronial data is maintained by the Coronial Services Unit (CSU) and stored in the Case Management System (CMS), a national internet-based database. The CMS includes all deaths reported to a coroner since July 2007. All deaths that result from acute chemical injury are deemed to be suspicious; therefore, a coroner's inquest should be completed.

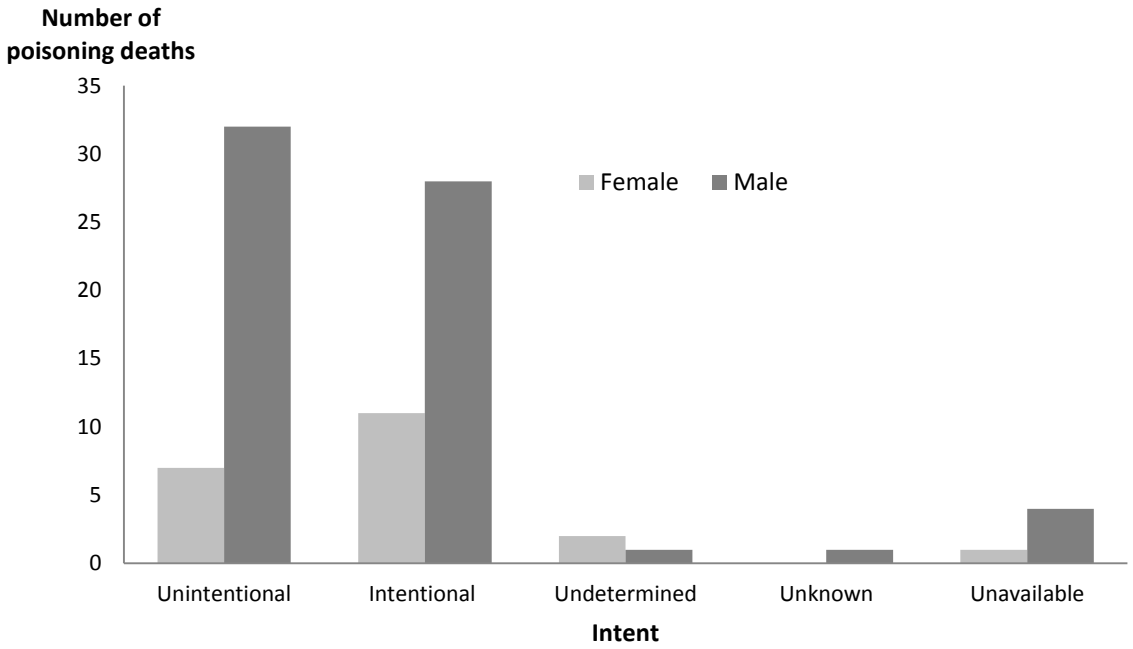
Key findings

- There were 87 poisoning deaths reported to the coroner from 2007 to 2011, of which 76 percent were males.
- There was an equal proportion of poisoning deaths that were attributed to both unintentional and intentional cause of death.
- Males outnumber females in unintentional and intentional cause of deaths.
- There were no deaths reported to the coroner of children less than five years of age.
- Toxic gases (e.g. liquid petroleum gas (LPG), butane, propane, methane) were the most common substances causing death especially in the 15-24 year age group.

Poisoning deaths by intent and gender

Figure 3 presents data on the number of deaths, by intent and gender, where the underlying cause of death as identified by the coroner was due to exposure to hazardous substances. There were 87 poisoning deaths from 2007 to 2011 which equates to 17 per year on average.

Figure 3: Poisoning deaths by intent and gender, 2007-2011



Intent was recorded according to the judgement of the coroner, and during that time, there was an equal proportion (44%) of poisoning deaths that were attributed to both unintentional and intentional cause of death. However, males outnumber females in intentional and unintentional cause of deaths. A male predominance may be due to the substances involved being more likely to be used in male-dominated work and hobby environments (EPA 2013).

Toxic gases are the leading causes of unintentional poisoning among 15-24 year olds

Toxic gases such as LPG, methane, propane, and butane were the most common substances causing death. Toxic gas (LPG, methane, propane, and butane) was more prominent among those in the 15-24 year age group. These substances were also the leading causes of unintentional poisoning within this age group (Table 2). Volatile substance abuse – also known as huffing – is the cause of most unintentional deaths among young people, with butane gas often involved (Child and Youth Mortality Review Committee 2013). There were 63 deaths in New Zealand due to the recreational inhalation of butane between 2000 and 2012. Of those, 55 were under 24 years of age (Office of the Chief Coroner 2012).

Table 2: Poisoning deaths by substance group and age group, 2007-2011

Substance Causing Injury	Age group (years)					
	5-14	15-24	25-44	45-64	65+	Total
LPG Gas, Natural Gas, Methane Gas, Propane Gas, Butane Gas	3	16	1	2	1	23
Other Sources of Carbon Monoxide			6	5		11
Other Specified Non-Pharmaceutical Chemical Substance		1	6	4		11
Petrol, Diesel, Gasoline	1	4	3	2		10
Weed Killer, Herbicide				4	3	7
Methylated Spirits		1	1	1		3
Other Specified Fuel or Solvent		1	1		1	3
Other Specified Pesticide Herbicide		1	1		1	3
Other Specified Cleaning Agent			1	1		2
Gas Cylinder				1	1	2
Other Insecticide		1			1	2
Heavy Metal nec			1			1
Alcohol nec		1				1
Bleach, Soaking Agent			1			1
Lubricating Oils, Motor Oil		1				1
Unspecified Fuel or Solvent			1			1
Helium Gas			1			1
Drain Cleaners					1	1
Other Specified Explosive Material or Flammable Object/Substance			1			1
Paint, Varnish, Stain			1			1
Unavailable		1				1
Grand Total	4	28	26	20	9	87

Source: Coronial Services Office (2013)

National Minimum Dataset (2006-2012)

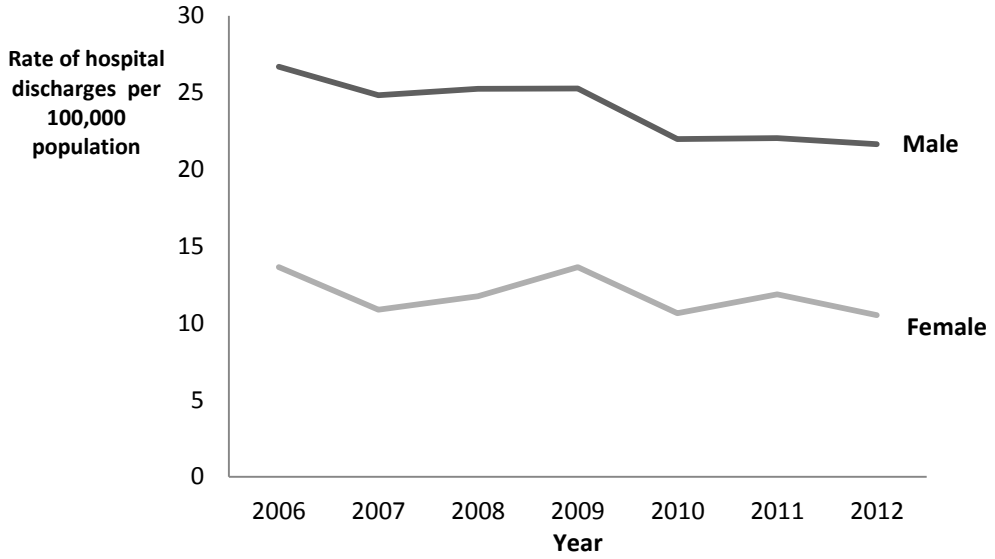
The following section presents key findings on publicly funded hospital discharges involving poisoning injuries. This is derived from the National Minimum Dataset (NMDS) which is maintained by the Ministry of Health.

