# Annual Hazardous Substances Injury Report

## 2016

### Report to the Ministry of Health

**21 November 2016**

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

hsss
Hazardous Substances Surveillance System

# Author

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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. A high proportion of these incidents is caused by hazardous substances used in everyday domestic and workplace situations.

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

### Key Findings

- There were 44 hazardous substances-related deaths registered in 2013 compared to 46 deaths in 2012
- Males had higher rates of mortality than females from hazardous substances
- There were no deaths of children less than five years old from 2006 to 2013 due to hazardous substances exposure
- Toxic effects of carbon monoxide contributed to 354 deaths between 2006 and 2013, of which 337 were intentional exposures or suicides. Death from carbon monoxide exposure was most common in the 25-44 year (131 deaths) and 45-64 year (139 deaths) age groups
- On average, 15 deaths from exposure to a hazardous substance are referred to the coroner every year
- There were 632 hazardous substances-related hospital discharges in 2015 compared to 677 in 2014
- Children under five years old and young adults (15-24 years) had the highest rates of hospital discharges from hazardous substances injuries in New Zealand. For children under five years, 347 (39%) of these injuries were from solvents, hydrocarbons and corrosive substances
- Māori had a higher hospital discharge rate from hazardous substances injuries than non-Māori for each of the last 10 years
- From 2006-2015, over half (3665 discharges) of all hazardous substances-related hospital discharges were from injuries that occurred in the home
- Hospital discharges due to hazardous substances exposure increased with socio-economic deprivation
- There were 121 lead absorption notifications in 2015, seven of which were for children under 15 years old
- Painters (16 notifications) were the occupational group most exposed to lead in 2015
- Lead-based paint was the most common source of non-occupational/unknown lead exposure for both children and adults
- There were 61 hazardous substances notifications in 2015, five of which were for children under five years old
- The New Zealand Fire Service attends over 1200 hazardous substances incidents each year. Ammonia, methane, and chlorine were the most common substances involved in the more serious (level 2, 3 or 4) incidents
- Over half (4395/8220) of the hazardous substances-related calls to the National Poisons Centre in 2015[1] involved children less than five years of age
- Calls regarding exposure to household agents, and more specifically household cleaners (813 calls) and detergents (387 calls), most frequently involved children. Of all agricultural agents, rodenticides (61 calls) were the most commonly reported product involving children.

[1] Data were available for nine months only

# 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 to meet a legal requirement[2] 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[3]. 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 monitors data from several different sources which capture hazardous substances injuries of different severity. These include:

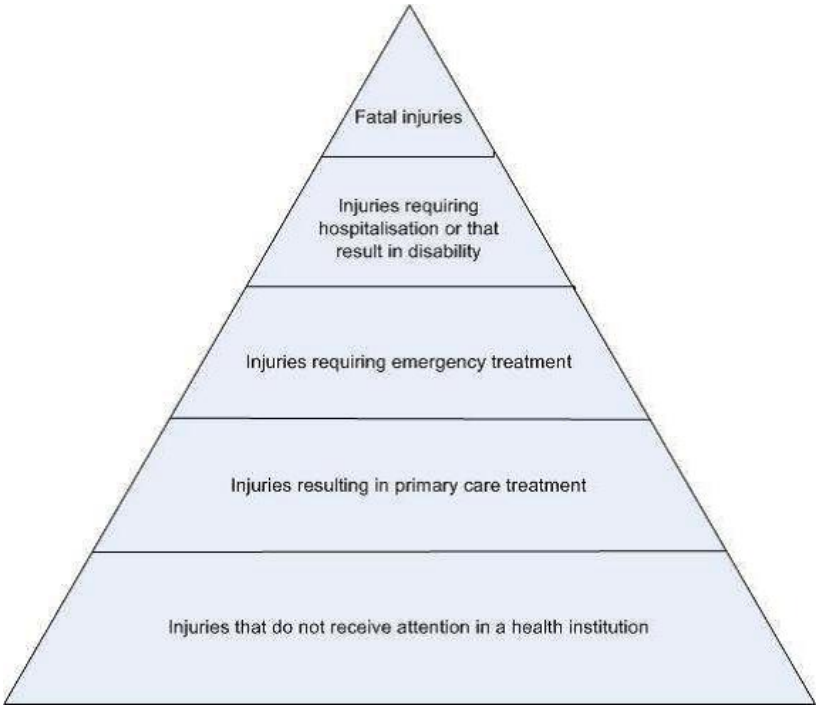
- mortality data
- coroners' reports
- hospital discharges
- primary care notifications
- hazardous substance incident reports
- National Poisons Centre calls.

To obtain robust and meaningful data on the incidence and prevalence of hazardous substance injuries and deaths, 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 that 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) enables more complete surveillance of hazardous substances injuries and deaths, and ultimately helps to prevent future disease and injury.

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

[3] Health Act 1956, Schedule 2.

**Figure 1:** Injury Pyramid




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

## What's in this report?

The report provides evidence for agencies (eg, government departments) involved in policy development and decision-making about hazardous substances, and provides information for researchers, health practitioners, regional and community organisations, and the wider public.

It presents findings on hazardous substances-related injuries from the following data sources:

- National Mortality Collection
- National Coronial Information System (NCIS)
- National Minimum Dataset (NMDS)
- Hazardous Substances Disease and Injury Reporting Tool (HSDIRT)
- New Zealand Fire Service
- National Poisons Centre (NPC).

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

- What is the current level of injury from hazardous substances in the population?
- How has it changed?
- Who are more at risk from diseases and injuries from hazardous substances?

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

## Definitions

### What is a hazardous substance?

The Hazardous Substances and New Organisms (HSNO) Act 1996 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 the 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. However, intentional harm has been included in this report as it is an important cause of deaths from hazardous substances in New Zealand.

## Data sources

### Numerators

Details on the data obtained, their sources and time periods are presented in Table 1.

**Table 1:** Sources of data

| Source | Data | Period |
|---|---|---|
| Ministry of Health | Mortality | 2006-2013 |
| | National Minimum Dataset (hospital discharges) | 2006-2015 |
| New Zealand National Coronial Information System | Coroners' findings | 2007-2014 |
| Hazardous Substances Disease and Injury Reporting Tool | Primary Care notifications | 2014-2015 |
| New Zealand Fire Service | Hazardous substances incidents | 2009-2015 |
| National Poisons Centre | Hazardous substances calls | 2009-2015 |
| Statistics New Zealand | Population estimates | 2006-2013 |
| | Population projections | 2014-2015 |

### National Minimum Dataset (NMDS)

A 'hospital discharge' includes a person that has been admitted to hospital and later discharged. However, this 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 have been excluded from the data set. In this report, a 'readmission' is defined as the unintended acute readmission of a patient from any injury within 30 days of discharge. Patients dying in hospital are also included.

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. External causes reflect the mechanism of the injury. The nature of injury reflects the clinical diagnosis. A full list of external-cause (E code) and diagnosis/nature-of-injury codes is provided in Appendix 2.

## Statistical Notes

### Age-specific and age-standardised rates

Data is presented primarily as numbers and rates. All age-standardised rates account for differences in population structure, and can be used to compare groups with different age structures (e.g., males and females, or Māori and non-Māori) and data from different years. Age-gender-specific rates are calculated to measure the frequency of hazardous substances-related deaths, hospital discharges, or notifications for specific groups.

In this report, age-standardised rates are standardised to the World Health Organization (WHO) world standard population. Rates are presented per 100,000 population (Ahmad et al., 2001).

### Denominators

Mid-year population estimates from 2006 to 2013 and population projections from 2014 to 2015 were the denominators for mortality, hospitalisation, and primary care notification rates. Denominators for the non-Māori rates were constructed by subtracting the Māori population estimates from the total New Zealand population estimates for each year.

### Area deprivation

The NZDep2006 and NZDep2013[4] index of small area deprivation were used to examine patterns by socioeconomic status. It ranks small areas from the least deprived (decile 1) to the most deprived (decile 10). Deprivation quintiles are used in this report. Each NZDep quintile contains about 20 percent of small areas in New Zealand. Quintile 1 represents people living in the least deprived 20 percent of small areas. Quintile 5 represents people living in the most deprived 20 percent of small areas.

[4] NZDep2006 was applied to year 2006 to 2009 and NZDep2013 was applied to year 2010 to 2015.

## National Mortality Collection (2006-2013)

This section provides key findings on hazardous substances deaths from the National Mortality Collection, which is maintained by the Ministry of Health. The delay in finalising the mortality data is due primarily to the release of the coroners' reports once an investigation has been completed.

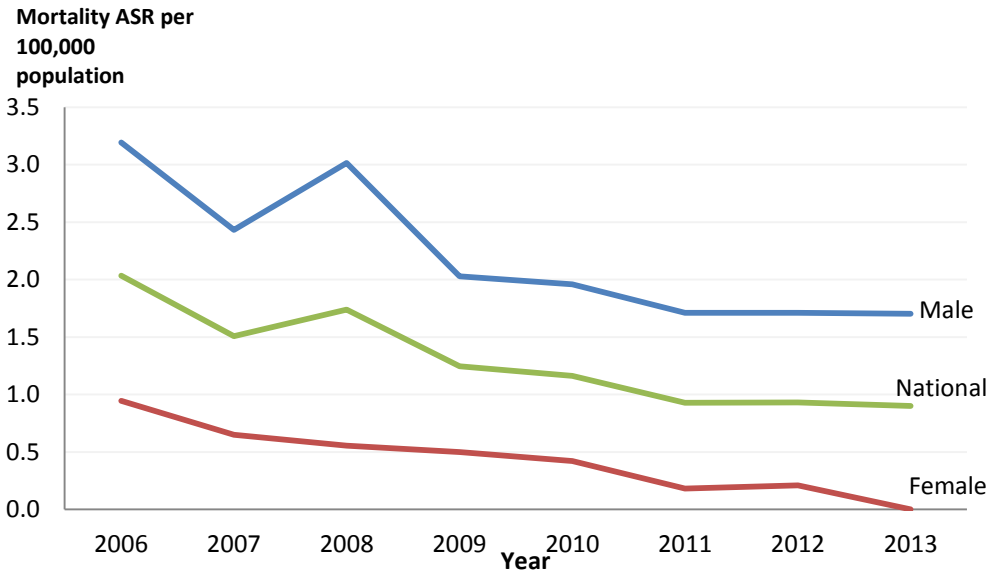
### Key findings

- There were 44 hazardous substances-related deaths registered in 2013. The number of deaths has singificantly decreased since 2006
- Males continue to have higher rates of mortality than females from hazardous substances
- Intentional exposure to hazardous substances accounted for 81 percent (391/483) of deaths between 2006 and 2013
- From 2006-2013, there were no hazardous substances-related deaths of children less than five years old
- Toxic effects of carbon monoxide contributed to 354 deaths between 2006 and 2013.

### Deaths from hazardous substances are decreasing

There were 44 hazardous substances-related deaths registered in 2013. This represents a 52 percent decrease in the number of hazardous substances deaths since 2006 (91 deaths). Figure 2 shows a downward trend in the national mortality rate.

**Figure 2:** Age-standardised rate (ASR) per 100,000 population of hazardous substances deaths by gender, 2006-2013




Source: National Mortality Collection

Note: ASR was not calculated for counts smaller than five.

