Surveillance of Chemical Induced Mortality in New Zealand:

Updated 2001 and Initial 2002 Coronial Services Office data

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Introduction

A national surveillance system (Chemical Injury Surveillance System or CISS) for the notification of (acute) injuries from hazardous substances is being developed by ESR for the Ministry of Health. Deaths attributable to chemical injury are a vital component of this surveillance system.

All deaths by chemical poisoning undergo a coroner's investigation (an actual inquest may or may not be necessary). There is often a delay from time of death until the coroner's report is filed at the national office. It is estimated that that by the end of a given year, approximately 50% of cases for that year are available. By the end of the consecutive year, it is anticipated that 90-95% of cases for the preceding year will be filed.

Methods

Coronial reports for deaths attributable to acute chemical injury that had occurred and subsequently been filed between 1 January 2001 and 28 January 2003 were examined periodically at the national Coronial Services Office (CSO) in Wellington by ESR staff. Relevant case and circumstance details were collected manually and entered into a database at ESR. Intentional deaths were separated from unintentional deaths according to the judgement of the coroner. Toxicology data were obtained from ESR toxicology reports that were present in approximately 95% of the coroner's files. In the latter half of 2002, ESR were able to gain access to electronic data from the coroners office. Cases previously collected manually were matched against this data set.

Results

As of 28 January 2003, the number of deaths attributable to acute chemical injuries in New Zealand for 2001 and 2002 is 200 and 93 respectively. The number of cases for 2002 is similar to that available for 2001 at the equivalent time last year. Seventy three percent of the 2001 deaths and 69% of the 2002 deaths were deemed intentional. Sex, age and ethnicity ratios were also similar for both years. Within these demographic categories, males, the 30-59 age group and European ethnicity dominated the statistics.

A total of 393 substances, comprising 75 differing substances were involved in the 2001 deaths. To date for 2002, 46 different substances, from a total of 166 substances were involved in the deaths for that year. The single most common substance for both years, by far, was carbon monoxide.

Discussion

Death from chemical injury in New Zealand is not negligible and 2001 figures for intentional and carbon monoxide deaths are compatible with NZHIS data for suicide deaths by poisoning between 1988-1997.

In the future, data collection is to be electronically sourced. An application to filter chemical injury cases from other coronial cases available electronically from the CSO is being developed and the practicalities of matching this data with electronic ESR toxicology reports is to be investigated. Data for 2001 will continue to be collected for another year to validate assumptions regarding completeness. A website is to be developed to disseminate the coronial data. Coronial data, in addition to data from other sources is to be analysed in a project to evaluate the concept of a comprehensive chemical injuries surveillance system.

1. INTRODUCTION

The Institute of Environmental Science and Research (ESR) has been commissioned by the Ministry of Health (MoH) to develop a national Chemical Injuries Surveillance System (CISS). The primary legislation for this system is the statutory requirement of Section 143 of the Hazardous Substances and New Organisms (HSNO) Act, 1996 which states that all hospitalisations from (acute) hazardous substance injury are to be notified to the Minister of Health.

Although outside the scope of the HSNO Act requirements, chemical injuries which result in death are also vital to the surveillance system which is intended to provide health professionals with a useful tool to gauge the burden of disease in New Zealand attributable to chemical injuries. This will help inform appropriate regulatory bodies and enable public health interventions to be implemented.

While a surveillance system to capture hospital information on acute chemical injuries is still evolving, data on acute cases of chemical injury resulting in death has been collected since 2001. All deaths by chemical poisoning are deemed to be suspicious and thus undergo a coroner's investigation (an actual inquest may or may not be necessary). The resulting reports are filed at the national Coronial Services Office (CSO) in Wellington. The timeliness of this data depends greatly on the scientific and legal complexity involved in each case and there is often a delay from time of death until the coroner's report is filed at the national office. It is estimated that by the end of a given year, approximately only 50% of cases for that year are available. By the end of the consecutive year, it is anticipated that 90-95% of cases for the preceding year will be filed.

Initial results for deaths occurring and filed at the CSO during 2001 have been published previously in a report prepared for the Ministry of Health[1]. This current report updates the 2001 results and provides initial results for chemical injury deaths occurring in 2002.

2. METHODS

Coronial reports for deaths attributable to acute chemical injury that had occurred and subsequently been filed between 1 January 2001 and 28 January 2003 were examined periodically at the CSO in Wellington by ESR staff. Relevant details (case demographics, circumstances surrounding death including intent, and toxicology results) were collected manually and entered into a database at ESR. Intentional deaths (suicides and homicides) were separated from unintentional deaths according to the judgement of the coroner. Note: Cases involving chemical substances as a secondary cause of death e.g. motor vehicle accidents involving alcohol, were not collected as part of the data set.

Ethnicity was obtained by Coronial Services staff from either the post mortem report or Police 47 report. If not in either of these reports, it was determined by staff from the briefs of evidence. If a discrepancy occurred between reports, the Coronial Service staff contacted the coroner for clarification.

Toxicology data were obtained from ESR toxicology reports that were present in approximately 95% of the coroner's files. Where this toxicology report was present, all substances detected were recorded with the exception of alcohol (where the blood level was less than 20mg/100mL) and lignocaine (a drug commonly given for resuscitation purposes).