Key findings

- In 2012, there were 712 hospital discharges due to poisoning .
- There has been a steady decline in the rates of hospital discharges since 2006.
- Male crude rates[4] are twice that for females.
- About half of poisonings were unintentional.
- Children under five years old had the highest rates of hospital discharges in New Zealand.
- The most common diagnostic groups were burns and corrosions (35%), and solvents, hydrocarbons and corrosive substances (26%)

[4] A crude rate is defined as the number of events in a given time period divided by the population at risk and multiplied by a constant.

Figure 4: Crude rate of hospital discharges per 100,000 population, 2006-2012



Over 700 people are hospitalised for acute poisonings each year

During the 7-year period reviewed (2006 to 2012), there were 5395 hospital discharges attributed to acute poisoning, an average of 770 a year. This represents approximately 0.07 percent of the total number of hospital discharges in New Zealand each year.

Hospital discharge rates are slightly declining

Between 2006 and 2012, there has been a steady decline in the rate of hospital discharges (Figure 4). While hospital discharge can be regarded as an indicator of severity, it is a major undercount of exposure to hazardous substances as not all disease and injuries will require hospitalisation.

Hospital discharges are categorised by intent, and in 2012, 48 percent were recorded as unintentional, 26 percent as intentional, and 24 percent of the intent was undetermined (Table 3). There was a similar pattern in 2011.

Males have higher hospital discharge rates for poisonings than females

Males continue to outnumber females in discharges for unintentional injury which is consistent with a previous international study (Chien, Lin et al. 2011). However, males and females had similar rates of discharges for intentional poisoning which have not changed markedly from 2010 to 2012. The male hospital discharge rate for acute poisoning was twice that for females in 2012 (Table 3).

Table 3: Hospital discharges for acute poisoning, counts and gender-specific crude rates per 100,000, 2006-2012

Year	Intentional Poisoning				Unintentional Poisoning				Undetermined				Total			
	Number		Rates		Number		Rates		Number		Rates		Number		Rates	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2006	127	128	6.2	6	202	126	9.8	5.9	221	39	10.7	1.8	550	293	26.7	13.6
2007	128	101	6.1	4.7	193	100	9.3	4.6	196	35	9.4	1.6	517	236	24.8	10.9
2008	101	110	4.8	5	244	113	11.6	5.2	186	34	8.8	1.6	531	257	25.2	11.7
2009	80	98	3.7	4.4	301	152	14.1	6.9	158	52	7.4	2.3	539	302	25.3	13.6
2010	94	90	4.4	4	239	105	11.1	4.7	141	43	6.5	1.9	474	238	22	10.6
2011	92	90	4.2	4	222	146	10.2	6.5	165	31	7.6	1.4	479	267	22	11.9
2012	94	94	4.3	4.2	232	117	10.6	5.2	148	27	6.8	1.2	474	238	21.6	10.5

Young children have the highest hospital discharge rates for poisoning

Marked differences are evident in age-specific poisoning-related discharge rates (Table 4). Compared to all other age groups, children under five years old continue to have higher discharge rates of poisoning from 2006-2012. This is in accordance with findings in other countries (McGuigan 1999). Yates (2003) also reported that children under five years had the highest rates of hospital discharges in New Zealand.

The high injury rate for this age group is of concern because exposure to hazardous substances is largely preventable. Figures released by the Accident Compensation Corporation (ACC) show that 60 percent of all new poisoning claims lodged were for injuries to children 0-3 years old, and this accounts for approximately 34 percent of total ACC poisoning-related costs between 2002 and 2009 (CYMRC 2013).

Table 4: Age-specific rates per 100,000 population of hospital discharges for acute poisoning, by age group, 2006-2012

Year	Age Groups (years)						
	0-4	5-14	15-24	25-44	45-64	65+	Total
2006	31.9	13.3	33.9	25.4	13.1	6.0	20.0
2007	32.7	7.4	29.5	20.4	13.7	9.2	17.7
2008	30.7	10.1	28.9	23.2	14.5	6.2	18.4
2009	34.0	8.9	29.4	24.3	14.6	9.8	19.4
2010	25.5	5.9	27.7	19.4	12.9	8.5	16.2
2011	34.4	9.7	24.7	18.2	14.5	8.7	17.0
2012	27.4	7.7	22.5	20.1	13.8	7.7	16.0

Nature and place of injury

Although specific information about the hazardous substance involved is not always recorded in the NMDS, some diagnostic categories indicate the major groups of substances involved. In this case, only the principal diagnosis is used to describe the reason for admission.

Solvents, hydrocarbons and corrosive substances is the most common diagnostic group among 0-4 year olds

From 2006-2012, the most common diagnostic groups were burns and corrosions (35%), and solvents, hydrocarbons and corrosive substances (21%) (Table 5). In the 0-4 year age group, the most common diagnostic groups were solvents, hydrocarbons and corrosive substance (39%) followed by pesticides (18%) with the majority of these poisonings occurring at home. The most common substances in the solvents and pesticide diagnostic groups are petroleum products and

organophosphate and carbamate insecticides.

Household agents are the most common cause of poisoning among children less than five years old, therefore increasing parental awareness of storing household hazardous substances appropriately is strongly encouraged.

Table 5: Number of hospital discharges due to acute poisoning, by age group and diagnostic group, 2006-2012

	Age Group (years)						
Diagnostic Group	0-4	5-14	15-24	25-44	45-64	65+	Total
Burns and corrosions	115	175	485	693	361	85	1914
Solvents, hydrocarbons and corrosive substances	255	71	304	316	132	42	1120
Carbon monoxide	4	14	90	252	151	46	557
Gases, fumes and vapours	19	40	108	164	155	48	534
Pesticides	120	27	78	125	74	33	457
Other toxic substances	85	27	104	115	77	26	434
Metals	19	10	41	70	64	8	212
Soaps and detergents	37	3	21	17	14	15	107
Dermatitis	3	2	2	14	15	13	49
Inorganic substances	2	1		4	3	2	12
Alcohol	1		3	3	2		9
Total	660	370	1236	1773	1048	318	5405

The majority of poisonings occurred in the home environment (52.7%). Other injuries or poisonings occurred in 'Unspecified places' (24.4%), and Industrial and construction (6.7%) areas (Table 6). These results suggest that there is a need to strengthen strategies to prevent poisoning in homes.