### Deaths from hazardous substances are more common in males than females

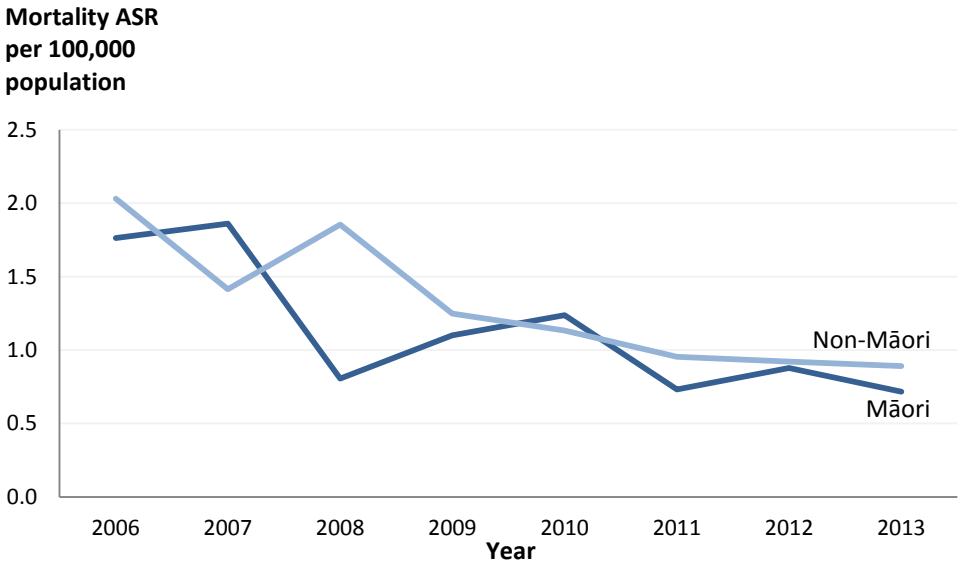
Between 2006 and 2013, the male age-standardised mortality rates from a hazardous substance were three to nine times greater than the female rates (Figure 2). These results are similar to those previously found ( Peiris-John, Kool, & Ameratunga, 2014). While the rate for males has steadily declined over time, there were some fluctuations between 2006 and 2009.The number and rate of female deaths from a hazardous substance has declined over time. In 2013, only four female deaths were reported, the lowest since 2006.

### No clear ethnic difference in deaths from hazardous substances

The age-standardised mortality rates from a hazardous substance for Māori and Non-Māori fluctuated from 2006 to 2013 with a decreasing trend (Figure 3). The Māori death rate from a hazardous substance was 0.71 per 100,000 population in 2013, the lowest since 2006.

Overall, there were no clear ethnic differences in deaths from a hazardous substance for Māori and Non-Māori.

**Figure 3:** Age-standardised rate (ASR) per 100,000 population of hazardous substances deaths by ethnicity, 2006-2013

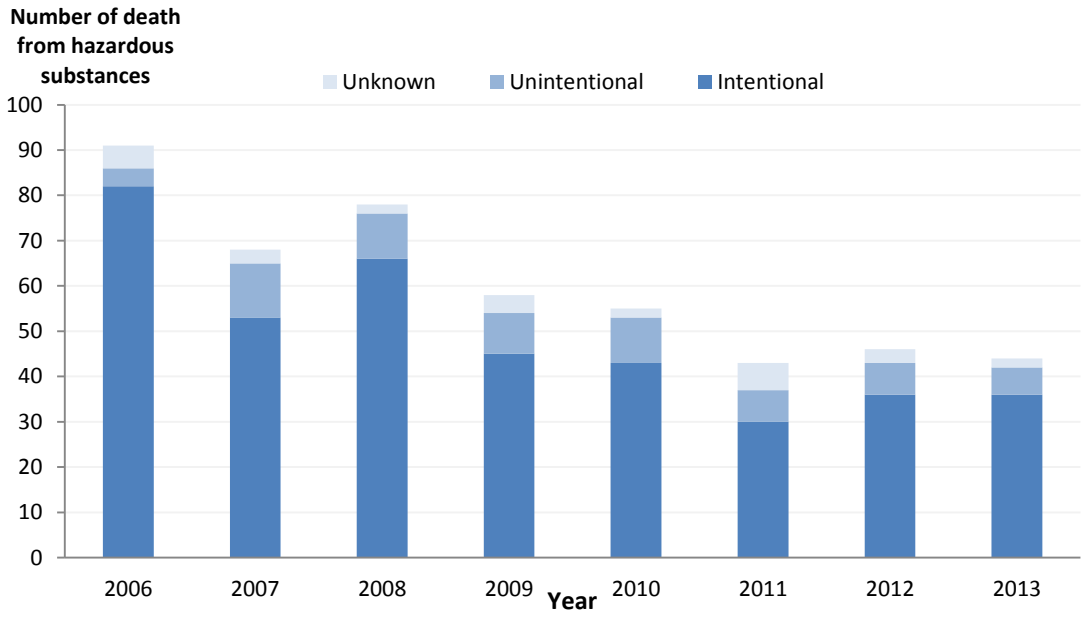



Source: National Mortality Collection

### Four out of five of hazardous substances deaths were due to intentional exposure

Between 2006 and 2013, there were 483 deaths from hazardous substances, of which 391 (81%) were attributed to intentional exposure, 65 (13%) were unintentional, and the intent was unknown for 27 deaths (6%) (Figure 4).

**Figure 4**: Number of hazardous substances-related deaths by intent, 2006-2013




Source: National Mortality Collection

### There were no hazardous substances-related deaths of children less than five years old

From 2006 to 2013, there were no reported hazardous substances-related deaths of children less than five years old (Table 2).The youngest death occurred in a child in the 5-14 years old age group due to exposure to petroleum products. The 45-64 and 25-44 year age groups contributed to 35 and 33 percent of all hazardous substances deaths respectively.

There were eight deaths in the 5-14 year age group, of which five were due to inhaling butane and three[5] were petrol-related. The remaining child suffered burns from an explosion. Six of the eight deaths in the 5-14 year age group were from the most deprived areas (NZDep06 and NZDep13 quintile 5[6]).

**Table 2:** Number of deaths from hazardous substances, by age group and cause of death, 2006-2013

| Cause of death | Age groups (years) | | | | | |
|---|---|---|---|---|---|---|
| | 05-14 | 15-24 | 25-44 | 45-64 | 65+ | Total |
| Pesticides | | 2 | 1 | 9 | 6 | 18 |
| Organic solvents and halogenated hydrocarbons and their vapours | 2 | 5 | 7 | 3 | | 17 |
| Other and unspecified chemicals and noxious substances | | 2 | 9 | 3 | 3 | 17 |
| Explosion of other materials | 1 | 2 | 1 | 4 | 1 | 9 |
| Exposure to ignition of highly flammable material | | 1 | | 1 | 3 | 5 |
| Explosion and rupture of gas cylinder | | 1 | | 3 | | 4 |
| Explosion and rupture of other specified pressurized devices | | | 1 | | | 1 |
| Explosion and rupture of pressurized tyre, pipe or hose | | | | | 1 | 1 |
| Other gases and vapours | 5 | 63 | 142 | 148 | 53 | 411 |
| **Total** | **8** | **76** | **161** | **171** | **67** | **483** |

Source: National Mortality Collection

[5] One case was exposed to both butane and petrol
[6] NZDep2006 was applied to year 2006 to 2009 and NZDep2013 was applied to year 2010 to 2015.

### Toxic effects of carbon monoxide contributed to the majority of deaths

Toxic effects of carbon monoxide contributed to 354 deaths between 2006 and 2013, of which 337 deaths were intentional exposures or suicides. Death from carbon monoxide exposure was most common in the 25-44 (131 deaths) and 45-64 (139 deaths) year age groups. Common sources of carbon monoxide include running a vehicle in a confined space such as a garage, unflued gas heaters, burning fuel in a confined space, gas stoves not working properly, or broken or blocked chimneys (WorkSafe New Zealand, 2010).

## Coronial data (2007-2014)

This section summarises key findings on hazardous substances deaths from the National Coronial Information System (NCIS). The NCIS is a data repository for mortality data from all Australian and New Zealand coroners. It includes all deaths reported to a coroner since July 2007. All deaths that result from acute hazardous substances injury are deemed to be suspicious; therefore, a coroner's inquest should be completed. New Zealand case information is only available on the NCIS once the coroner has completed the investigation.

### Key findings

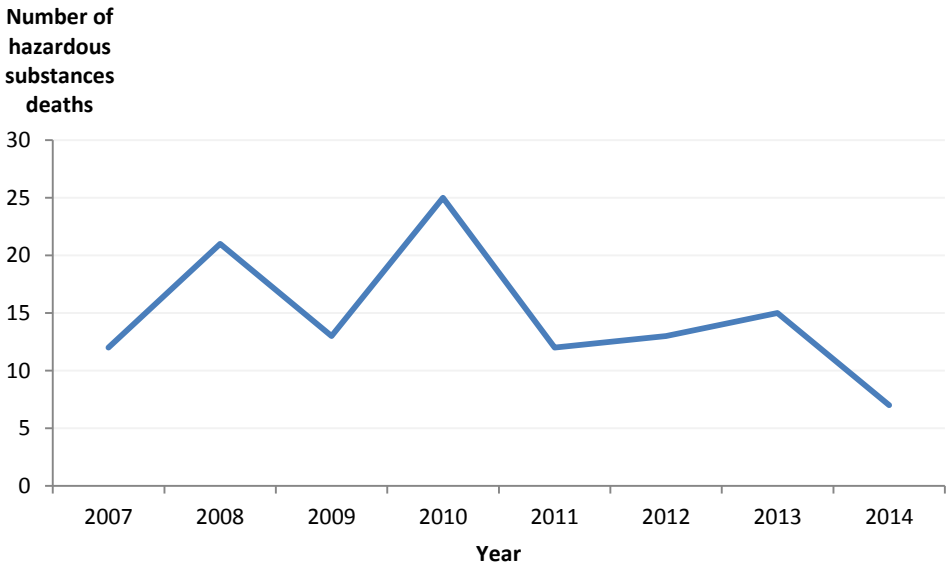
- On average, 15 deaths are referred to the coroner due to hazardous substances exposure every year
- Males outnumbered females in both unintentional and intentional causes of death from hazardous substances
- There were no deaths from hazardous substances that were reported to the coroner for children less than five years old between 2007 and 2014
- Toxic gases (e.g. liquid petroleum gas (LPG), butane, propane and methane) were the most common substances causing death, especially in the 15-24 year age group.

### Approximately 15 deaths from hazardous substances are referred to the coroner each year

There were 118 hazardous substances deaths referred to the coroner from 2007 to 2014, which equated to approximately 15 deaths per year on average (Figure 5). There were seven deaths reported to the coroner in 2014 due to hazardous substances, compared to 15 deaths in 2013.

The 2015 HSSS report reported 13 deaths for 2013 – this number has increased due to the completion of additional coronial investigations.

**Figure 5:** Number of hazardous substances deaths reported to the coroner, 2007-2014




Source: National Coronial Information System

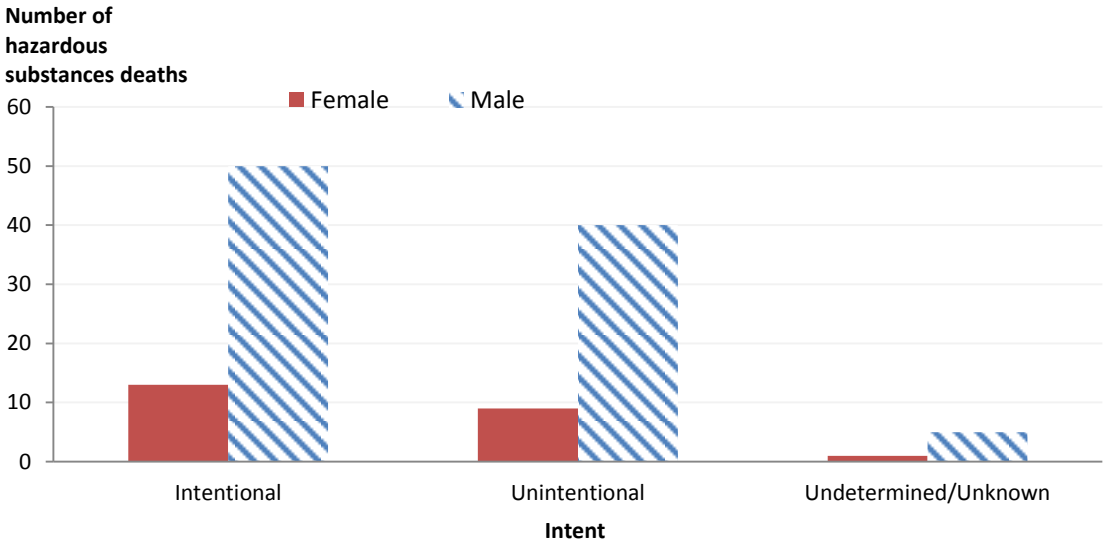
Note:

1. Only cases that were closed by coroners were included in this report.
2. This report is based on information recorded in the NCIS as at 27 October 2016. Updates or additions made to the coronial dataset are not reflected in this report.