In many instances, drugs were detected (or tentatively detected) at therapeutic or in some instances, sub-therapeutic level. In some situations, analysis for certain substances was not undertaken due to the high level of other drugs present. Some substances detected are both breakdown products from other drugs as well as drugs in their own right, e.g. nortriptyline. These drugs were only recorded in the database when taken as a drug in their own right (distinction was made from information contained in the toxicology and coroners report). Cannabis was detected in several cases by a screening test. While the substance was recorded, it should be emphasised that the test can yield a small percentage of false positive results. Where the toxicology report was absent, the substances involved were extracted from one of, the coroner's summary, the pathology report, police statements, and statements of family/friends.

In the later half of 2002, ESR were able to gain access to electronic data (Access database) stored at the CSO. Cases collected previously via the manual system were matched against this data set by Coronial Number. Data for this report was analysed using Access 97.

3. RESULTS

3.1. Updated 2001 Results

3.1.1. Incidence by year and month

The updated total of 2001 coronial cases at the end of 2002 is 200, giving a rate of 5.4 deaths per 100 000 attributable to acute chemical injury in New Zealand. In contrast, the total number of deaths filed at the end of 2001 was 98. It is estimated that this total of 200 deaths represents between 90 and 95% of the true number of cases for 2001. The extent of the remainder will not be known until additional time has elapsed in order to allow late coronial cases to be filed as some isolated cases can take years to arrive at the CSO.

One hundred and forty six (73.0%) of the 200 deaths were deemed intentional by the coroner. The remaining 54 (27.0%) were classed as non-intentional (accidental).

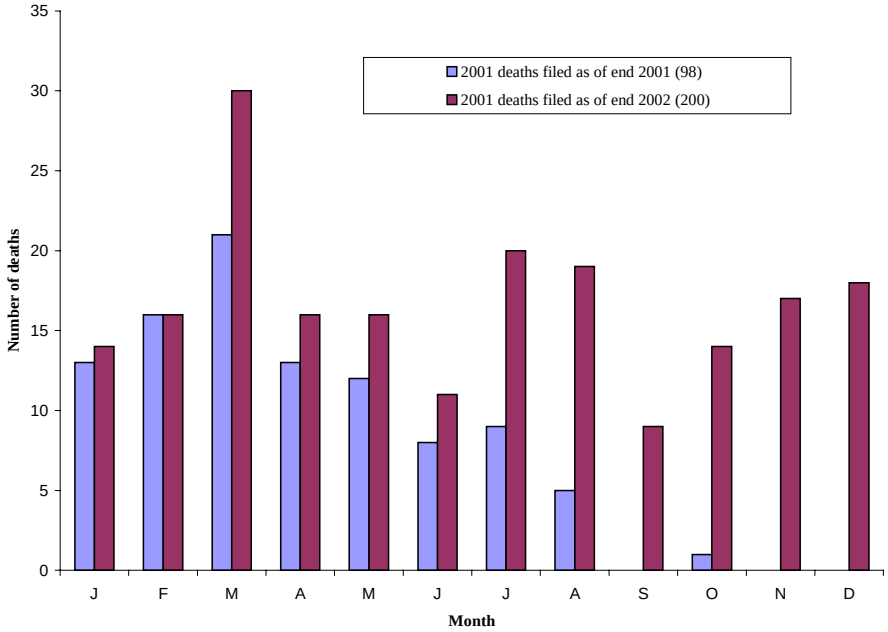
Deaths by month are presented in Table 1. March (30 deaths, 15.0%) and July (20, 10.0%) incurred the highest number of fatalities with the least deaths occurring in September (9, 4.5%) and June (11, 5.5%).

Table 1: CISS Deaths by Month, updated 2001

Month	Number	% of Total
January	14	7.0
February	16	8.0
March	30	15.0
April	16	8.0
May	16	8.0
June	11	5.5
July	20	10.0
August	19	9.5
September	9	4.5
October	14	7.0
November	17	8.5
December	18	9.0
TOTAL	**200**	**100**

The majority of the additional 102 deaths filed during 2002 occurred in the last six months of the year (Figure 1).

Figure 1: 2001 CISS deaths by month for those filed at the end of 2001 and 2002



3.1.2. Incidence by District Health Board

Table 2 presents the number of deaths and rates for each District Health Board (DHB) based on exposure address. As numbers for some DHBs are quite low, caution should be taken when interpreting rates.

Table 2: CISS Deaths by DHB[1], updated 2001

DHB	Intentional	Non Intentional	Total	Rate[2]
Northland	5	2	7	5.0
Waitemata	19	4	23	5.4
Auckland	9	8	17	4.6
Counties Manukau	13	5	18	4.8
Waikato	12	5	17	5.4
Lakes	2	0	2	2.1
Bay of Plenty	12	4	16	9.0
Tairawhiti	0	1	1	2.3
Taranaki	8	2	10	9.7
Hawke's Bay	6	3	9	6.3
Whanganui	4	1	5	7.9
Midcentral	8	2	10	6.5
Hutt	4	1	5	3.8
Capital and Coast	5	1	6	2.4
Wairarapa	0	1	1	2.6
Nelson Marlborough	7	3	10	8.2
West Coast	3	1	4	13.2
Canterbury	18	9	27	6.3
South Canterbury	3	1	4	7.6
Otago	4	0	4	2.3
Southland	4	0	4	3.9
TOTAL	**146**	**54**	**200**	**5.4**

[1] DHB is based on location of exposure. If unknown, home address is used.