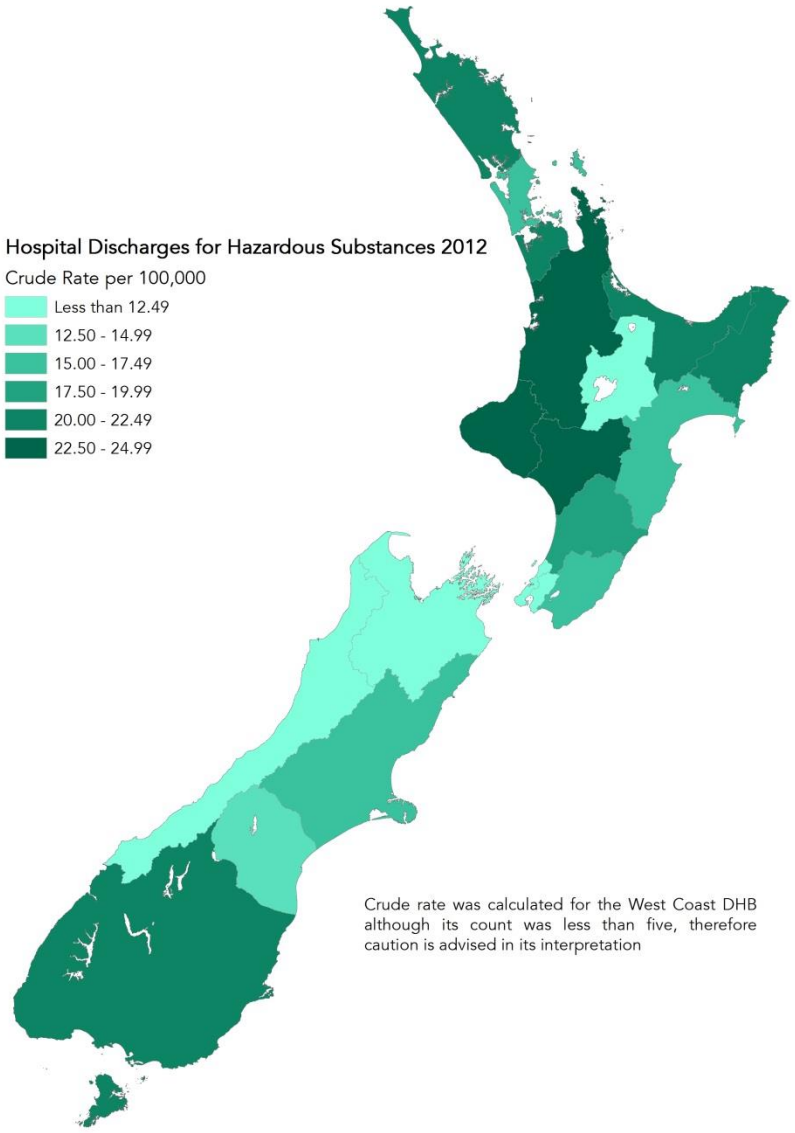
Table 6: Number and percentage of hospital discharges due to acute poisoning, by place of occurrence, 2012

Place of Occurrence	**Number**	**%**
Home	375	52.7
Industrial and construction area	48	6.7
School, other institution and public administrative	29	4.1
Farm	23	3.2
Other specified place of occurrence	22	3.1
Trade and service area	21	2.9
Street and highway	13	1.8
Residential institution	5	0.7
Sports and athletics area	2	0.3
Unspecified place of occurrence	174	24.4
Grand total	712	100

Whanganui, Taranaki, and Waikato DHBs had the highest rates of hospital discharges for acute poisoning

In 2010, Whanganui, (24.1 per 100,000), Taranaki (24.0 per 100,000) and Waikato (23.9 per 100,000) District Health Boards (DHBs) had the highest rates of hospital discharge for acute poisoning (Figure 5). Capital and Coast DHB had the lowest rate[5] of hospital discharges (10.1 per 100,000).

Figure 5: Crude rates per 100,000 population of hospital discharges due to acute poisoning by DHB, 2012



[5] This excludes West Coast DHB due to counts less than five

EpiSurv notifications (2012)

The following section presents data from EpiSurv- the national notifiable disease surveillance system maintained by the Institute of Environmental Science and Research Ltd (ESR). Notifiable diseases such as lead absorption and poisoning arising from chemical contamination of the environment are presented here.

Key findings

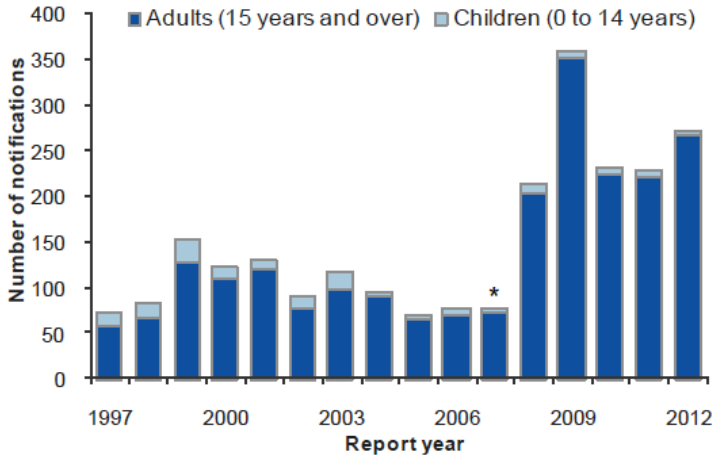
- There were 272 lead absorption cases notified through EpiSurv in 2012.
- The number of notifications of adults has increased since 2007.
- Living in, or regularly visiting, a building built prior to 1970 that had paint chalking or flaking and/or had recently undergone alteration or refurbishment was a common risk factor for children.
- For adults, exposure to a high-risk occupation was a common risk factor.
- The Wairarapa DHB had the highest lead notification rate in 2012.
- There were seven cases of poisoning arising from chemical contamination of the environment in 2012.

Lead absorption

There has been an increase in the number of lead absorption notifications for adults since 2007

In 2012, District Health Board (DHB) Medical Officers of Health were notified of 272 cases of lead absorption (compared with 230 in 2011). Figure 6 shows a substantial increase in the number of notifications of adults aged 15 years and over since 2007.

Figure 6: Lead absorption notification in children and adults, 1997-2012



* In 2007, direct laboratory notification was introduced, the non-occupational notifiable blood level was lowered from 0.72 to 0.48 µmol/L and enhanced occupational screening was introduced in the Auckland region.

Source: ESR Notifiable and other diseases in New Zealand: Annual Report 2012

The increase in lead poisoning notifications since 2007 also coincided with enhanced routine occupational screening in the Auckland region, lowering of the non-occupational notifiable blood-lead level from 0.72 to 0.48µmol/L in September 2007, and the introduction of direct laboratory notification in December 2007.

Notifications peaked in 2009 with around 50 lead poisoning cases associated with repainting the Auckland Harbour Bridge, and this was drawn to the attention of the then Department of Labour (now Worksafe NZ). As a result, the then Department of Labour revised their Guidelines for the Medical Surveillance of Lead Workers in 2011. These guidelines state that employers

must ensure that medical surveillance is provided to all workers involved in lead work.