### Males had more deaths from hazardous substances exposure than females

From 2007 to 2014, the majority of hazardous substances deaths were from males (95/118 deaths)) (Figure 6). Intent was recorded according to the judgement of the coroner. During 2007-2014, more than half (63/118) of deaths from hazardous substances were intentional, and 49 deaths unintentional. Males outnumbered females in both intentional and unintentional cause of deaths.

**Figure 6:** Number of hazardous substances deaths reported to the coroner, by intent and gender, 2007-2014




Source: National Coronial Information System

### Toxic gases were the leading causes of exposure among 15-24 years olds

From 2007 to 2014, toxic gases such as liquid petroleum gas (LPG), methane, propane, and butane were the most common substances causing death, with the 15-24 year age group the most affected (Table 3). Carbon monoxide was the second most common cause of deaths.

**Table 3:** Number of hazardous substances deaths reported to the coroner, by substance group and age group, 2007-2014

| Substance causing injury | Age groups (years) | | | | | Total |
|---|---|---|---|---|---|---|
| | 5-14 | 15-24 | 25-44 | 45-64 | 65+ | |
| LPG Gas, Natural Gas, Methane Gas, Propane Gas, Butane Gas | 4 | 21 | 3 | 2 | 1 | 31 |
| Other Sources of Carbon Monoxide | | 2 | 7 | 11 | 2 | 22 |
| Cyanide | | 1 | 5 | 1 | 1 | 8 |
| Weed Killer, Herbicide | | | 1 | 4 | 3 | 8 |
| Ethylene Glycol, Antifreeze | | 1 | 3 | 3 | | 7 |
| Petrol, Diesel, Gasoline | 1 | 4 | 2 | | | 7 |
| Other Specified Non-Pharmaceutical Chemical Substance | | | 4 | 1 | | 5 |
| Methylated Spirits | | 1 | 1 | 1 | | 3 |
| Other Insecticide | | 1 | | 1 | 1 | 3 |
| Paraquat | | | 1 | 2 | | 3 |
| Alcohol, Methanol NEC | | 1 | 1 | | | 2 |
| Explosive | | | 1 | 1 | | 2 |
| Hydrogen Sulphide | | | | | 2 | 2 |
| Organophosphate NEC | | | | 1 | 1 | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Other Specified Pesticide Herbicide | | 1 | 1 | | | 2 |
| Barbeque, Weber Grill, Outdoor Cookers/Griller, Outdoor Clay Oven | | | 1 | | | 1 |
| Drain Cleaners | | | | | 1 | 1 |
| Epoxies | | | 1 | | | 1 |
| Helium Gas | | | 1 | | | 1 |
| Lubricating Oils, Motor Oil | | 1 | | | | 1 |
| Other Specified Object/Substance | | | | 1 | | 1 |
| Paint, Varnish, Stain | | | 1 | | | 1 |
| Plant Food or Fertiliser, Plant Hormones | | | | 1 | | 1 |
| Sodium Hydroxide, Caustic Soda | | | | 1 | | 1 |
| Toluene | | | 1 | | | 1 |
| Unspecified Fuel or Solvent | | | 1 | | | 1 |
| **Total** | **5** | **34** | **36** | **31** | **12** | **118** |

Source: National Coronial Information System

## National Minimum Dataset (2006-2015)

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

### Key findings

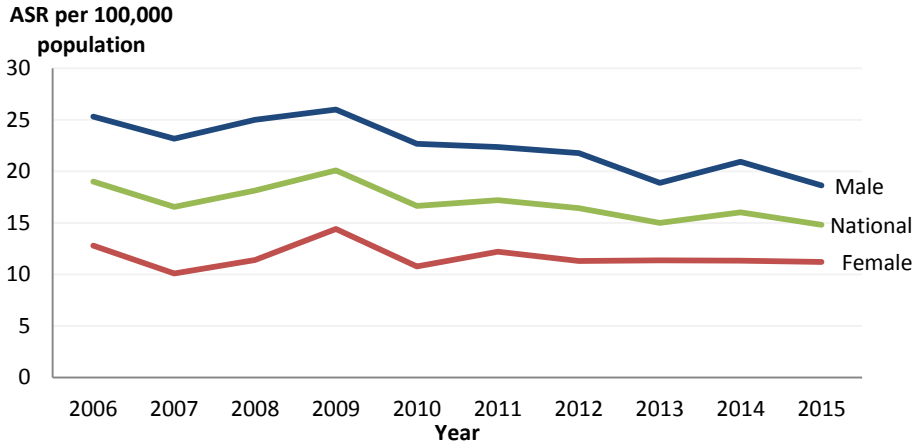
- There were 632 hazardous substances-related hospital discharges in 2015
- On average, there were approximately 700 hospital discharges from exposure to hazardous substances every year from 2006 to 2015
- Each year more males were hospitalised from exposure to hazardous substances than females
- Children under five years old and young adults (15-24 years) had the highest rates of hospital discharges from hazardous substances injuries in New Zealand
- Māori had higher hospital discharge rates from hazardous substances than non-Māori
- The most common cause of hazardous substances injury for children under the age of five years was solvents, hydrocarbons and corrosive substances
- From 2006 to 2015, over half (3665 hospital discharges) of all hazardous substances injuries occurred in the home
- Hospital discharges due to hazardous substances exposure generally increased with socio-economic deprivation.

### There were 632 hazardous substances-related hospital discharges in 2015

In 2015, there were 632 hazardous substances-related hospital discharges. During the ten-year period reviewed (2006 to 2015), there were 6971 hospital discharges attributed to hazardous substances exposure, an average of 697 per year.

Each year males had a higher hospital discharge rates compared to females (Figure 7). While hospital discharges can be regarded as an indicator of severity, it is a major undercount of exposure to hazardous substances as not all diseases and injuries will require hospitalisation.

**Figure 7:** Age-standardised rate (ASR) per 100,000 population of hospital discharges from hazardous substances by gender, 2006-2015




Source: National Minimum Dataset

### More males were hospitalised from exposure to hazardous substances than females

Males had doubled the female hospitalisation rate for unintentional hazardous substances injury (Table 4). However, males and females had similar rates for intentional exposure. These rates have not changed markedly since 2006. The rate of undetermined exposure discharges among males has decreased from 10.7 to 5.9 per 100,000 population from 2006 to 2015.

**Table 4:** Hospital discharges from hazardous substances, numbers and gender-specific rates per 100,000 population, 2006-2015

| Year | Intentional exposure | | | | Unintentional exposure | | | | Undetermined | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | | Rate | | Number | | Rate | | Number | | Rate | | Number | | Rate | |
| | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male |
| **2006** | 88 | 63 | 4.1 | 3.1 | 126 | 203 | 5.9 | 9.9 | 39 | 220 | 1.8 | 10.7 | 253 | 486 | 11.8 | 23.7 |
| **2007** | 70 | 65 | 3.2 | 3.1 | 100 | 193 | 4.6 | 9.3 | 35 | 196 | 1.6 | 9.5 | 205 | 454 | 9.5 | 22.0 |
| **2008** | 87 | 63 | 4.0 | 3.0 | 115 | 245 | 5.3 | 11.8 | 33 | 186 | 1.5 | 8.9 | 235 | 494 | 10.8 | 23.7 |
| **2009** | 88 | 66 | 4.0 | 3.1 | 152 | 302 | 6.9 | 14.4 | 52 | 158 | 2.4 | 7.5 | 292 | 526 | 13.3 | 25.0 |
| **2010** | 81 | 79 | 3.6 | 3.7 | 106 | 239 | 4.8 | 11.2 | 43 | 141 | 1.9 | 6.6 | 230 | 459 | 10.3 | 21.6 |
| **2011** | 80 | 73 | 3.6 | 3.4 | 146 | 224 | 6.5 | 10.5 | 31 | 163 | 1.4 | 7.6 | 257 | 460 | 11.5 | 21.5 |
| **2012** | 92 | 71 | 4.1 | 3.3 | 117 | 232 | 5.2 | 10.8 | 27 | 148 | 1.2 | 6.9 | 236 | 451 | 10.5 | 20.9 |
| **2013** | 83 | 66 | 3.7 | 3.0 | 111 | 213 | 4.9 | 9.8 | 38 | 113 | 1.7 | 5.2 | 232 | 392 | 10.2 | 18.0 |
| **2014** | 111 | 86 | 4.8 | 3.9 | 91 | 238 | 4.0 | 10.8 | 31 | 120 | 1.3 | 5.4 | 233 | 444 | 10.1 | 20.1 |
| **2015** | 101 | 66 | 4.3 | 2.9 | 106 | 204 | 4.5 | 9.1 | 23 | 132 | 1.0 | 5.9 | 230 | 402 | 9.8 | 17.9 |

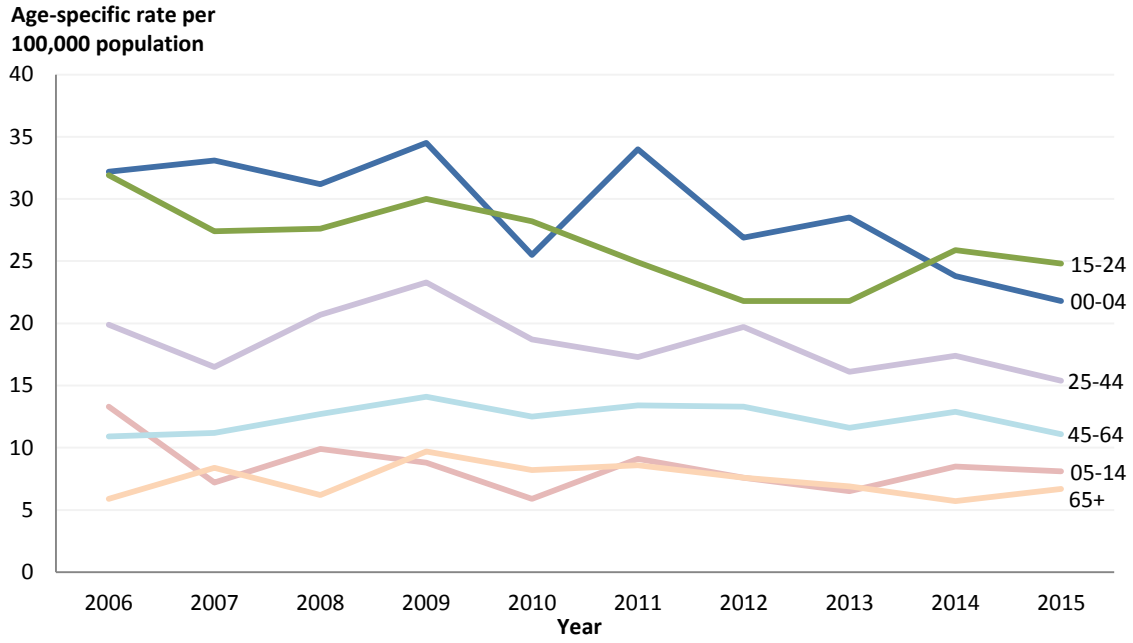
Source: National Minimum Dataset

### Children under five years old had the highest rates of hospital discharge from hazardous substances exposure

From 2006 to 2015, marked differences were evident in age-specific hazardous substances-related discharge rates (Figure 8). Compared to all other age groups, children under five years old continued to have higher discharge rates from hazardous substances. However, in 2010, 2014 and 2015, rates were the highest in the youth age group (15-24 years).