[2] Rate is expressed per 100 000 population and is calculated using 2001 Census data

3.1.3. Incidence by age, sex and ethnicity

There were no deaths amongst infants or toddlers, and only one death deemed intentional among the 5-14 year age group (Table 3). The highest number of deaths (120/200, 60.0%) and rate (7.8 per 100 000) by age category was the 30-59 year age group. Within this age group, almost three quarters (88/120, 73.3%) of cases were male (corresponding rate 11.8 per 100 000) (Table 6). Overall, deaths amongst males (rate of 7.9 per 100 000 vs. 2.9 for females) accounted for 72.0% (144/200) of cases (Table 4).

Seventy percent (140/200) of the deaths were of European ethnicity (Table 5). The corresponding rate of 5.4 deaths per 100 000 was the highest among the three main ethnic groups, and the same as the national rate. Ethnic proportions differed between intentional and unintentional deaths. Maori account for only 6.8% of the intentional deaths compared to 20.4% of the deaths deemed unintentional (respective rates 1.9 per 100 000 and 2.1 per 100 000). By contrast the rate for intentional deaths among Europeans was 3.9 per 100 000 compared to 1.4 among non intentional deaths.

Table 3: CISS Deaths by Age & Intent, updated 2001

Age Group	Intentional	Non Intentional	Total	Rate[1]
0-4	0	0	0	0.0
5-14	1	0	1	0.2
15-29	34	10	44	5.9
30-59	79	41	120	7.8
60+	31	3	34	5.6
Unknown	1	0	1	-
TOTAL	**146**	**54**	**200**	**5.4**

Table 4: CISS Deaths by Sex & Intent, updated 2001

Sex	Intentional	Non Intentional	Total	Rate[1]
Male	105	39	144	7.9
Female	41	15	56	2.9
TOTAL	**146**	**54**	**200**	**5.4**

Table 5: CISS Deaths by Ethnic Group and Intent, updated 2001

Ethnic Group	Intentional	Non Intentional	Total	Rate[1]
European	103	37	140	5.4
Maori	10	11	21	4.0
Pacific People	3	3	6	3.0
Other	4	0	4	1.6
Unknown	26	3	29	-
TOTAL	**146**	**54**	**200**	**5.4**

Table 6: CISS Deaths by Age & Sex, updated 2001

	Age Category					
Sex	5-14	15-29	30-59	60+	Unk	Total
Male	0	26	88	29	1	144
Female	1	18	32	5	0	56
TOTAL	**1**	**44**	**120**	**34**	**1**	**200**

[1]Rate is expressed per 100 000 population and is calculated using 2001 Census data

3.1.4. Incidence by occupation

Persons classified as unemployed (36, 18.0%), beneficiary (28, 14.0%) and retired (24, 12.0%) accounted for nearly half of the fatalities attributable to chemical injury in 2001 (Table 7).

Table 7: CISS Deaths by Occupation, updated 2001

Occupation Category	Number	% of Total
Unemployed	36	18.0
Beneficiary	28	14.0
Retired	24	12.0
Trades	17	8.5
Student	10	5.0
Agriculture/horticulture/fishing/forestry	7	3.5
Labourer/handyman/storeman	7	3.5
Hospitality	6	3.0
Sales & Marketing	5	2.5
Manufacturing & Operations	5	2.5
Health	4	2.0
Teacher/tutor	4	2.0
Retail	3	1.5
Mother/housewife/homemaker	3	1.5
Engineering	3	1.5
Transport	3	1.5
Caregiver/child care	3	1.5
Administration & customer services	3	1.5
Management	2	1.0
Security	2	1.0
Finance & legal	2	1.0
Self employed	1	0.5
Patient	1	0.5
Other	8	4.0
Unknown	13	6.5
TOTAL	**200**	**100**

3.1.5. Incidence by exposure setting

Where exposure setting was known (121/200 cases), 62% of deaths (75/121) occurred in the cases private home. The next most common setting was an outdoor environment such as roads, rivers, forests, parks etc (Table 8).

Table 8: CISS Deaths by Exposure Setting, updated 2001

Exposure Setting	Number	% of Total
Cases private home	75	37.5
Road/river/reserve/picnic area/park/lake/forest/carpark/bay/ farm/golf club/church yard	27	13.5
Other private home	8	4.0
Motor camp/caravan	3	1.5
School	2	1.0
Workplace	2	1.0
Community Centre	1	0.5
Detoxification Unit	1	0.5
Accommodation for mentally stressed people	1	0.5
Drug user & supplier house	1	0.5
Unknown	79	39.5
TOTAL	**200**	**100**

3.1.6. Incidence by exposure type

With the exception of four cases, all deaths attributable to chemical injury in 2001 were classified as poisoning. Death in the remaining four cases were due to fire/burns involving petrol.

3.1.7. Substance class

A summary of the substance class statistics are given in Table 9. A total of 393 substances were involved in the 200 deaths. Nearly half of these substances were therapeutics (182, 46.3%). Household/domestic substances and chemicals/drugs of abuse were second and third respectively. Together these three classes accounted for 98.2% of the substances involved in the 2001 fatalities.