Pre-1970 buildings undergoing refurbishment is a common risk factor for children

Exposure to lead paint is a leading cause of lead poisoning in children and adults. For children, the most common risk factor was living in, or regularly visiting, a building built prior to 1970 that had paint chalking or flaking and/or had recently undergone alteration or refurbishment.

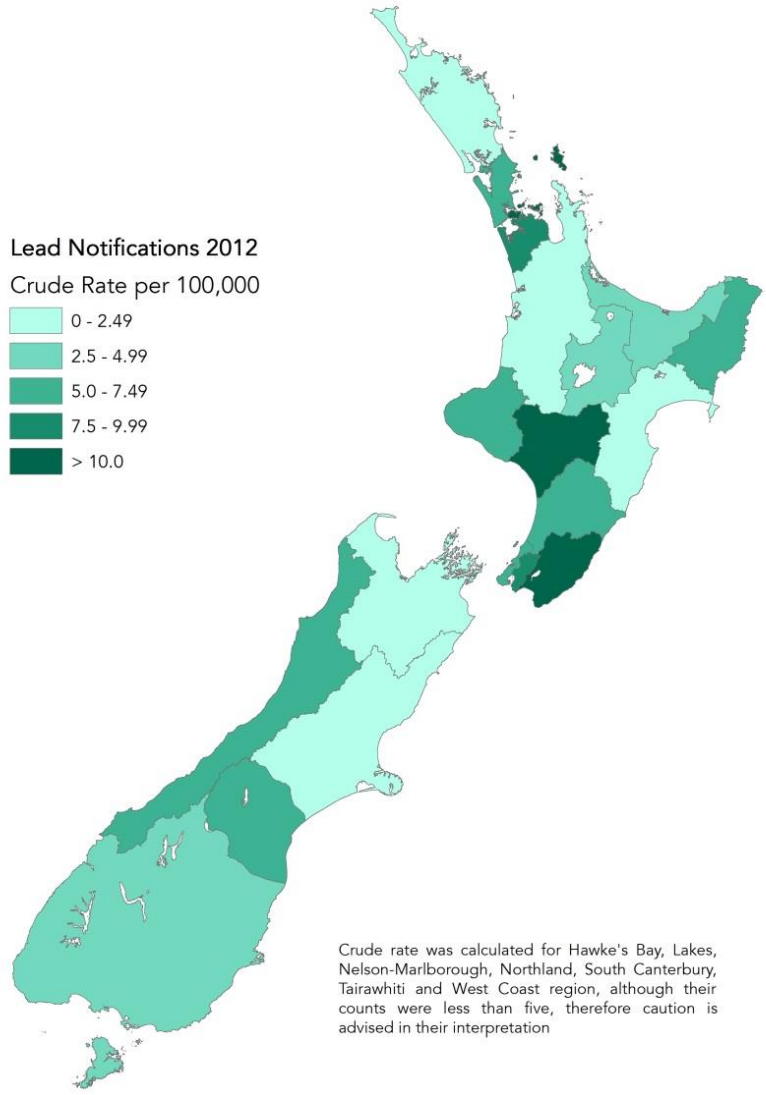
Occupational exposure is a common cause of lead poisoning in adults

The most common risk factor for adults was exposure to a high-risk occupation such as painter/decorators, foundry workers, radiator fitter, electrician/electrical engineer and scrap metal workers.

Wairarapa DHB had the highest rate of lead notifications in New Zealand

The highest lead notification rate was for Wairarapa DHB (17.2 per 100,000 population), followed by Whanganui (16.0 per 100,000) and Auckland (14.3 per 100,000 population) (Figure 7). In the previous year, the three DHBs with the highest rates of lead poisoning were South Canterbury (14.2 per 100,000), Whanganui (11.1 per 100,000), and Auckland (10.3 per 100,000).

Figure 7: Crude rates per 100,000 population of lead notifications by DHB, 2012



Source: ESR Notifiable and other diseases in New Zealand: Annual Report 2012

Poisoning arising from chemical contamination of the environment

In 2012, Medical Officers of Health were notified of seven cases of poisoning arising from chemical contamination of the environment (compared with three cases in 2011). These were from inhalation exposures to carbon monoxide (three cases), bleach (one), mould and mildew remover (one), fish smoking (one), and chlorine by-products at a public pool (one).

Hazardous substances incidents (2009-2012)

This section presents data from the hazardous substances incidents database maintained by the EPA. The EPA collects information on any event that involves hazardous substances that may or may not cause adverse effects to human health or the environment. However, not all hazardous substance incidents are reported to the EPA.

Incidents are categorised from 0 (insufficient information) to 5 (massive) according to the effects the incident has on people and the environment.

Key findings

- No level 4 or 5 category incidents notified since 2009.
- The number of level 2 and 3 incidents has decreased.
- Petroleum products are the most common substances involved in level 2 and 3 incidents.

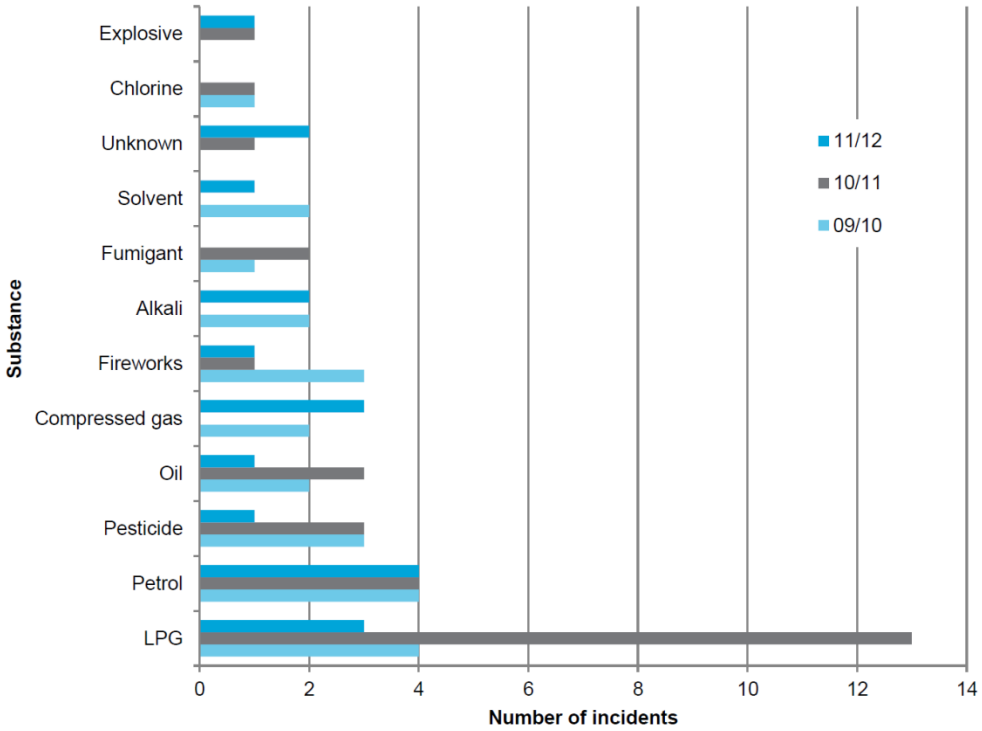
No level 4 or 5 categories since 2009

Since 2009, there have not been any level 4 or 5 categories with the most common incidents being level 1. This report focuses on incidents of level 2 and above because level 1 incidents cause no or minimal harm to people and the environment (EPA 2013).