The 5-14 and 65+ year age groups had the lowest rates of hospital discharges over this ten-year period.

**Figure 8:** Age-specific rates per 100,000 population of hospital discharges from hazardous substance injuries, by age group, 2006-2015

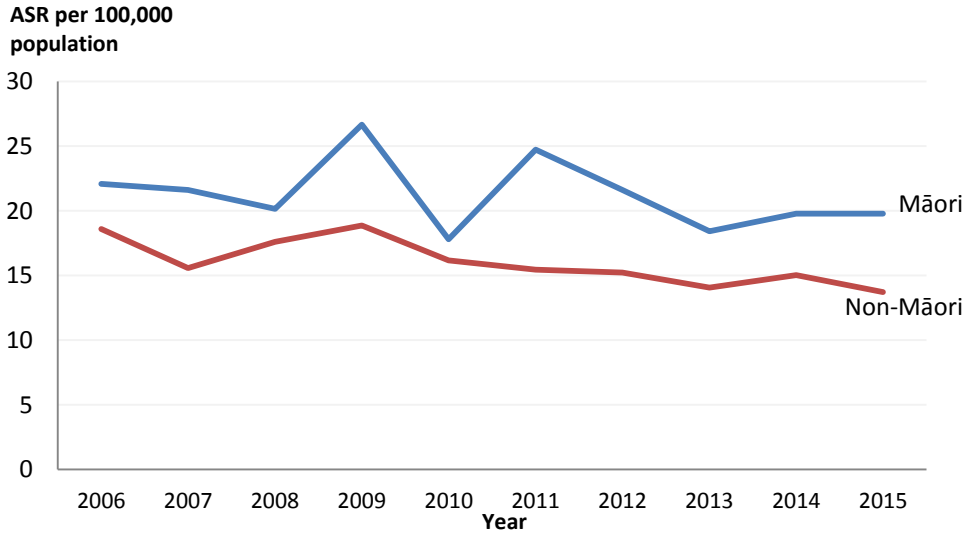



Source: National Minimum Dataset

### Māori had higher hospital discharge rates from hazardous substances exposure compared to non-Māori

During the period 2006-2015, the age-standadrised rate (ASR) for Māori hospital discharges from hazardous substances injuries was higher than non-Māori for each of the last 10 years (Figure 9). Hospital discharge rates for Māori fluctuated between 2008 and 2013 while the rate for non-Māori has held steady over this period.

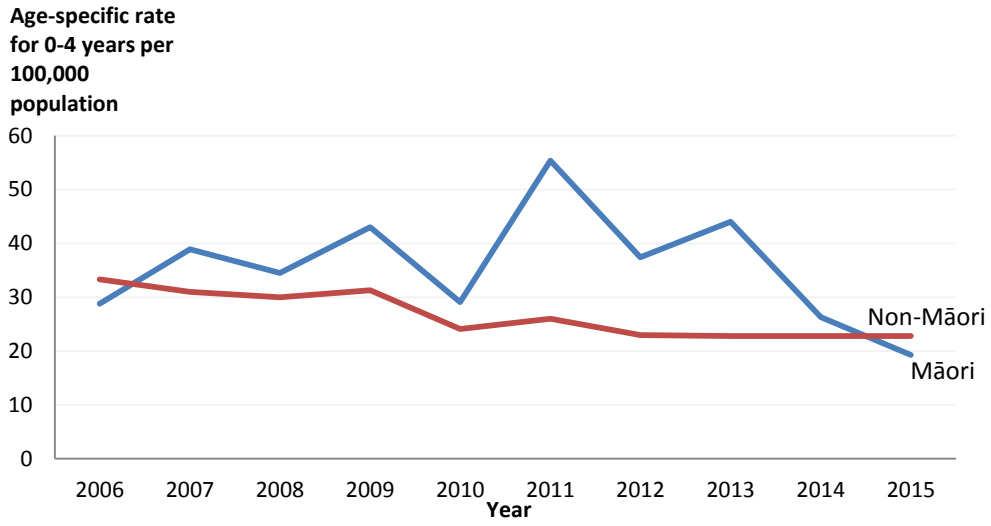
**Figure 9:** Age-standardised rate (ASR) per 100,000 population of hospital discharges from hazardous substances injuries by ethnicity, 2006-2015




Source: National Minimum Dataset

From 2006 to 2015, for children under five years old, Māori children had higher rates of hazardous substances-related hospital discharges than non-Māori children, except for the years 2006 and 2015 (Figure 10).

**Figure 10:** Age-specific rate per 100,000 population of hospital discharges from hazardous substances injuries, 0-4 years, by ethnicity, 2006-2015

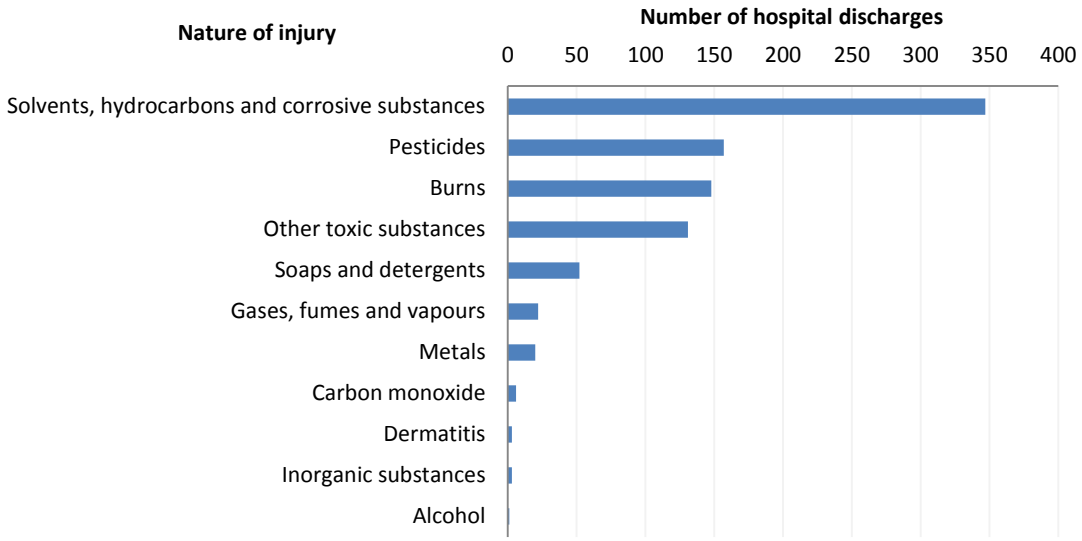



Source: National Minimum Dataset

### Solvents, hydrocarbons and corrosive substances was the most common diagnostic group among children 0-4 years old

Of the 890 hospital discharges among children aged 0-4 years between 2006 and 2015, 347 were due to solvents, hydrocarbons and corrosive substance exposures and 157 from exposures to pesticides (Figure 11). In contrast, burns from hazardous substances were the most common injury across all age groups followed by injuries from solvents, hydrocarbons and corrosive substances.

**Figure 11:** Number of hospital discharges from hazardous substances injuries in children 0-4 years, by diagnostic group, 2006-2015

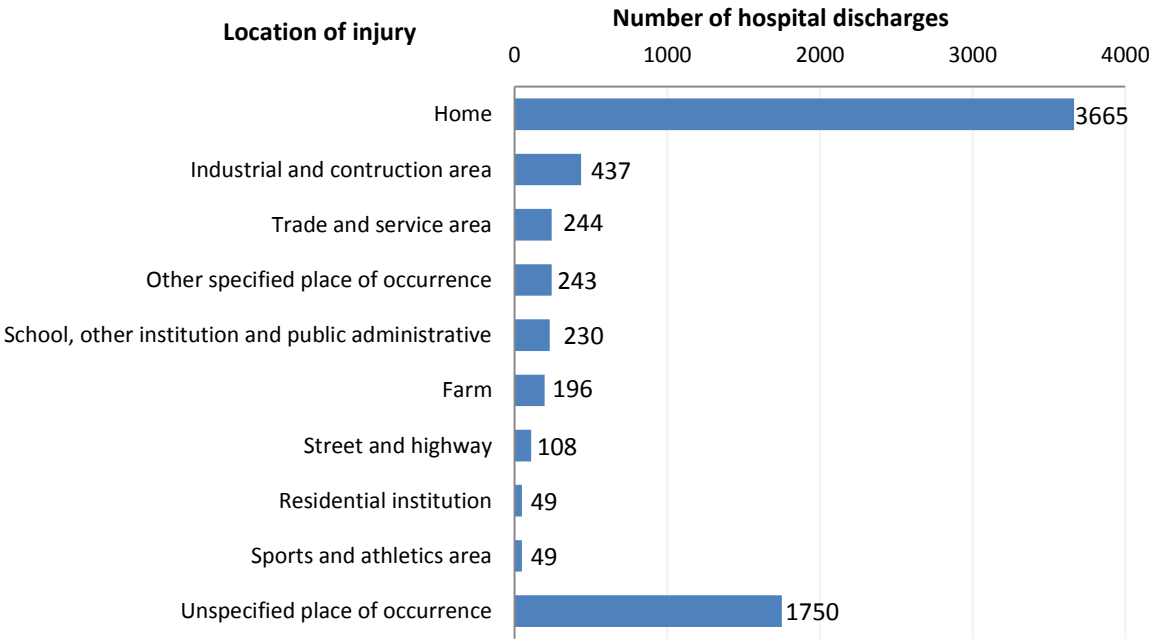



Source: National Minimum Dataset

### Most hazardous substances injuries occurred in the home

Between 2006 and 2015, of the 6971 hazardous substances-related hospital discharges, over half (3665 discharges) were from injuries that occurred in the home environment (Figure 12) , followed by injuries which occurred at a 'Industrial and construction area' (437).