Note: some substances, most notably morphine, can be considered both therapeutic and drug of abuse. In this report morphine had been characterised as a drug of abuse.

Table 9: CISS Deaths by Substance Class, updated 2001

Substance Class	No. of Deaths	% of Total
Therapeutics	182	46.3
Household/Domestic	108*	27.5
Chemical/Drugs of Abuse	96	24.4
Agrichemicals	6	1.5
Herbal Remedy/Dietary Supplement	1	0.3
TOTAL	**393**	**100**

* Includes 98 cases of carbon monoxide poisoning

3.1.8. Substance (total and primary)

There were a total of 75 individual substances identified from the total 393 substances. The most common substances were carbon monoxide (98 cases), ethanol (69), morphine & morphine/heroin (14) and methadone (13) (Table 10). There were 40 different primary substances identified (substance primarily but not necessarily singly involved in fatality) (Table 11). Again the most common was carbon monoxide (98 cases). This was followed by methadone (12), morphine & morphine/heroin (12) and ethanol (9).

Table 10: Substances (Total) involved in CISS Deaths, updated 2001

Frequency	Total substances
98	Carbon Monoxide
69	Ethanol
14	Morphine & Morphine/Heroin
13	Methadone
12	Dothiepin, Zopiclone
10	Amitriptyline, Diazepam, Paracetamol
8	Dextropropoxyphene, Fluoxetine
7	Clonazepam
6	Citalopram, Paroxetine
5	Nortriptyline, Temazepam, Tetrahydrocannabinols,
4	Alprazolam, Cyanide
3	Benzene/Toluene (petrol), Carbamazepine, Codeine, Ethylene Glycol, Hydrocarbon, Nitrazepam, Nordiazepam, Olanzapine, Thioridazine, Triazolam
2	3,4-Methylenedioxymethamphetamine, Chlormethiazole, Diphenhydramine, Doxepin, Lorazepam, Methamphetamine, Metoclopramide, Oxazepam, Pethidine, Quinine, Risperidone, Trimipramine
1	2-Naphthaleneacetic Acid, Amoxapine, Atracurium, Benztropine, Brallobarbitone, Chlorphentermine, Chlorpromazine, Clomipramine, Desipramine, Dextromethorphan, Dichlorobenzene (Mixed Isomers), Ephedrine, Ethanol/Methanol (methylated spirits), Glyphosate, Imipramine, Lithium, LPG, Methylphenidate, Mexilitine, Paraquat, Primidone, Prochorperazine, Procyclidine, Promethazine, Propofol, Pseudoephedrine, Quinalbarbitone, Serzone, Smoke/Toxic Fumes From Fire, Toluene, Turpentine, Valproate, Venlafaxine

Table 11: Primary Substances involved in CISS Deaths, updated 2001

Frequency	Primary Substance
98	Carbon Monoxide
12	Methadone, Morphine & Morphine/Heroin
9	Ethanol
7	Dothiepin
5	Amitriptyline, Dextropropoxyphene, Nortriptyline
4	Cyanide
3	Benzene/toluene (petrol), Ethylene Glycol, Hydrocarbon, Zopiclone
2	Carbamazepine, Clonazepam, Doxepin, Pethidine
1	3,4-methylenedioxymethamphetamine, Chlormethiazole, Chlorpromazine, Clomipramine, Codeine, Ethanol/methanol (methylated spirits), Glyphosate, Imipramine, LPG, Methamphetamine, Mexilitine, Paracetamol, Paraquat, Paroxetine, Primidone, Propofol, Quinalbarbitone, Quinine, Temazepam, Toluene, Triazolam, Trimipramine, Turpentine

3.1.9. Multiple substances

More than one substance was involved in just over half of the cases (105/200, 52.5%). The greatest number of substances involved with one case was seven (Table 12).

Table 12: Number of Substances Involved in CISS Deaths, updated 2001

No. of Substances involved	Corresponding No. Cases
1	95
2	60
3	20
4	14
5	4
6	6
7	1
TOTAL	**200**

3.1.10. Primary substance by intent

Carbon monoxide was involved in 96 of the 146 (65.8%) intentional deaths. Methadone and morphine and morphine/heroin combinations were the leading cause of non intentional death (Table 13).

Table 13: CISS Primary Substances (Top 5) by Intent, updated 2001

Primary Substance	Intentional	Non Intentional	Total
Carbon Monoxide	96	2	98
Methadone	1	11	12
Morphine & Morphine/Heroin	1	11	12
Ethanol	0	9	9
Dothiepin	7	0	7
TOTAL	**105**	**33**	**138**

3.1.11. Primary substance by sex

Primary substance by sex data are presented in Table 14. A noticeable trend for the top four primary substances is that males have higher counts than females. For example, of the 98 carbon monoxide deaths, 81.6% (80 cases) were males. Contrary to this trend is the sex stratification for dothiepin where 85.7% (6/7) of the deaths involved females.

Table 14: CISS Primary Substances (Top 5) by Sex, updated 2001

	Sex		
Primary Substance	Male	Female	Total
Carbon Monoxide	80	18	98
Methadone	9	3	12
Morphine & Morphine/Heroin	10	2	12
Ethanol	7	2	9
Dothiepin	1	6	7
TOTAL	**107**	**31**	**138**

3.1.12. Primary substance by age group

The 15-29 year age group accounted for just over a quarter (25/98), while the 30-59 year age group accounted for 55.1% of the carbon monoxide cases (Table 15).