Petroleum products were the most common substances involved

There were 23 level 2 and 3 incidents in the 2011-2012 financial year compared to 30 incidents in the previous year with petroleum products (petrol, LPG, oil) being the most common substances involved (Figure 8). This is due to their widespread use and hazardous properties (EPA 2013). Several LPG incidents were related to fires and/or explosions.

Figure 8: Substances involved in two or more level 2 and 3 incidents, 2009-2012



Source: Environmental Protection Authority (2013)

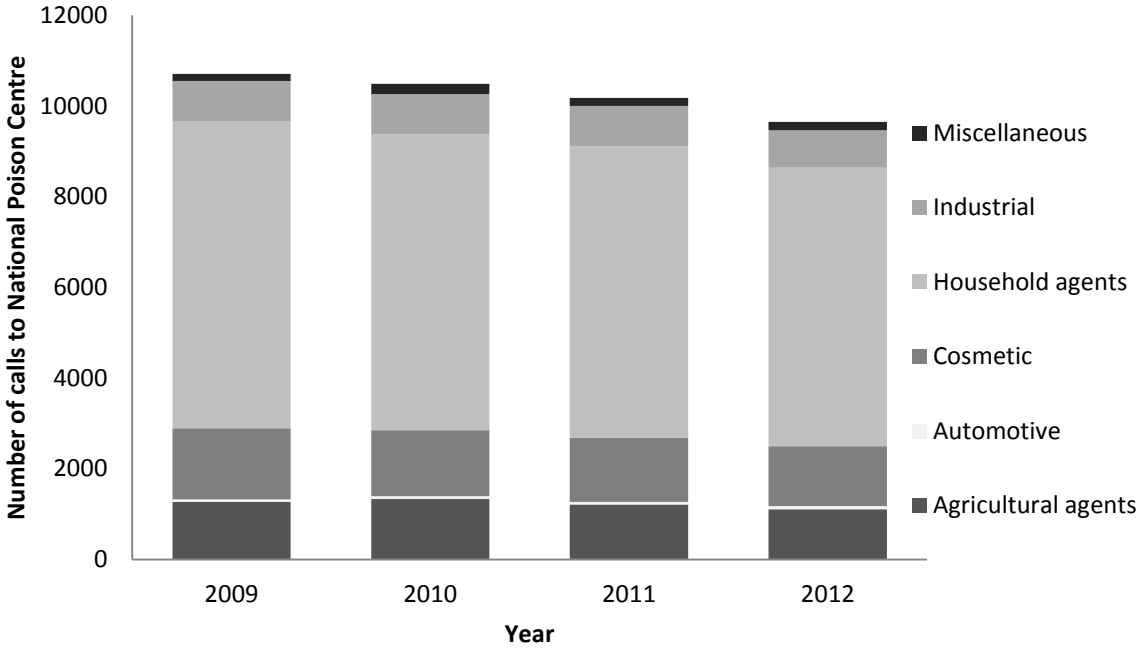
Hazardous substance-related telephone calls (2009-2012)

The National Poisons Centre (NPC) operates a 24 hour telephone service that fields enquiries regarding actual and potential poisoning exposures. Records in this database are from self-reported calls: they reflect only information provided when the public or healthcare professionals report an actual or potential exposure to a substance. There is no follow-up of the callers and confirmation of possible outcomes.

Key findings

- There were 41,038 hazardous substance-related calls that were made to the National Poisons Centre between 2009 and 2012.
- The number of hazardous substance-related calls has slightly decreased since 2009
- Of the 41,038 calls, 25,706 (63%) were related to children.
- Calls regarding household agents (63%) were most frequent.
- The majority (57%) of calls concerned unintentional child exploratory[6] followed by unintentional poisoning (38%).
- 88% of exposures occurred in the home.

Figure 9: Calls to the National Poison Centre by substance classification, 2009-2012



Over 60 percent of calls were related to children

Between 2009 and 2012, the NPC received 41,038 hazardous substance-related calls of which 63 percent were related to children[7], and 88 percent occurred at home.

Household products were the most common (63%) exposure reported to the NPC followed by cosmetics (14%) and industrial agents (12%) (Figure 9). Among children, calls regarding household products (68%) and cosmetics (18%) were the most common exposure in New Zealand (Table 7). When individual substances were examined, the top four substances most frequently involved in child exposures were silica gel (1086), toilet gel disc (469), dishwashing liquid (452), and petrol (369).

[6] Child exploratory - where children less than six years of age (but typically between two and three years old) ingest toxic substances

[7] Persons under 12 years of age were classified as children

Table 7: Number of calls to the National Poison Centre, 2009-2012

Substance Classification	Adult	Child	Unknown	Total
Household agents	8187 (54%)	17630 (69%)	37 (43%)	25854 (63%)
Cosmetic	997 (7%)	4754 (18%)	6 (7%)	5757 (14%)
Agricultural agents	2960 (19%)	1959 (8%)	19 (22%)	4938 (12%)
Industrial	2718 (18%)	766 (3%)	21 (24%)	3505 (9%)
Automotive	98 (1%)	144 (1%)	-	242 (1%)
Miscellaneous	286 (2%)	453 (2%)	3 (3%)	742 (2%)
Total	**15246**	**25706**	**86**	**41038**

Child-resistant packaging and using less hazardous alternatives will prevent unintentional ingestion of household cleaning products among children

The majority of household cleaning substances are irritants (e.g. hypochlorite bleach) or alkaline corrosive agents (e.g. oven, toilet bowl and drain cleaners). Household bleaches contain varying concentrations of sodium peroxide, sodium perborate and sodium hypochlorite (McGuigan 1999). Preventing the unintentional ingestion of alkaline corrosive agents is best accomplished through the use of child-resistant packaging, proper storage of the product, and the use of less hazardous alternatives. The residue in 'empty' containers should also be rinsed out before disposing of them. Prevention of ingestion of cosmetic or personal care products (e.g. hand sanitiser, perfume, nail polish) by young children requires safe storage of cosmetics, because these items are intended to be appealing and are often not available in child-resistant containers.

Primary Care notifications (HSDIRT)

Main points

- The Hazardous Substances and Injury Reporting Tool (HSDIRT) is now available in all health districts in New Zealand.
- The promotion of the tool to primary health care professionals has been developed and is being implemented from July 2013-June 2014.
- Results from HSDIRT will be included in future surveillance reports.