**Figure 12:** Number of hospital discharges from hazardous substances injuries, by injury location, 2006-2015




Source: National Minimum Dataset

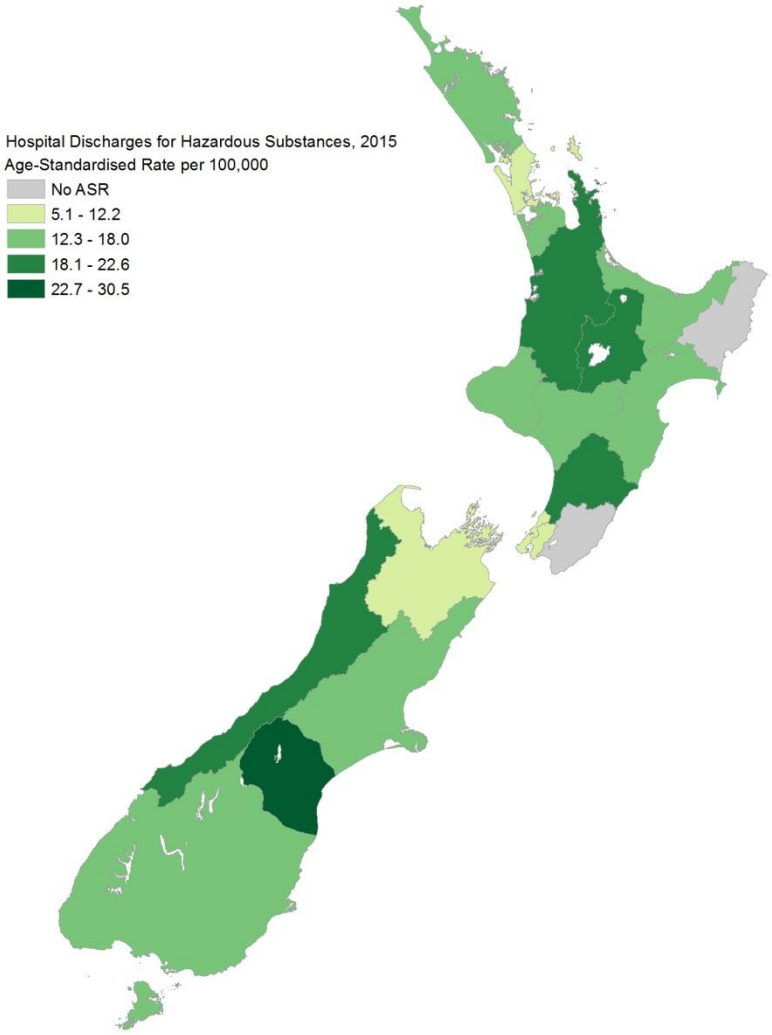
Eighty-two percent (731/890) of hazardous substances injuries in children under five years old occurred at home. Children are great explorers, and preschool children spend much of their time exploring at home. This can lead to children unintentionally being exposed to a number of hazardous substances.

### South Canterbury had the highest rate of hospital discharges

In 2015, South Canterbury District Health Board (DHB) had the highest age-standardised rate of hospital discharges (30.5 per 100,000 population) for hazardous substances injuries (Figure 13). Hutt DHB had the lowest rate of hospital discharges (7.7 per 100,000 population).

Overall, 11 out of the 20 DHBs had higher hospital discharge rates than the national rate (14.8 per 100,000 population) for 2015 (see Appendix 5).

**Figure 13:** Age-standardised rates per 100,000 population of hospital discharges from hazardous substances injuries by DHB, 2015



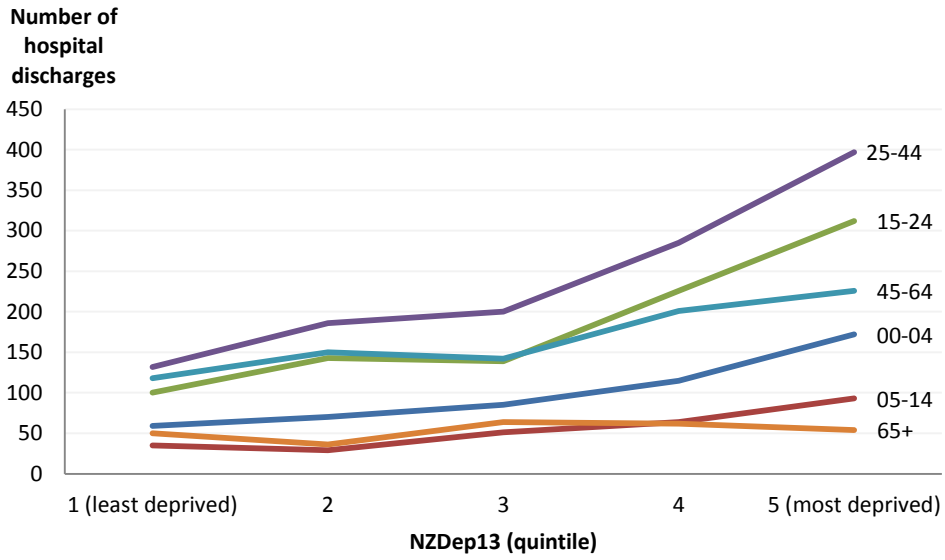

Source: National Minimum Dataset
Note: Rates are not calculated for counts smaller than five

### Hospital discharges due to hazardous substances exposure increased with socio-economic deprivation

From 2010 to 2015, the number of hospital discharges increased with socio-economic deprivation for all age groups (Figure 14). The number of hospital discharges was highest among those who resided in deprivation quintiles 4 and 5 (most deprived), and lowest in quintile 1 (least deprived).

The relationship between deprivation level and hazardous substances injuries was more apparent in the age groups 0-4, 15-24, 25-44 and 45-64 years. The same trend was less evident in age groups 5-14 and 65+ years.

**Figure 14:** Number of hospital discharges from hazardous substances injuries, by deprivation quintile and age group, 2010-2015




Note: There were 30 hospital discharges unable to be assigned a deprivation score.
Source: National Minimum Dataset

## Primary care notifications (2014-2015)

The Hazardous Substances Disease and Injury Reporting tool (HSDIRT) is an electronic form that simplifies notification of hazardous substances injuries, from primary health care to Medical Officers of Health. It was developed by the CPHR in conjunction with bestpractice Decision Support (BPAC), and funded by the Ministry of Health. The HSDIRT has been designed to allow notification of:

- lead absorption ≥0.48µmol/l
- injuries and diseases due to hazardous substances
- poisoning arising from chemical contamination of the environment.

### Key findings

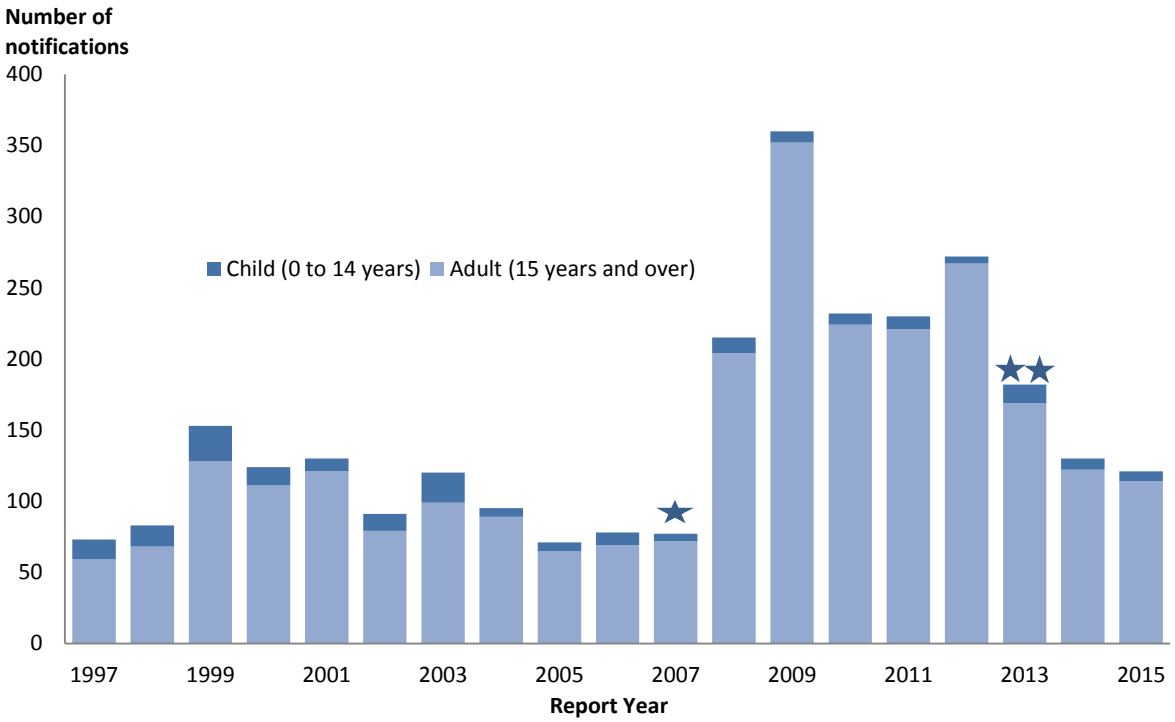
- There were 121 lead absorption notifications in 2015, compared to 130 notifications in 2014
- There were seven lead absorption notifications for children under 15 years in 2015
- Taranaki DHB had the highest rate of lead notifications in 2015
- Painters (16 notifications) were the occupation most exposed to lead in 2015
- Lead-based paint was the most common source of non-occupational/unknown lead exposure for both children and adults
- There were 61 hazardous substances notifications in 2015, five of which were for children under five years old
- Eighty-four percent (51 notifications) of hazardous substances notifications were unintentional exposures
- Industrial chemical was the most common substance category (25 notifications)
- The number of hazardous substances notification generally increased with socio-economic deprivation
- There were four agrichemical spray-drift notifications in 2015.

## Lead notifications

### There were 121 lead absorption notifications in 2015 compared to 130 notifications in the previous year

There were 121 notifications of lead absorption in 2015 (2.6 per 100,000 population) compared with 130 notifications in 2014 (2.9 per 100,000 population) (Figure 15).

**Figure 15:** Number of lead absorption notifications in children and adults by year, 1997-2015




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

****** In 2013, the Hazardous Substances Disease and Injury Reporting Tool (HSDIRT) was rolled out to all health districts. Repeat blood lead level tests taken within a year of the original test has been excluded from this data unless further investigation has resulted.

Sources: Institute of Environmental Science and Research (1997-2012) and HSDIRT (2013-2015).

### There were seven child lead notifications in 2015

Of the 121 lead absorption notifications in 2015, seven were children under the age of 15 years (Table 5). In 2014, there were eight child lead notifications. In 2015, 84 percent (102/121) of all lead notifications were males, and the most common age groups were 45-64 years (56 notifications), followed by 25-44 years (33 notifications).

**Table 5:** Lead notifications by age group and gender, 2015

| Age group (years) | Female | Male | Unknown | Total |
|---|---|---|---|---|
| 00-04 | 6 | | | 6 |
| 05-14 | | 1 | | 1 |
| 15-24 | | 9 | | 9 |
| 25-44 | 7 | 26 | | 33 |
| 45-64 | 3 | 52 | 1 | 56 |
| 65+ | 2 | 14 | | 16 |
| **Total** | **18** | **102** | **1** | **121** |

Source: HSDIRT

### Taranaki DHB had the highest rate of lead absorption notifications

Taranaki District Health Board (DHB) had the highest rate of lead notifications (11.2 per 100,000 population) in 2015, followed by MidCentral DHB (4.1 per 100,000 population) (Table 6). In 2014, Wairarapa DHB had the highest rate of lead notifications, followed by MidCentral DHB (Table 6).

**Table 6:** Number and crude rate (per 100,000 population) of lead absorption notifications by DHB and year

| DHB | 2014 | | 2015 | |
|---|---|---|---|---|
| | Notifications | Rate | Notifications | Rate |
| Northland | 0 | | 0 | |
| Waitemata | 7 | 1.2 | 12 | 2.1 |
| Auckland | 24 | 5.1 | 18 | 3.7 |
| Counties Manukau | 8 | 1.6 | 6 | 1.2 |
| Waikato | 8 | 2.1 | 7 | 1.8 |
| Lakes | 2 | | 1 | |
| Bay of Plenty | 4 | | 4 | |
| Tairawhiti | 1 | | 0 | |
| Taranaki | 3 | | 13 | 11.2 |
| Hawke's Bay | 2 | | 1 | |
| Whanganui | 3 | | 3 | |
| MidCentral | 16 | 9.4 | 7 | 4.1 |
| Hutt Valley | 5 | 3.5 | 4 | |
| Capital and Coast | 9 | 3.0 | 10 | 3.3 |
| Wairarapa | 6 | 14.0 | 3 | |
| Nelson Marlborough | 1 | | 3 | |
| West Coast | 4 | | 0 | |
| Canterbury | 7 | 1.4 | 19 | 3.6 |
| South Canterbury | 4 | | 4 | |
| Southern | 7 | 2.3 | 4 | |
| Unknown | 9 | | 2 | |
| **Total** | **130** | **2.9** | **121** | **2.6** |

Note:

1. Crude rates were not calculated for counts less than five
2. Spatial analysis was based on an individual's residential address.