Table 15: CISS Primary Substances (Top 5) by Age, updated 2001

	Age Group					
Primary Substance	**5-14**	**15-29**	**30-59**	**60+**	**Unk**	**Total**
Carbon Monoxide	0	25	54	18	1	98
Methadone	0	2	10	0	0	12
Morphine & Morphine/Heroin	0	1	9	2	0	12
Ethanol	0	0	7	2	0	9
Dothiepin	0	3	3	1	0	7
TOTAL	**0**	**31**	**83**	**23**	**1**	**138**

3.2. Initial 2002 Results

3.2.1. Incidence by year and month

The current total of coronial cases for 2002 is 93. This is very similar to the number of 2001 cases (98) available at the equivalent time last year. Distribution of cases by month, especially for the last six months of the year is also very comparable (Table 16). As this data is thought to only represent approximately 50% of the cases for 2002, rates are not included in the tables.

There were 64 (68.8%) intentional and 26 (28.0%) unintentional deaths reported. Three (3.2%) cases were of unknown intent.

Table 16: CISS Deaths by Month, initial 2001 and 2002

Month	Number (2001)	% of Total (2001)	Number (2002)	% of Total (2002)
January	13	13.3	21	22.6
February	16	16.3	6	6.5
March	21	21.4	11	11.8
April	13	13.3	11	11.8
May	12	12.2	10	10.8
June	8	8.2	9	9.7
July	9	9.2	10	10.8
August	5	5.1	6	6.5
September	0	0.0	6	6.5
October	1	1.0	3	3.2
November	0	0.0	0	0.0
December	0	0.0	0	0.0
TOTAL	**98**	**100**	**93**	**100**

3.2.2. Incidence by District Health Board

Cases by District Health Board are given in Table 17. Of note is that to date there have been no deaths filed for the Capital and Coast, Hutt and Wairarapa DHB's and 10 deaths for Midcentral DHB..

Table 17: CISS Deaths by DHB[1], initial 2002

DHB	Intentional	Non Intentional	Intent Unknown	Total
Northland	0	1	1	2
Waitemata	9	3	0	12
Auckland	5	3	0	8
Counties Manukau	6	3	0	9
Waikato	6	4	1	11
Lakes	2	0	0	2
Bay of Plenty	5	0	0	5
Tairawhiti	1	1	0	2
Taranaki	0	1	0	1
Hawke's Bay	2	0	1	3
Whanganui	1	0	0	1
Midcentral	8	2	0	10
Hutt	0	0	0	0
Capital and Coast	0	0	0	0
Wairarapa	0	0	0	0
Nelson Marlborough	3	0	0	3
West Coast	2	1	0	3
Canterbury	4	1	0	5
South Canterbury	2	1	0	3
Otago	6	3	0	9
Southland	2	2	0	4
TOTAL	**64**	**26**	**3**	**93**

[1] DHB is based on location of exposure. If unknown, home address is used.

3.2.3. Incidence by age, sex and ethnicity

As in 2001, the greatest number of deaths attributable to chemical injury occurred in the 30-59 age group (55 cases, 59.1%). Approximately one quarter of these deaths were deemed non intentional (Table 18). While male deaths exceeded female deaths (70 vs. 23), the ratio of intentional to non intentional was similar for both sexes (Table 19). From Table 20 it can be seen that the dominant ethnicity group (by absolute numbers) was again European (73/93, 78.5%).

Table 18: CISS Deaths by Age & Intent, initial 2002

Age Group	Intentional	Non Intentional	Intent Unknown	Total
0-4	0	0	0	0
5-14	0	0	0	0
15-29	16	9	0	25
30-59	39	14	2	55
60+	9	3	0	12
Unknown	0	0	1	1
TOTAL	**64**	**26**	**3**	**93**

Table 19: CISS Deaths by Sex & Intent, initial 2002

Sex	Intentional	Non Intentional	Intent Unknown	Total
Male	48	20	2	70
Female	16	6	1	23
TOTAL	**64**	**26**	**3**	**93**

Table 20: CISS Deaths by Ethnic Group and Intent, initial 2002

Ethnic Group	Intentional	Non Intentional	Intent Unknown	Total
European	53	17	3	73
Maori	2	4	0	6
Pacific People	0	1	0	1
Other	3	0	0	3
Unknown	6	4	0	10
TOTAL	**64**	**26**	**3**	**93**

Table 21: CISS Deaths by Age & Sex, initial 2002

	Age Category					
Sex	**0-14**	**15-29**	**30-59**	**60+**	**Unk**	**Total**
Male	0	19	43	8	0	70
Female	0	6	12	4	1	23
TOTAL	**0**	**25**	**55**	**12**	**1**	**93**

3.2.4. Incidence by occupation

Persons classed as unemployed, beneficiary and retired were the top three occupations given for coronial cases in 2001. Unemployed and retired persons were also in the top three for 2002 figures to date (Table 22). The other occupation category in the top three for 2002 was trades. Trades came in fourth for 2001.