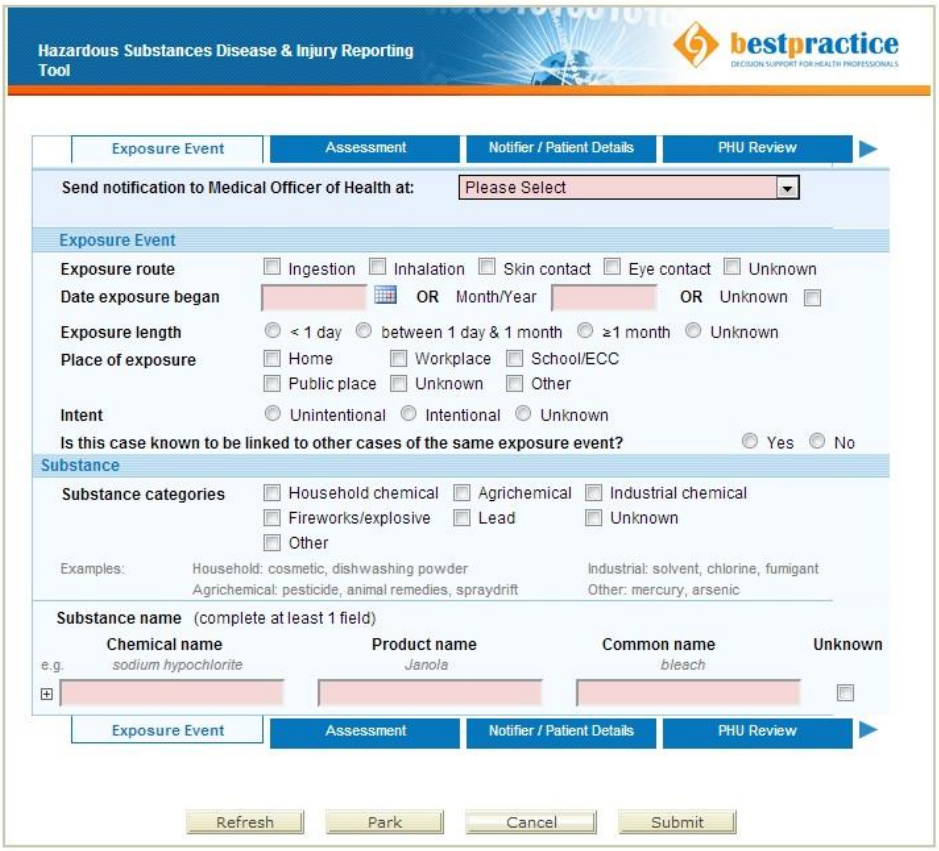
Hazardous Substances Disease and Injury Reporting Tool (HSDIRT)

The Hazardous Substances Disease and Injury Reporting Tool (HSDIRT) is now operating in all health districts of New Zealand, following a successful trial. The HSDIRT is an electronic form that simplifies notification of hazardous substances injuries, from primary health care to Medical Officers of Health (Figure 10). It was developed by the CPHR in conjunction with bestpractice decision support (BPAC), and funded by the Ministry of Health. This new system aims to improve surveillance of ill-health associated with exposure to hazardous substances in New Zealand. It links primary care notification, public health unit (PHU) response and national disease and injury prevention and control policies.

Medical practitioners are required by law to notify hazardous substances injuries. The HSDIRT has also been designed to allow notification of lead absorption ≥0.48µmol/l, and poisoning arising from chemical contamination of the environment (both notifiable under the Health Act 1956).

Improving data collection about hazardous substances, by including notifications from general practitioners will result in more complete patterns of disease and injury and enhance the evidence for future prevention.

Figure 10: An example of the HSDIRT screen as it appears to primary care notifiers



Future updates

With the HSDIRT now fully operational, the next phase of the project involves publicising the tool to primary health care professionals, to ensure that they are aware of the reporting requirements and the tool's existence. Information from this system is used in two ways. At a local level, the Medical Officer of Health and other PHU staff assess the notification and determine if further patient (or event) follow-up is required. At a national level, CPHR uses the anonymised data for surveillance.

Regular reports will be provided to the Ministry of Health and PHUs, and support disease and injury prevention and control activities. CPHR will provide each PHU with a 2013 report by May 2014 comprising EpiSurv lead and HSDIRT data. Raw data are also available to each PHU in order to carry out their own analyses, if desired. Results will also be available in future hazardous substances surveillance reports.

Conclusion

Each year during 2006-2010, hazardous substances poisonings were responsible for the deaths of over 70 and approximately 770 hospital discharges in New Zealand. Over this five-year period (2006-2010), the number of poisoning deaths has decreased to the lowest in 2010, with 56 deaths. There has been a steady decline in the rates of hospital discharges since 2006.

While there were no reported deaths of children less than five years old, this age group did have the highest hospitalisation rates for unintentional poisoning. This is more likely due to unintentional exposure to household chemicals. The high injury rate for this age group is of concern because exposure to hazardous substances is largely preventable.

Volatile substance abuse is evident among 15-24 year olds which involved a high number of butane-related deaths. Butane is readily and cheapily available, and most of the other substances used are household items, so access to the substances cannot easily be controlled.

The findings from this report will help inform about the adverse health effects of hazardous substances in New Zealand. It is important that preventive strategies are put in place in order to help to prevent future disease and injury particularly among the vulnerable groups.

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Appendix 1: Technical Notes

Coronial Services Office data

- The main limitation associated with the coronial data is timelines. It is estimated that by the end of a given year, approximately 50-60 percent of cases for that year are available. By the end of the following year, it is estimated that 90-95 percent of cases for the preceding year will have files readily accessible.

National Mortality Collection and National Minimum Dataset

- The Ministry of Health maintains the national mortality and hospital discharge databases. The data provided in this report is the most recent data available.
- Hospital discharge and mortality data are presented by calendar year.
- Morbidity data are primarily based on hospitalisations from public hospitals. Day cases are included but attendances at emergency departments and outpatient clinics are not.
- These data do not adequately capture chronic disease from hazardous substances as in most cases the cause of chronic disease cannot be identified.
- The methods used to extract the data set have been reviewed and some changes have been made therefore the figures presented here are higher than what was reported in the EPA HSNO Monitoring Report 2013.

Appendix 2: External cause codes (E-code)

E-code	Description
X66	Organic solvents and halogenated hydrocarbons and their vapours
X67	Other gases and vapours
X68	Pesticides
X69	Other and unspecified chemicals and noxious substances
X75	Intentional self-harm by explosive material
X46	Organic solvents and halogenated hydrocarbons and their vapours
X47	Other gases and vapours
X48	Pesticides
X49	Other and unspecified chemicals and noxious substances
W36	Explosion and rupture of gas cylinder
W37	Explosion and rupture of pressurized tyre, pipe or hose
W38	Explosion and rupture of other specified pressurized devices
W39	Discharge of firework
W40	Explosion of other materials
X04	Exposure to ignition of highly flammable material
Y25	Contact with explosive material
Y16	Organic solvents and halogenated hydrocarbons and their vapours
Y17	Other gases and vapours
Y18	Pesticides
Y19	Other and unspecified chemicals and noxious substances