Source: HSDIRT

### Painters were the most exposed to lead

In 2015, there were 37[7] lead absorption notifications (31% of all lead notifications) where occupation was recorded as the source of exposure. Painter (16 notifications) was the most commonly reported occupation for occupational lead exposure, followed by radiator repairer (5 notifications) (Table 7). In 2014, painter (20 notifications) and metal worker (5 notifications) were the most commonly reported occupations.

[7] Three cases were recorded as both occupational and non-occupational/unknown exposure. Those three cases were included in both occupational and non-occupational/unknown cases analyses.

**Table 7:** Number of lead notifications with occupation recorded as the source of exposure, 2015

| Occupation | Notifications |
|---|---|
| Painter | 16 |
| Radiator repairer | 5 |
| Builder | 3 |
| Metal worker | 3 |
| Glazier | 2 |
| Sandblaster | 2 |
| Engineer | 1 |
| Port worker | 1 |
| Renovator | 1 |
| Machinery mechanics and fitters | 1 |
| Cabinet maker | 1 |
| Student | 1 |
| Unknown | 1 |
| **Total** | **38*** |

Note: More than one occupation can be reported for a single notification. Therefore, the sum of notification for each occupation may be higher than the total notifications.

Source: HSDIRT

### Lead-based paint was the most common source of non-occupational/unknown lead exposure

There were 87 lead absorption notifications where a non-occupational/unknown source of exposure was recorded. The most common source of lead exposure for both children and adults (15+ years) was lead-based paint (Table 8).

**Table 8:** Sources of non-occupational/unknown lead exposure, 2015

| Non-occupational/unknown lead sources | Notifications |
|---|---|
| Lead-based paint | 26 |
| Indoor rifle range | 20 |
| Bullet/sinker manufacturer | 5 |
| Pica (an eating disorder) | 2 |
| Close contact with people who were exposed to lead | 2 |
| Occupation involved lead exposure | 2 |
| Traditional medicine or cosmetic | 2 |
| Leadlighting | 1 |
| Bullet | 1 |
| Lead-based solder | 1 |
| Unknown/other | 33 |
| **Total** | **95*** |

Note: More than one source of lead exposure can be selected for a single notification, therefore the total can add to more than the number of notifications.

Source: HSDIRT

There was no clear trend between NZDep13 level and the number of lead absorption notifications.

## Hazardous substances notifications

### Hazardous substances notifications have decreased since 2014

There were 61[8] notifications related to hazardous substances in 2015, compared to 95 in 2014 (Table 9). Over half of the notifications (33 notifications) were from males.

Forty-one percent (25 notifications) of the hazardous substances notifications were from the 25-44 year age group, followed by 26 percent (16 notifications) from the 45-64 year age group (Table 9).

Nearly one third (19 notifications) of the hazardous substances notifications were admitted to hospital.

**Table 9**: Hazardous substances notifications by age group and gender, 2015

| Age group (years) | Female | Male | Unknown | Total |
|---|---|---|---|---|
| 00-04 | 4 | 1 | | 5 |
| 05-14 | 2 | 2 | | 4 |
| 15-24 | 4 | 1 | | 5 |
| 25-44 | 9 | 16 | | 25 |
| 45-64 | 4 | 11 | 1 | 16 |
| 65+ | 4 | 1 | | 5 |
| Unknown | | 1 | | 1 |
| **Total** | **27** | **33** | **1** | **61** |

Source: HSDIRT

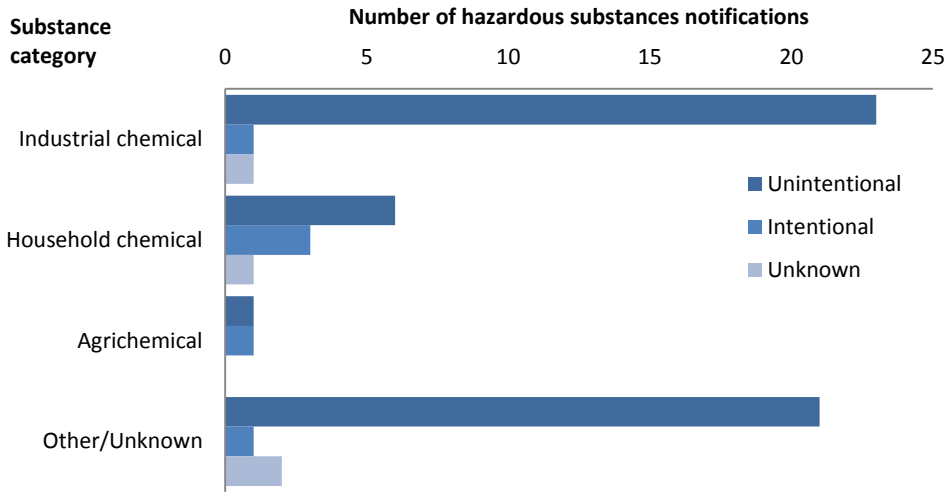
### Majority of hazardous substances notifications were due to unintentional exposures

Eighty-four percent (51 notifications) of hazardous substances notifications were from unintentional exposures and the most common substance category was industrial chemical (25 notifications) (Figure 16).

Nearly half (29 notifications) of the hazardous substances notifications occurred at home. Over one third (21 notifications) of the notifications occurred at workplaces. Two notifications were exposed to hazardous substances in public places.

[8] Nineteen notifications have been excluded from this analysis as they were either recorded as 'Not a case' or they were exposed to substances not subject to the HSNO act.

**Figure 16:** Number of hazardous substances notifications, by substance category and intent, 2015

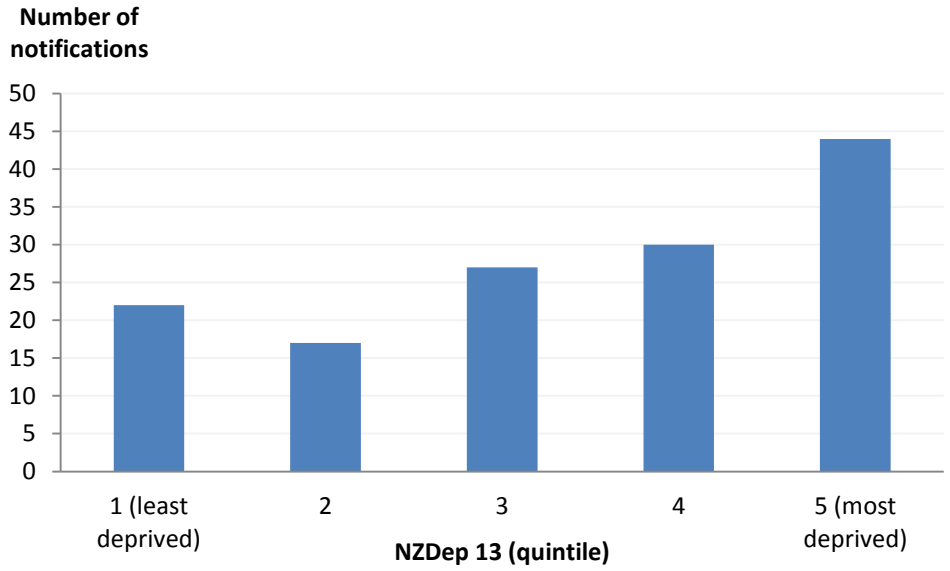



Source: HSDIRT

### The number of hazardous substances notifications generally increased with socio-economic deprivation

From 2014 to 2015, the number of hazardous substances notifications was highest among those who resided in deprivation quintile 5 (most deprived), and lowest in quintiles 1 and 2 (least deprived). (Figure 17)

**Figure 17:** Number of hazardous substances notifications, by deprivation quintile, 2014-2015




Note: NZDep scores were not allocated to 16 notifications. Those notifications were excluded from the figure.

Source: HSDIRT

## Agrichemical spray-drift notifications

There were four agrichemical spray-drift notifications in 2015, compared to five notifications in 2014. Half of the notifications were for males and half were for females. All notifications were for adults.

## Hazardous substances incidents (2009-2015)

This section presents data from the hazardous substances incidents database maintained by the New Zealand Fire Service. The Fire Service is the primary source of incident information because they attend the majority of call-outs where a hazardous substance is involved. Some incidents will involve more than one hazardous substance. A hazardous substance incident is an unplanned or uncontrolled release of hazardous substances such as fuels, flammable substances, explosives, toxic chemicals, pesticides, radioactive material, or microorganisms, including contaminated waste products. New Zealand Fire Service incidents are categorised on a scale from 1 to 5. This is based on the severity of the incident where 1 is low and 5 very high.

There was a drop in the number of incidents in 2011 and 2012 which is primarily attributed to industrial action in the New Zealand Fire Service. During the period of industrial action, even though the Fire Service continued to respond to all emergencies, incident records did not get fully reported.

### Key findings

- In 2015, the New Zealand Fire Service attended 1354 hazardous substances incidents
- There have been no very high (level 5) alarm level hazardous substances incidents reported since 2009
- Nearly sixty percent of all hazardous substances incidents are liquid gas leak/spill incidents without a fire
- Ammonia, methane gas, and chlorine were the most common hazardous substances involved in level 2 or 3 incidents between 2009 and 2015.

### The New Zealand Fire Service attends over 1200 hazardous substances incidents every year

From 2009 to 2015, the New Zealand Fire Service attended 8632 hazardous substances incidents (Table 10), an average of 1233 incidents every year. The highest number of incidents (1436) was reported in 2010 followed by 1354 incidents in 2015.

There was a drop in the number of incidents in 2011 and 2012 due to industrial action in the New Zealand Fire Service.

**Table 10:** Number of hazardous substances incidents attended by the New Zealand Fire Service, by alarm level, 2009-2015

| Alarm Level | Year | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | |
| 1 | 1142 | 1413 | 988 | 1093 | 1302 | 1234 | 1321 | 8493 |
| 2 | 10 | 22 | 11 | 18 | 19 | 17 | 30 | 127 |
| 3 | | 1 | 1 | 1 | 1 | 5 | 2 | 11 |
| 4 | | | | | | | 1 | 1 |
| **Total** | **1152** | **1436** | **1000** | **1112** | **1322** | **1256** | **1354** | **8632** |

Note: Alarm level indicates the severity of an incident where 1=low and 5=very high.

Source: New Zealand Fire Service

### No level 5 hazardous substances-related incidents have been reported since 2009

There have been no very high alarm level (level 5) hazardous substances incidents since reporting began in 2009. Of the 8632 incidents, one was level 4, 11 were level 3, 127 were level 2, and the vast majority (8493) were level 1 incidents (Table 10). The first level 4 hazardous substances incident occurred in 2015, involving anhydrous ammonia. Of the 11 level 3 incidents since 2009, seven occurred in 2014 and 2015. The level 3 incidents involved anhydrous ammonia, chlorine, fuel, hydrochloric acid, hydrogen peroxide, petrol, methane gas, and an unnamed corrosive liquid.

### Nearly sixty percent of all hazardous substances incidents were liquid gas leak/spill incident without a fire

From 2009 to 2015, 59 percent of hazardous substances incidents were liquid gas leak/spill incidents without a fire, with around 730 incidents per year (Table 11). This was followed by 'gas liquid spill: vehicle accident' incidents, with around 140 incidents per year. Chemical emergency incidents occurred at about 100 to 150 a year.