Table 22: CISS Deaths by Occupation, initial 2002

Occupation Category	Number	% of Total
Unemployed	17	18.3
Trades	10	10.8
Retired	10	10.8
Student	7	7.5
Beneficiary	6	6.5
Manufacturing & Operations	6	6.5
Self employed	4	4.3
Labourer/handyman/storeman	4	4.3
Agriculture/horticulture/fishing/forestry	4	4.3
Management	3	3.2
Health	3	3.2
Teacher/tutor	1	1.1
Mother/housewife/homemaker	1	1.1
Patient	1	1.1
Caregiver/child care	1	1.1
Sales & Marketing	1	1.1
Other	4	4.3
Unknown	10	10.8
TOTAL	**93**	**100**

3.2.5. Incidence by exposure setting

As in 2001, the setting for the majority of deaths to date for 2002 was the cases private home (Table 23).

Table 23: CISS Deaths by Exposure Setting, initial 2002

Exposure Setting	Number	% of Total
Cases private home	57	61.3
Road/river/reserve/park/forest/carpark/paddock/orchard/ bay/valley etc	18	19.4
Other private home	4	4.3
Hospital	2	2.2
Motel/club rooms	2	2.2
Drug and alcohol retreat	1	1.1
Centre of drug distribution	1	1.1
Unknown	8	8.6
TOTAL	**93**	**100**

3.2.6. Incidence by exposure setting

Of the 93 chemical injury deaths to date for 2002, 89 were due to poisoning while four were attributed to petrol burns/fire.

3.2.7. Substance Class

Of the 166 substances involved in the 2002 deaths filed to date, 42.8% (71/166) were therapeutics, 33.7% (56/166) were household/domestic substances and 22.9% (38/166) were chemical/drugs of abuse (Table 24). Carbon monoxide accounted for 85.7% (48/56) of the household/domestic substances.

Table 24: CISS Deaths by Substance Class, initial 2002

Substance Class	No. of Deaths	% of Total
Therapeutics	71	42.8
Household/Domestic	56*	33.7
Chemical/Drugs of Abuse	38	22.9
Agrichemicals	1	0.6
Herbal Remedy/Dietary Supplement	0	0.0
TOTAL	**166**	**100**

* Includes 48 cases of carbon monoxide poisoning

3.2.8. Substance (total and primary)

Forty six different substances were involved in the 93 deaths filed to date for 2002. Of these, 21 substances were primarily (although not necessarily singly) responsible for the death of the case. Carbon monoxide was the most common substance, both overall (48 instances) and as a primary cause of death (also 48 instances). Morphine, heroin, morphine/heroin combinations (8 total, 6 primary) and ethanol (24 total and 5 primary) made up the top three for both classifications (Tables 25 and 26).

Table 25: Substances (Total) involved in CISS Deaths, initial 2002

Frequency	Total Substance
48	Carbon Monoxide
24	Ethanol
8	Morphine, Heroin, Morphine/Heroin
6	Amitriptyline, Zopiclone
5	Diazepam, Methadone
4	Doxepin, Paracetamol
3	Benzene/Toluene (Petrol), Codeine, Ethanol/Methanol (Methylated Spirits), Nortriptyline, Propanolol, Tetrahydrocannabinols
2	Citalopram, Dothiepin, Fluoxetine, Methamphetamine, Temazepam, Tramadol, Triazolam
1	Acetylsalicylic Acid, Amphetamine, Atorvastatin, Benztropine, Boric Acid, Cilazapril, Clonazepam, Clozapine, Cyanide, Cyclizine, Diclofenac, Frusemide, Lithium, Lorazepam, Methanol, Methotrimeprazine, Moclobemide, Olanzapine, Orphenadrine, Oxazepam, Paroxetine, Promethazine, Risperidone, Theophylline

Table 26: Primary Substances involved in CISS Deaths, initial 2002

Frequency	Primary Substances
48	Carbon Monoxide
6	Morphine, Heroin, Morphine/Heroin
5	Ethanol, Methadone
4	Amitriptyline
3	Benzene/toluene, Doxepin, Propanolol
2	Codeine, Paracetamol, Triazolam
1	Boric Acid, Cilazapril, Clozapine, Cyanide, Dothiepin, Ethanol/methanol, Methamphetamine, Methanol, Nortriptyline, Temazepam

3.2.9. Multiple substances

Most deaths attributable to chemical injury filed to date for 2002 involved either one (47.3%) or two (37.6%) substances. More than one substance was involved in just over half of the cases (49/93, 52.7%) (Table 27).

Table 27: Number of Substances Involved in CISS Deaths, initial 2002

No. of Substances involved	Corresponding No. Cases
1	44
2	35
3	7
4	3
5	3
6	1
TOTAL	**93**

3.2.10. Primary substance by intent

All of the deaths involving methadone and ethanol as the primary substances were deemed non intentional (Table 28). Carbon monoxide was the leading cause of both intentional and non intentional deaths for 2002 cases to date.

Table 28: CISS Primary Substances (Top 5) by Intent, initial 2002

Primary Substance	Intentional	Non Intentional	Intent Unknown	Total
Carbon Monoxide	42	6	0	48
Morphine & Morphine/Heroin	2	4	0	6
Methadone	0	5	0	5
Ethanol	0	5	0	5
Amitriptyline	3	0	1	4
TOTAL	**47**	**20**	**1**	**68**

3.2.11. Primary substance by sex

Primary substance by sex statistics are presented in Tables 29. Of the 48 carbon monoxide deaths, 87.5% (42 cases) were of male gender.