Appendix 2: Diagnosis/Nature of injury codes

Diag Codes	Substance	Group
T511	Methanol	Alcohol
T512	2-Propanol	Alcohol
T513	Fusel oil	Alcohol
T520	Petroleum products	Solvents, hydrocarbons and corrosive substances
T521	Benzene	Solvents, hydrocarbons and corrosive substances
T522	Homologues of benzene	Solvents, hydrocarbons and corrosive substances
T523	Glycols	Solvents, hydrocarbons and corrosive substances
T524	Ketones	Solvents, hydrocarbons and corrosive substances
T528	Other organic solvents	Solvents, hydrocarbons and corrosive substances
T529	Organic solvent, unspecified	Solvents, hydrocarbons and corrosive substances
T530	Carbon tetrachloride	Solvents, hydrocarbons and corrosive substances
T531	Chloroform	Solvents, hydrocarbons and corrosive substances
T532	Trichloroethylene	Solvents, hydrocarbons and corrosive substances
T533	Tetrachloroethylene	Solvents, hydrocarbons and corrosive substances
T534	Dichloromethane	Solvents, hydrocarbons and corrosive substances
T535	Chlorofluorocarbons	Solvents, hydrocarbons and corrosive substances
T536	Other halogen derivatives of aliphatic hydrocarbons	Solvents, hydrocarbons and corrosive substances
T537	Other halogen derivatives of aromatic hydrocarbons	Solvents, hydrocarbons and corrosive substances
T539	Halogen derivative of aliphatic and aromatic hydrocarbons, unspecified	Solvents, hydrocarbons and corrosive substances
T540	Phenol and phenol homologues	Solvents, hydrocarbons and corrosive substances
T541	Other corrosive organic compounds	Solvents, hydrocarbons and corrosive substances
T542	Corrosive acids and acid-like substances	Solvents, hydrocarbons and corrosive substances
T543	Corrosive alkalis and alkali-like substances	Solvents, hydrocarbons and corrosive substances
T549	Corrosive substance, unspecified	Solvents, hydrocarbons and corrosive substances
T55	Toxic effect of soaps and detergents	Soaps and detergents

T560	Lead and its compounds	Metals
T561	Mercury and its compounds	Metals
T562	Chromium and its compounds	Metals
T563	Cadmium and its compounds	Metals
T564	Copper and its compounds	Metals
T565	Zinc and its compounds	Metals
T566	Tin and its compounds	Metals
T567	Beryllium and its compounds	Metals
T568	Other metals	Metals
T569	Metal, unspecified	Metals
T570	Arsenic and its compounds	Inorganic substances
T571	Phosphorus and its compounds	Inorganic substances
T572	Manganese and its compounds	Inorganic substances
T573	Hydrogen cyanide	Inorganic substances
T578	Other specified inorganic substances	Inorganic substances
T579	Inorganic substance, unspecified	Inorganic substances
T58	Toxic effect of carbon monoxide	Carbon monoxide
T590	Nitrogen oxides	Gases, fumes and vapours
T591	Sulfur dioxide	Gases, fumes and vapours
T592	Formaldehyde	Gases, fumes and vapours
T593	Lacrimogenic gas	Gases, fumes and vapours
T594	Chlorine gas	Gases, fumes and vapours
T595	Fluorine gas and hydrogen fluoride	Gases, fumes and vapours
T596	Hydrogen sulfide	Gases, fumes and vapours
T597	Carbon dioxide	Gases, fumes and vapours
T598	Other specified gases, fumes and vapours	Gases, fumes and vapours
T599	Gases, fumes and vapours, unspecified	Gases, fumes and vapours
T600	Organophosphate and carbamate insecticides	Pesticides
T601	Halogenated insecticides	Pesticides

T602	Other insecticides	Pesticides
T603	Herbicides and fungicides	Pesticides
T604	Rodenticides	Pesticides
T608	Other pesticides	Pesticides
T609	Pesticide, unspecified	Pesticides
T650	Cyanides	Other toxic substances
T651	Strychnine and its salts	Other toxic substances
T653	Nitroderivatives and aminoderivatives of benzene and its homologues	Other toxic substances
T654	Carbon disulfide	Other toxic substances
T655	Nitroglycerin and other nitric acids and esters	Other toxic substances
T656	Paints and dyes, not elsewhere classified	Other toxic substances
T658	Toxic effect of other specified substances	Other toxic substances
T659	Toxic effect of unspecified substance	Other toxic substances
T2123	Partial thickness [blisters, epidermal loss] burn of abdominal wall	Burns
T2124	Partial thickness [blisters, epidermal loss] burn of back [any part]	Burns
T2125	Partial thickness [blisters, epidermal loss] burn of genitalia [external]	Burns
T2129	Partial thickness [blisters, epidermal loss] burn of other sites of trunk	Burns
T2130	Full thickness burn of trunk, unspecified site	Burns
T2131	Full thickness burn of breast	Burns
T2132	Full thickness burn of chest wall, excluding breast and nipple thorax [external]	Burns
T2133	Full thickness burn of abdominal wall	Burns
T2134	Full thickness burn of back [any part]	Burns
T2135	Full thickness burn of genitalia [external]	Burns
T2139	Full thickness burn of other sites of trunk	Burns
T2200	Burn of unspecified thickness of shoulder and upper limb, except wrist and hand, unspecified site	Burns
T2201	Burn of unspecified thickness forearm and elbow	Burns
T2202	Burn of unspecified thickness arm (upper) and shoulder region	Burns
T2210	Erythema of shoulder and upper limb, except wrist and hand, unspecified site	Burns
T2211	Erythema of forearm and elbow	Burns

T2212	Erythema of arm (upper) and shoulder region	Burns
T2220	Partial thick [blisters epidermal loss] burn shoulder & upper limb except wrist & hand & unspec site	Burns
T2221	Partial thickness [blisters, epidermal loss] burn of forearm and elbow	Burns
T2222	Partial thickness [blisters, epidermal loss] burn of arm (upper) and shoulder region	Burns
T2230	Full thickness burn of shoulder and upper limb, except wrist and hand, upper limb, unspecified site	Burns
T2231	Full thickness burn of forearm and elbow	Burns
T2232	Full thickness burn of arm (upper) and shoulder region	Burns
T230	Burn of unspecified thickness of wrist and hand	Burns
T231	Erythema of wrist and hand	Burns
T232	Partial thickness [blisters, epidermal loss] burn of wrist and hand	Burns
T233	Full thickness burn of wrist and hand	Burns
T240	Burn of unspecified thickness of hip and lower limb, except ankle and foot	Burns
T241	Erythema of hip and lower limb, except ankle and foot	Burns
T242	Partial thickness [blisters, epidermal loss] burn of hip and lower limb, except ankle and foot	Burns
T243	Full thickness burn of hip and lower limb, except ankle and foot	Burns
T250	Burn of unspecified thickness of ankle and foot	Burns
T251	Erythema of ankle and foot	Burns
T252	Partial thickness [blisters, epidermal loss] burn of ankle and foot	Burns
T253	Full thickness burn of ankle and foot	Burns
T260	Burn of eyelid and periocular area	Burns
T261	Burn of cornea and conjunctival sac	Burns
T262	Burn with resulting rupture and destruction of eyeball	Burns
T263	Burn of other parts of eye and adnexa	Burns
T264	Burn of eye and adnexa, part unspecified	Burns
T270	Burn of larynx and trachea	Burns
T271	Burn involving larynx and trachea with lung	Burns
T272	Burn of other parts of respiratory tract	Burns
T273	Burn of respiratory tract, part unspecified	Burns
T280	Burn of mouth and pharynx	Burns