**Table 11:** Number of hazardous substances incidents attended by the New Zealand Fire Service by incident type, 2009-2015

| Incident Type | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Total |
|---|---|---|---|---|---|---|---|---|
| Liquid Gas leak or spill: No fire | 639 | 827 | 593 | 678 | 781 | 753 | 821 | 5092 |
| Gas Liquid spill: Vehicle accident | 150 | 166 | 127 | 128 | 138 | 105 | 151 | 965 |
| Chemical emergency | 117 | 146 | 97 | 109 | 110 | 127 | 107 | 813 |
| Gas Liquid spill: No vehicle accident | 108 | 144 | 85 | 85 | 110 | 116 | 111 | 759 |
| Miscellaneous hazardous condition - not classified above | 81 | 93 | 67 | 77 | 130 | 110 | 122 | 680 |
| Attempted burning | 14 | 16 | 6 | 9 | 6 | 5 | 8 | 64 |
| Chemical spill: Vehicle accident | 10 | 11 | 7 | 7 | 6 | 7 | 8 | 56 |
| Mobile property hazardous incident - not classified above | 13 | 7 | 5 | 3 | 14 | 6 | 8 | 56 |
| Biohazard emergency | 6 | 8 | 3 | 8 | 12 | 12 | 4 | 53 |
| Gas liquid spill: Incorrect vehicle loading | 7 | 7 | 6 | 4 | 8 | 7 | 5 | 44 |
| Explosive present | 6 | 7 | 2 | 3 | 5 | 3 | 2 | 28 |
| Chemical spill: Incorrect vehicle loading | 1 | 3 | 2 | 1 | 1 | 5 | 7 | 20 |
| Radioactive condition[9] | | 1 | | | 1 | | | 2 |
| **Total** | **1152** | **1436** | **1000** | **1112** | **1322** | **1256** | **1354** | **8632** |

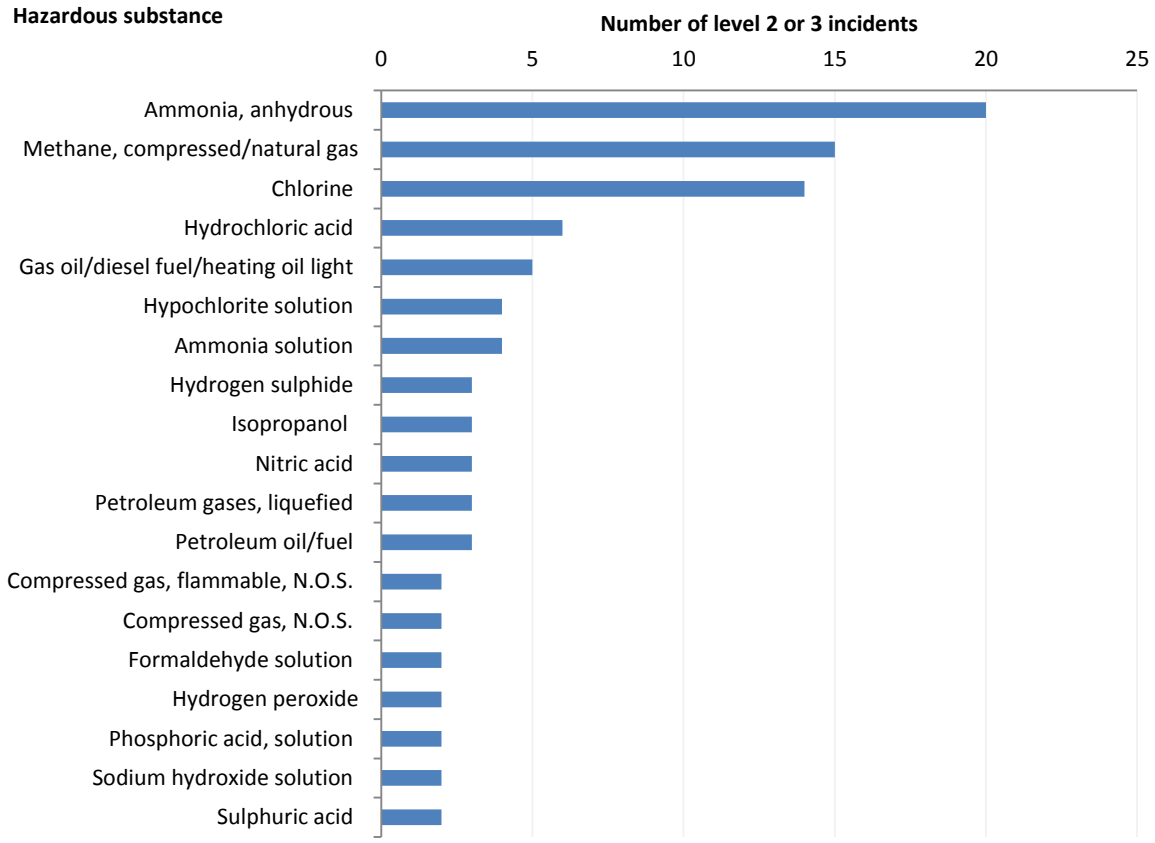
Source: New Zealand Fire Service

### Ammonia, methane gas, and chlorine were the most common hazardous substances involved in level 2 or 3 incidents

From 2009 to 2015, the top three most common hazardous substances involved in level 2 or 3 incidents were anhydrous ammonia, methane gas, and chlorine (Figure 18).

[9] The HSNO Act does not include radioactive substances.

**Figure 18:** Hazardous substances most frequently involved in level 2 or 3 incidents, 2009-2015.




Note:

1. Some incidents will be reported with more than one hazardous substance.
2. Only hazardous substances involved in more than one level 2 or 3 incidents are presented here.

Source: New Zealand Fire Service

## Hazardous substance-related telephone calls (2009-2015)

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. Data analysis for 2013 and 2015 is based on summary tables rather than raw data, therefore, numbers may differ from previous years. Only nine months data was available for 2015 due to data quality and a change in NPC reporting format to the Ministry of Health.

### Key findings

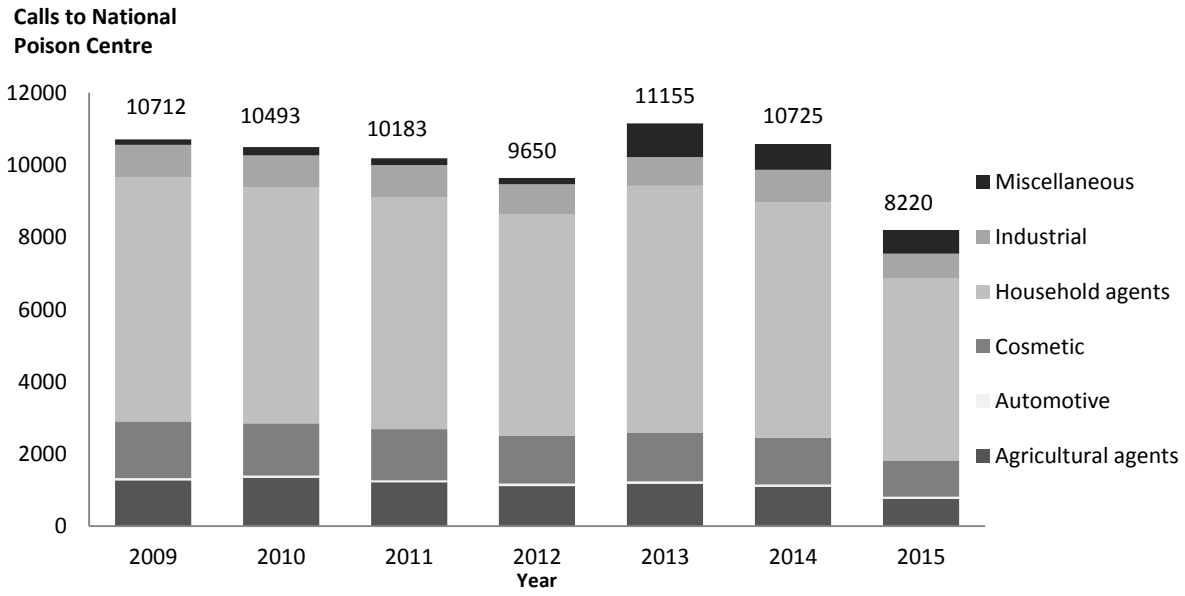
- There were 8220 calls concerning hazardous substances in nine months of 2015
- Over half (4395/8220) of the hazardous substances-related calls in 2015 involved children less than five years old
- Calls regarding household agents, and more specifically household cleaners (813 calls) and detergents (378 calls) most frequently involved children
- Among adults, household cleaners were the most common household product (434 calls) and herbicides (169 calls) the most common agricultural agent cited
- Child exploratory behaviour was responsible for more than half (4646/8220) of all hazardous substances calls in 2015.

### There were 8220 calls concerning hazardous substances in 2015

There were 8220 calls concerning hazardous substances in nine months of 2015. In 2014, there were 10725 calls concerning hazardous substances (Figure 19).

From 2009 to 2015, household products were the most common (62%) exposure reported to the NPC, followed by cosmetics (13%) and agricultural agents (11%).

**Figure 19:** Number of hazardous substances-related calls to the National Poisons Centre, by substance classification, 2009-2015



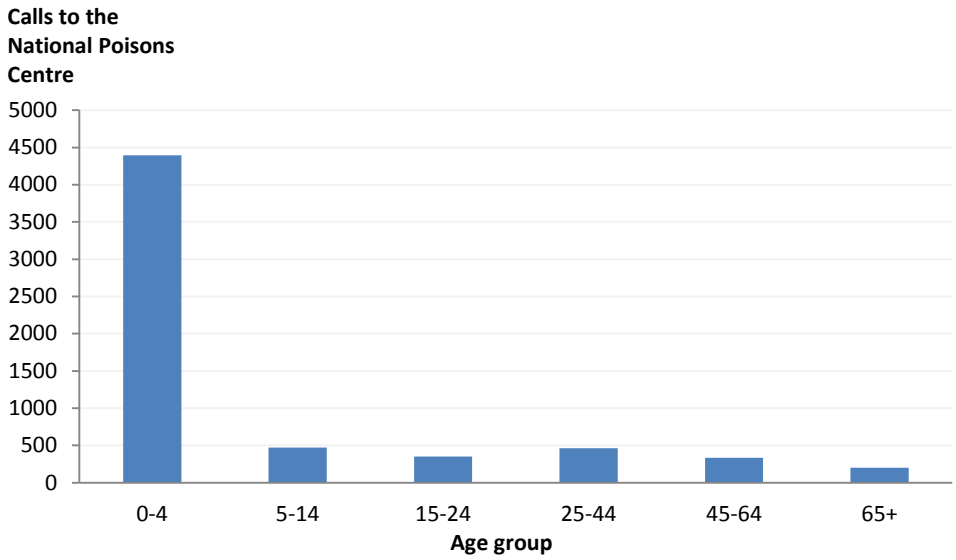

Source: National Poison Centre

Note: Only nine months of data was included in 2015. Data from June, November and December 2015 were not included.

### Over half of the hazardous substances-related calls in 2015 concerned children less than five years old

Of the 8220 hazardous substances-related calls made in 2015, over half (4395 calls) concerned children less than five years old (Figure 20). A similar trend was reported in previous years.

**Figure 20:** Number of hazardous substances-related calls to the National Poisons Centre, by age group, 2015




Source: National Poisons Centre

Note:

1. Calls, where age is recorded as 'Unknown', have been excluded from this graph.
2. Only nine months of data was included in 2015. Data from June, November and December 2015 were not included.

### Calls regarding household products were most frequent among children

Among calls relating to children aged 0-4 years, household products (2982 calls) and cosmetics (772 calls) were the most common exposure in 2015 (Table 12). Of all household agents recorded, household cleaners (813 calls) and detergents (378 calls) were the most common exposure regarding children. For agricultural agents, rodenticides (61 calls) were the most common product involving children.