Table 29: CISS Primary Substances (Top 5) by Sex, initial 2002

Primary Substance	Sex		
	Male	Female	Total
Carbon Monoxide	42	6	48
Morphine & Morphine/Heroin	5	1	6
Methadone	2	3	5
Ethanol	4	1	5
Amitriptyline	4	0	4
TOTAL	**57**	**11**	**68**

3.2.12. Primary substance by age group

Primary substance by age group statistics are presented in Tables 30.

Table 30: CISS Primary Substances (Top 5) by Age, initial 2002

Primary Substance	Age Group					Total
	0-14	15-29	30-59	60+	Unk	
Carbon Monoxide	0	14	29	5	0	48
Morphine & Morphine/Heroin	0	1	5	0	0	6
Methadone	0	2	3	0	0	5
Ethanol	0	1	3	1	0	5
Amitriptyline	0	1	3	0	0	4
TOTAL	**0**	**19**	**43**	**6**	**0**	**68**

4. DISCUSSION

4.1. Significance of findings within a New Zealand and International context

While the leading causes of death in New Zealand are cancer and ischaemic heart disease, the number of deaths from chemical injuries is not negligible. To date, 200 deaths from chemical injury in 2001 have been filed at the Coronial Services Office, giving a rate of 5.4 per 100 000 population. One hundred and forty six of these deaths were deemed intentional (suicide). Overall, 72.0% (144/200) of the 2001 cases were males (rate of 7.9 per 100 000 is over two and a half times greater than that for females). A large percentage (61.1 %) of the male cases were in the 30-59 year age group. The rate for this sex/age group was 11.8 per 100 000 population. By contrast, the rates for the 15-29 and 60+ male age groups were 7.0 and 10.6 per 100 000 respectively. There was only one death (deemed intentional) in the 5-14 year age group. Another demographic trend of note is that absolute numbers and rates for chemical substance fatalities in 2001 were highest within the European ethnic group (140/200 cases, 5.4 deaths per 100 000 population). However, the rate for non intentional deaths was highest among the Maori population (2.1 per 100 000). It is estimated that these figures are 90-95% complete.

Carbon monoxide poisoning was by far the leading cause of intentional deaths attributable to chemical injury for both 2001, and 2002 to date (96/200 and 42/93 deaths respectively). It was also the top primary substance for unintentional deaths in 2002 (six fatalities). However, in 2001, methadone and morphine and morphine/heroin combinations were the leading cause of unintentional deaths (11 fatalities each, compared to two deaths by carbon monoxide).

The New Zealand Health Information Service (NZHIS) produced a report in 2001 on Suicide Trends in New Zealand[2]. Figures for the 10 years from 1988 to 1997 (the most complete figures at the time, thus highlighting the need for a more timely surveillance system for chemical injury deaths) show that the number of deaths by poisoning ranged from 164 in 1991 to 229 in 1994. The ratio of deaths classified as poisoning by other gases and vapours (motor vehicle exhausts) to deaths from poisoning by solid or liquid substance (further breakdown of substances is not available) ranged from 1.5:1 in 1988 to 3.3:1 in 1995. The 2001 total of intentional deaths (146) and corresponding ratio of deaths from carbon monoxide to deaths from other hazardous substances of 1.9:1 (carbon monoxide was the primary cause of death in 96 of the 146 intentional deaths) are not greatly dissimilar given the different data collection and classification methods and the complete NZHIS data set (our estimate that by the end of the following year, 90-95% of cases for the previous year will be filed at the Coronial Services Office is yet to be confirmed). A salient feature of the carbon monoxide deaths is its prevalence amongst males. Eighty two percent (80/98) of carbon monoxide deaths in 2001 and 87.5% (42/48) of the 2002 deaths to date were male.

In the United States, carbon monoxide results in more than 500 unintentional deaths, and over 2000 suicides per year[3]. As in New Zealand, it is responsible for more fatal intentional poisonings than any other agent. In Australia, motor-vehicle exhaust gas is the most common method of suicide in young males[4].

Issues such as suicide risk factors and suicidal behaviour are outside the scope of this report and have been documented elsewhere. However, it is worth mentioning that method restriction may not necessarily reduce overall suicide rates given that suicide is a purposive act and this approach does not address underlying risk factors. Restricting access to a particular method may just increase the use of an alternative method[5]. However, suggested measures aimed at reducing the availability of vehicle exhaust as a suicide method include fitting catalytic converters to vehicles, installation of carbon monoxide detectors which shut down engines and prevent restarting, and designing ignition systems that prevent motor vehicles from idling for more than a short period of time. Each method has limitations.

An in depth discussion regarding the remaining substances identified in chemical injury deaths is outside the scope of this report. However, a few of the most prominent findings will be discussed briefly.

A significant number of cases involved alcohol. For the 2001 cases, ethanol was identified in the toxicology report of 69 cases and was the primary substance involved in the death of 9 cases (4th overall behind carbon monoxide, methadone and morphine and morphine/heroin combinations). Almost a third (30/98, 30.6%) of the carbon monoxide deaths involved alcohol. This finding is of public health concern due to the easy access of the New Zealand population to alcohol (in comparison to the majority of the therapeutic substances which require a prescription).