T281	Burn of oesophagus	Burns
T282	Burn of other parts of alimentary tract	Burns
T283	Burn of internal genitourinary organs	Burns
T284	Burn of other and unspecified internal organs	Burns
T290	Burns of multiple regions, unspecified thickness	Burns
T291	Burns of multiple regions, no more than erythema burns mentioned	Burns
T292	Burns of multiple regions, no more than partial thickness burns mentioned	Burns
T293	Burns of multiple regions, at least one burn of full thickness mentioned	Burns
T300	Burn of unspecified body region, unspecified thickness	Burns
T301	Erythema, body region unspecified	Burns
T302	Burn of partial thicknes, body region unspecified	Burns
T303	Burn of full thickness, body region unspecified	Burns
T3100	Burns involving less than 10% of body surface with less 10 % or unspecified full thickness burns	Burns
T3110	Burns involving 10-19% of body surface, with less than 10 % or unspecified full thickness burns	Burns
T3111	Burns involving 10-19% of body surface, with 10-19% full thickness burns	Burns
T3120	Burns involving 20-29% of body surface, with less than 10 % or unspecified full thickness burns	Burns
T3121	Burns involving 20-29% of body surface, with 10-19% full thickness burns	Burns
T3122	Burns involving 20-29% of body surface, with 20-29% full thickness burns	Burns
T3130	Burns involving 30-39% of body surface, with less than 10 % or unspecified full thickness burns	Burns
T3131	Burns involving 30-39% of body surface, with 10-19% full thickness burns	Burns
T3132	Burns involving 30-39% of body surface, with 20-29% full thickness burns	Burns
T3133	Burns involving 30-39% of body surface, with 30-39% full thickness burns	Burns
T3140	Burns involving 40-49% of body surface, with less than 10 % or unspecified full thickness burns	Burns
T3141	Burns involving 40-49% of body surface, with 10-19% full thickness burns	Burns
T3142	Burns involving 40-49% of body surface, with 20-29% full thickness burns	Burns
T3143	Burns involving 40-49% of body surface, with 30-39% full thickness burns	Burns
T3144	Burns involving 40-49% of body surface, with 40-49% full thickness burns	Burns
T3150	Burns involving 50-59% of body surface, with less than 10% or unspecified full thickness burns	Burns
T3151	Burns involving 50-59% of body surface, with 10-19% full thickness burns	Burns

T3152	Burns involving 50-59% of body surface, with 20-29% full thickness burns	Burns
T3153	Burns involving 50-59% of body surface, with 30-39% full thickness burns	Burns
T3154	Burns involving 50-59% of body surface, with 40-49% full thickness burns	Burns
T3155	Burns involving 50-59% of body surface, with 50-59% full thickness burns	Burns
T3160	Burns involving 60-69% of body surface, with less than 10 % or unspecified full thickness burns	Burns
T3161	Burns involving 60-69% of body surface, with 10-19% full thickness burns	Burns
T3162	Burns involving 60-69% of body surface, with 20-29% full thickness burns	Burns
T3163	Burns involving 60-69% of body surface, with 30-39% full thickness burns	Burns
T3164	Burns involving 60-69% of body surface, with 40-49% full thickness burns	Burns
T3165	Burns involving 60-69% of body surface, with 50-59% full thickness burns	Burns
T3166	Burns involving 60-69% of body surface, with 60-69% full thickness burns	Burns
T3170	Burns involving 70-79% of body surface, with less than 10% or unspecified full thickness burns	Burns
T3171	Burns involving 70-79% of body surface, with 10-19% full thickness burns	Burns
T3172	Burns involving 70-79% of body surface, with 20-29% full thickness burns	Burns
T3173	Burns involving 70-79% of body surface, with 30-39% full thickness burns	Burns
T3174	Burns involving 70-79% of body surface, with 40-49% full thickness burns	Burns
T3175	Burns involving 70-79% of body surface, with 50-59% full thickness burns	Burns
T3176	Burns involving 70-79% of body surface, with 60-39% full thickness burns	Burns
T3177	Burns involving 70-79% of body surface, with 70-79% full thickness burns	Burns
T3180	Burns involving 80-89% of body surface, with less than 10% or unspecified full thickness burns	Burns
T3181	Burns involving 80-89% of body surface, with 10-19% full thickness burns	Burns
T3182	Burns involving 80-89% of body surface, with 20-29% full thickness burns	Burns
T3183	Burns involving 80-89% of body surface, with 30-39% full thickness burns	Burns
T3184	Burns involving 80-89% of body surface, with 40-49% full thickness burns	Burns
T3185	Burns involving 80-89% of body surface, with 50-59% full thickness burns	Burns
T3186	Burns involving 80-89% of body surface, with 60-69% full thickness burns	Burns
T3187	Burns involving 80-89% of body surface, with 70-79% full thickness burns	Burns
T3188	Burns involving 80-89% of body surface, with 80-89% full thickness burns	Burns
T3190	Burns involving 90% or more of body surface, with less than 10% or unspecified full thickness burns	Burns

T3191	Burns involving 90% or more of body surface, with 10-19% full thickness burns	Burns
T3192	Burns involving 90% or more of body surface, with 20-29% full thickness burns	Burns
T3193	Burns involving 90% or more of body surface, with 30-39% full thickness burns	Burns
T3194	Burns involving 90% or more of body surface, with 40-49% full thickness burns	Burns
T3195	Burns involving 90% or more of body surface, with 50-59% full thickness burns	Burns
T3196	Burns involving 90% or more of body surface, with 60-69% full thickness burns	Burns
T3197	Burns involving 90% or more of body surface, with70-79% full thickness burns	Burns
T3198	Burns involving 90% or more of body surface, with 80-89% full thickness burns	Burns
T3199	Burns involving 90% or more of body surface, with 90% or more of body surface full thickness burns	Burns
L230	Allergic contact dermatitis due to metals	Dermatitis
L231	Allergic contact dermatitis due to adhesives	Dermatitis
L232	Allergic contact dermatitis due to cosmetics	Dermatitis
L234	Allergic contact dermatitis due to dyes	Dermatitis
L235	Allergic contact dermatitis due to other chemical products	Dermatitis
L240	Irritant contact dermatitis due to detergents	Dermatitis
L241	Irritant contact dermatitis due to oils and greases	Dermatitis
L242	Irritant contact dermatitis due to solvents	Dermatitis
L243	Irritant contact dermatitis due to cosmetics	Dermatitis
L245	Irritant contact dermatitis due to other chemical products	Dermatitis
L250	Unspecified contact dermatitis due to cosmetics	Dermatitis
L252	Unspecified contact dermatitis due to dyes	Dermatitis
L253	Unspecified contact dermatitis due to other chemical products	Dermatitis

Appendix 3: Map of District Health Boards