Among adults, household cleaners (434 calls) was the most common household product and herbicides (169 calls) was the most common agricultural agent recorded.

**Table 12:** Number of hazardous substances-related calls to the National Poisons Centre, by age group and substance category, 2015

| Substances Classification | Age group | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0-4 | 5-14 | 15-24 | 25-44 | 45-64 | 65+ | Child (Age unknown) | Adult (Age unknown) | Unknown | |
| **Agricultural** | 253 | 35 | 40 | 79 | 72 | 27 | 15 | 229 | 3 | **753** |
| **Cosmetic** | 772 | 49 | 36 | 13 | 7 | 21 | 23 | 87 | 0 | **1008** |
| **Household** | 2982 | 283 | 179 | 253 | 180 | 114 | 103 | 944 | 9 | **5047** |
| **Industrial** | 86 | 23 | 66 | 83 | 52 | 21 | 9 | 328 | 7 | **675** |
| **Miscellaneous** | 277 | 75 | 28 | 30 | 23 | 15 | 19 | 205 | 2 | **674** |
| **Automotive** | 25 | 7 | 1 | 6 | 2 | 5 | 0 | 16 | 1 | **63** |
| **Total** | **4395** | **472** | **350** | **464** | **336** | **203** | **169** | **1809** | **22** | **8220** |

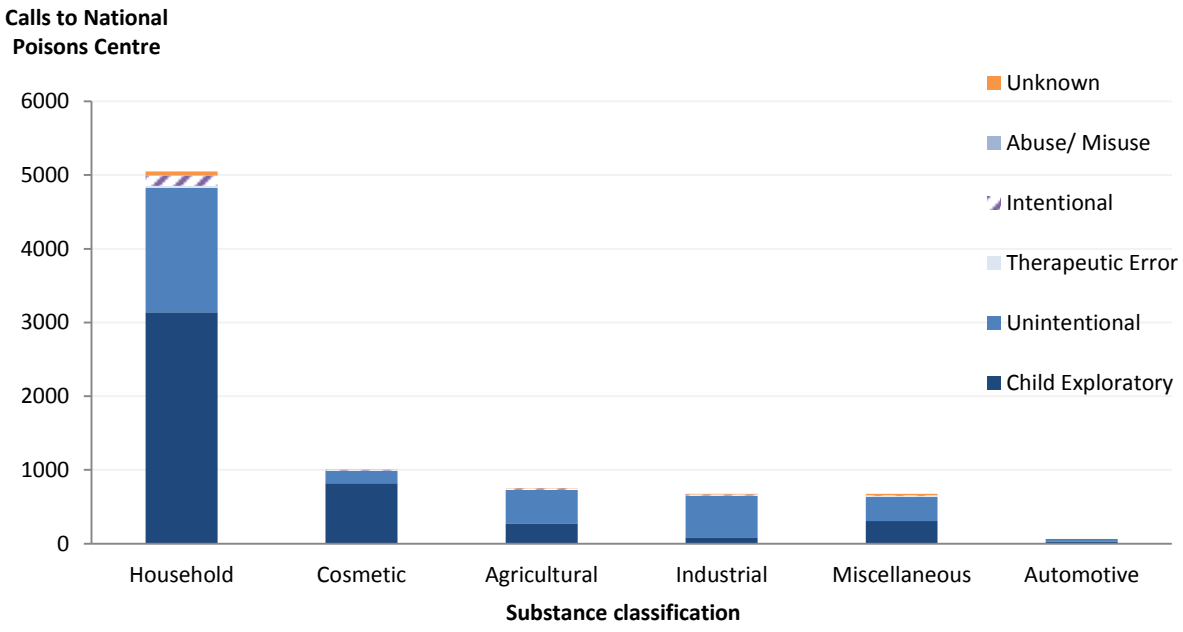
Source: National Poisons Centre

Note: Only nine months of data was included in 2015. Data from June, November and December 2015 were not included.

### Child exploratory behaviour was responsible for 57 percent of calls

In 2015, 57 percent (4646 calls) of all hazardous substances-related calls were from child-exploratory behaviour, and 40 percent (3248 calls) were from adult unintentional exposures (Figure 21). The majority of calls concerning household and cosmetic products were from child exploratory behaviour while unintentional exposures were more common in calls concerning agricultural and industrial products.

**Figure 21:** Number of hazardous substances-related calls to the National Poisons Centre by substance classification and intent, 2015




Source: National Poisons Centre

Note: Only nine months of data was included in 2015. Data from June, November and December 2015 were not included.

## Conclusion

Hazardous substance exposure accounted for 44 registered deaths from the National Mortality Collection in 2013 (the most recent year for which data were available). In 2015, it accounted for 632 hospital discharges, 186 primary care notifications, 1354 Fire Service hazardous substances incidents, and 8220 calls to the National Poisons Centre. Most of these injuries could have been prevented. Mortality and hospital discharge rates have either declined or remained stable between 2006 and 2015. However, these numbers are a major undercount of exposure to hazardous substances as not all illness and injuries are fatal or require hospitalisation.

Some population groups are at much higher risk from exposure to a hazardous substance that results in illness or injury, particularly children under five years old, Māori and people who live in more deprived areas.

Even though there have been no reported deaths of children less than five years old since 2006 due to hazardous substance exposure, this age group continues to have the highest hospital discharge rate. The high rate for this age group is of concern because illness and injuries from hazardous substances are largely preventable. The number of hospital discharges also generally increased with socio-economic deprivation in almost all age groups.

While there were no clear ethnic differences in deaths from hazardous substances between Māori and non-Māori, the Māori population experienced a higher hospital discharge rate compared to non-Māori for each of the last 10 years.

The findings from this report will help inform policy makers about the adverse health effects of hazardous substances in New Zealand. It is important that preventive strategies are put in place to reduce future disease and injury, particularly among the most vulnerable population 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. The mortality data is based on the date of registration rather than the date of death.
- Readmissions have been excluded from the data set. In this report, a 'readmission' is defined as the unintended acute readmission of a patient from any injury within 30 days of discharge.
- Morbidity data are primarily based on hospitalisations from public hospitals. Day cases and patients dying in hospital 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.
- Prioritised ethnicity has been used in the mortality and hospital discharge datasets

### Limitations of datasets

- There is insufficient information to determine the work-related nature of a case from most of the datasets used in the report. Therefore, it is difficult to reliably breakdown hazardous substances illness and injuries into occupational and non-occupational illness and injuries.

## Appendix 2: External cause codes (E-code)

This table gives the external cause codes used in the mortality and hospital discharge data.

| 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 pressurised tyre, pipe or hose |
| W38 | Explosion and rupture of other specified pressurised 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 3: 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 amino derivatives 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 |

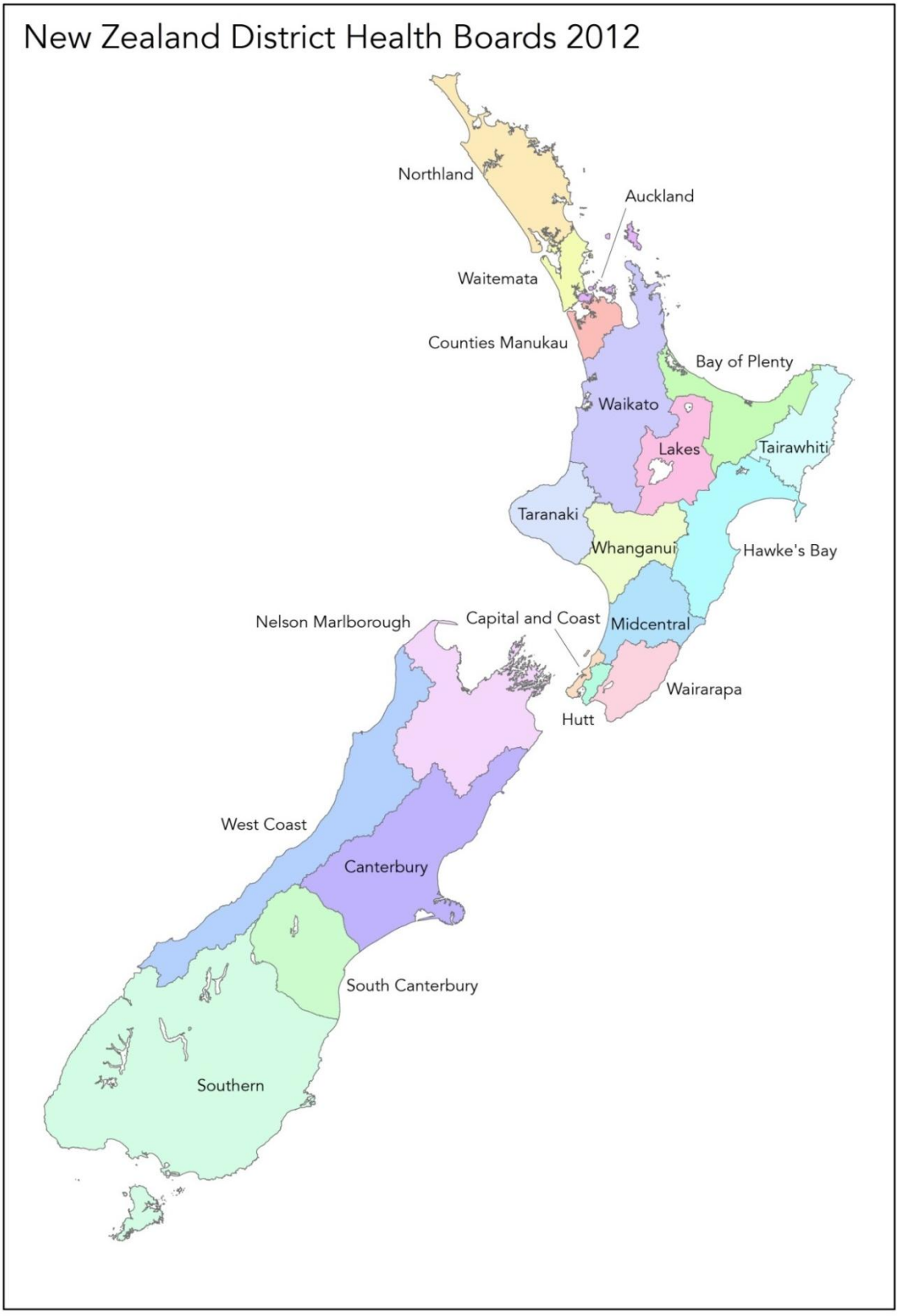
| | | |
|---|---|---|
| T2212 | Erythema of arm (upper) and shoulder region | Burns |
| T2220 | Partial thick [blisters epidermal loss] burn shoulder & upper limb except wrist & hand & unspec site | Burns |
| T2221 | Partial thickness [blisters, epidermal loss] burn of forearm and elbow | Burns |
| T2222 | 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 thickness, 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 4: Map of District Health Boards



## Appendix 5: Age-standardised rate per 100,000 population of hospital discharges from hazardous substances injuries by DHB, 2015

| DHB | Age-Standardised Rate per 100,000 population |
|---|---|
| Northland | 15.8 |
| Waitemata | 12.2 |
| Auckland | 11.9 |
| Counties Manukau | 18.0 |
| Waikato | 18.8 |
| Lakes | 22.6 |
| Bay of Plenty | 16.8 |
| Tairawhiti | - |
| Taranaki | 16.3 |
| Hawke's Bay | 17.7 |
| Whanganui | 13.7 |
| MidCentral | 18.8 |
| Hutt Valley | 7.7 |
| Capital and Coast | 9.2 |
| Wairarapa | - |
| Nelson Marlborough | 10.9 |
| West Coast | 22.0 |
| Canterbury | 13.3 |
| South Canterbury | 30.5 |
| Southern | 17.0 |
| **New Zealand Total** | **14.8** |

Source: National Minimum Dataset