Paracetamol, an over the counter medicine was involved in 10 of the 2001 deaths, for one of which it was the only (and therefore primary) substance involved in the death. This death was deemed intentional. Two deaths to date in the 2002 data set involved paracetamol as the primary substance. One was classed as non intentional and the other was of unknown intent.

Methadone and morphine + morphine/heroin combinations were the second highest primary substances identified in 2001 (12 deaths each). For 2002 data to date, morphine and morphine/heroin combinations is ranked second (6 deaths) and methadone is third with ethanol (5 deaths). Of particular note is the high proportion of these deaths which were unintentional. In 2001, 11 of the 12 deaths for both morphine and morphine/heroin combinations and methadone (as the primary substances) were deemed non intentional. All of the 2002 deaths to date involving methadone as the primary substance were non intentional while 4/6 of the deaths involving morphine and morphine/heroin combinations were deemed unintentional.

A paper by Reith and colleagues[6], which examines the antidepressant related deaths using the data presented in this report has been submitted to the New Zealand Medical Journal. Coronial data were analysed in conjunction with prescription data to determine fatal toxicity indexes. Overall, antidepressants were involved in 40 deaths and were the primary cause of death in 23 cases. There were 5.52 deaths per 100 000 prescriptions for tricyclic antidepressants but only 2.51 deaths per 100 000 prescriptions for selective serotonin reuptake inhibitors, illustrating that toxicity in overdose should be considered when prescribing antidepressants.

4.2. Data Collection

Updates of the electronic coronial data are sent to ESR on a regular basis. However, as these updates contain data on all coroners' reports, work is currently underway to develop a software application to filter out the chemical injury cases.

The majority of the fields collected via the manual process are available in the electronic data set. The exceptions are address of exposure and a comprehensive listing of the substances involved in each fatality. While address of exposure is not available electronically, place of hearing (e.g. Auckland) is. This could be used as a substitute. Alternatively, address of exposure could be collected manually from the Coronial Services Office once or twice a year for all the cases identified from the electronic data set. Given that, a) the coronial number for all cases of interest would be known and b) the filing system in place at the Coronial Services Office is very accommodating, this process would not be too labour intensive. Further discussions are needed on this issue.

A comprehensive listing of the substances involved with each case has to date been obtained by manually viewing the ESR toxicology reports which are filed with the coroners reports for approximately 95% of the chemical injury cases. Given that these toxicological analyses are performed within ESR's forensic group, the obvious solution would be to obtain electronic copies of these reports internally. It is proposed that the practicalities of this (data accessibility, case matching etc) be investigated.

The data presented in this report for 2001 is thought to be 90-95% complete. The feasibility and utility of collecting the last 5 – 10% needs to be raised. Given that it may take years for some cases to be filed, the resources required to achieve this may not outweigh any possible advantages the extra data may provide. The practicalities of updating and reporting the data also come into question. However, given that it is our estimate that by the end of the following year 90-95% of the valid cases for the previous year will be available, it is suggested that 2001 cases filed during 2003 be collected in order to validate this assumption.

4.3. Data Dissemination

In addition to this report, the coronial chemical injury data is to be disseminated via the internet. Plans are underway for a website to be available by the end of June 2003. This tool will provide end users with the ability to view data in tabular form and perform simple queries. This website will be extended to chemical injury data collected from other sources and will in time be a part of a larger ESR based public and environmental health surveillance website. Options are also being explored regarding the inclusion of the coronial data on the New Zealand Public Health Observatory website.

4.4. Comprehensive Chemical Injury Surveillance System

As death is the most severe outcome possible from chemical injury, inclusion of fatal cases in the hazardous substance surveillance system is crucial in order to gauge the burden of disease attributable to chemical injury in New Zealand. The ratio of acute chemical injury deaths to hospitalisations is not yet known. Furthermore, the number of

chemical injuries dealt with in the home, sometimes with the assistance of advice from the National Poisons Centre, or cases seen by a General Practitioner as opposed to a secondary care professional is not available. If the true burden of disease in New Zealand attributable to chemical injury were to be gauged so that appropriate public health interventions can be implemented, data from various sources would need to be collected and analysed within the scope of a comprehensive chemical injury surveillance system. Data of interest therefore includes that from the National Poisons Centre, Ambulance Services and General Practitioners in addition to hospital emergency patients, hospital inpatients and coronial cases. While it is recognised that each data source has its own merits and disadvantages and may not individually fulfil the optimal attributes of a surveillance system, when analysed in combination with each other the limitations associated with each may be less significant.

For example, attempts to date by ESR to obtain data on cases requiring hospitalisation has proved to be challenging. Several approaches have been assessed and trialled with varying success. In the meantime, some Public Health Units are receiving some notifications from some of their affiliated hospitals. If this data can be analysed in combination with data available from NZHIS and the other sources suggested, the gaps in the hospital data may not be so significant in the overall context. In addition, certain trends which could be extrapolated may be found, for example the ratio of deaths to hospitalisations for alcohol related poisonings.

ESR is currently working with the Auckland Public Health Unit and the various data providers to test this concept. Results and a proposal for the future direction of a comprehensive surveillance system is expected to be reported to the Ministry of Health by the end of June 2003.

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