Hidden drownings: A New Zealand case study

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Introduction

As part of the International Collaborative Effort on Injury Statistics (ICE) studies are being undertaken which seek to evaluate and compare differences in vital statistics using specific injury types. One such study is of drowning and New Zealand is participating in that study.

In order to determine rates, participating countries are being asked to use standard codes to define drowning. These codes are:

E830: Accident to watercraft causing submersion
E832: Other accidental submersion or drowning in water transport accident
E910: Accidental drowning and submersion
E954: Suicide and self-inflicted injury by submersion [drowning]
E964: Assault by submersion [drowning]
E984 Submersion [drowning] undetermined whether accidentally or purposely inflicted

Although this is the complete range of specific E codes for drownings unfortunately it does not identify all cases of drowning in a country, since there are drownings which occur under other circumstances and are hidden within other E codes. An insight into the potential significance of such cases is provided by reference to some of the exclusions for E910 listed in ICD 9. The full list of exclusions is:

•diving accident (NOS) resulting in injury except drowning (E883.0)
•diving with insufficient air supply (E913.2)

•drowning and submersion due to cataclysm (E908-E909)
•machinery accident (E919.0-E919.9)
•transport accident (E800.0-845.9)
•effect of high or low pressure (E902.2)
•injury from striking against objects while in running water (E917.2)

Thus in the case where a drowning resulted from a single motor vehicle incident in which the vehicle failed to take a corner and crashed into a river, this would be coded as E816: Motor vehicle traffic accident due to loss of control, without collision on the highway.

Rates based on the E codes listed for the proposed international drowning study will therefore underestimate the extent of the problem. By how much will depend to some degree on the physical environment in a given country, such as the length of roadway alongside lakes and rivers. The aim of the study described here was to determine for New Zealand:

1) to what degree use of the ICD drowning codes underestimates the incidence of drowning;
2) how the "hidden" drownings are distributed across the full range of E codes; and
3) whether the proportion of drownings which have been hidden has changed over time.

Method
New Zealand maintains an electronic national mortality data file. All injury deaths are coded according to the International Classification of Diseases Supplementary Classification of External Causes of Injury and Poisoning, commonly referred to as E codes (WHO 1975). Injury diagnoses are not coded neither are multiple causes of death. For each injury death there is an electronic field of up to 95 characters of narrative, which is used to briefly describe the circumstances of death, including the nature of injury. There are no specific guidelines for completing this field. Information for this field is obtained from a variety of sources, including the death certificate, coroner report, and hospital files.

Mortality files for the period 1977-92, which were coded in the range E800-E999 (External causes of injury and poisoning), were electronically searched using the key word "drown".

Results
For the period 1977-92 1913 drownings were recorded under the drowning codes listed above (E830,E832,E910,E954,E964,E984). By searching for the term "drown" we identified 2321 cases. This represents a 21.3% increase in cases. All drowning cases identified by drowning codes had "drown" in the narrative.

Table 1 shows the distribution of the drownings identified by the narrative search according to the E code groupings under which they were classified. The majority (65%) of 408 drownings not coded as such (hereafter referred to as 'hidden' drownings) were coded as E810-E819: Motor vehicle traffic accidents. These incidents represent 11.4% of the drowning problem in New Zealand. The remainder of the hidden drownings were evenly distributed over a range of E code

groupings (Table 1)

Table 2 provides greater detail of the classification of the hidden E codes, by listing the most common 3 digit E categories to which they were coded. Three findings are of note. First, single vehicle crashes (E816) accounted for just over half of all cases. They represent 9.4% of all drownings in New Zealand. For the same period there was a total of 2233 single vehicle crashes (E816), drowning was mentioned as an outcome in the free text in 9.8% of these. Second, is the large number of events classified as E957: Suicide and self inflicted injuries by jumping from a high place. The effect of the use of this classification is that reference solely to E954 will underestimate the size of the suicide drowning problem by 7%. Finally, a similar problem, although less significant, arises when seeking to determine the incidence of drownings associated with water transport. The drowning codes in Table 1 suggests there are 511 cases (E830,E832). Reference non drowning codes in Table 1, however, suggests there were an additional 16 cases.

Figure 1 shows that the percentage of drownings which were hidden drownings remained relatively constant from 1977 until the late 1980's, when in 1989 it peaked at 53% then dropped away but has remained at a higher level in the early seventies. Further analyses of the data reveal that this peak is largely attributable to the increasing significance of motor vehicle traffic accidents over time as a contributor to the total drowning burden (Fig 2). Whether there has been a real increase in these drownings or E code classification has changed in recent years is not known.

Discussion

The analyses presented here show that estimates of the prevalence of drowning in New Zealand will be seriously underestimated by reference solely to the specific drowning E codes. It seems likely that this will be the situation in other countries. In some countries this matter will be able to be addressed by reference to the four digit code for the nature of injury, namely: "994.1 Drowning and nonfatal submersion". As previously indicated this, the preferred approach, was not possible in New Zealand as nature of injury is not coded. It would be available in a limited number of countries (e.g. USA) which have multiple cause of death coding.

Not only has the use of free text information enabled a more accurate estimate of the prevalence of drowning but it has also highlighted the significance of specific drowning events, in particular those associated with motor vehicle crashes. Motor vehicle traffic crashes accounted for 11% of all drownings. In the USA the comparable figure is approximately 5% (Baker et al 1992).

We have also shown that free text information is useful in identifying cases where only the underlying cause of death is coded. WHO defines underlying cause as the disease or injury which initiated the train of morbid events which produced fatal injury. Therefore if someone intentionally jumps from a high place and then drowns this incident should be classified as E957. In this context we wish to emphasise that the revised estimate of intentional self drownings (n=116, 4.9%) probably remains an underestimate. For example, some of the single vehicle motor vehicle crashes may be intentionally self-inflicted. Support for this view is provided by a more detailed investigation into drownings in the Auckland area. That study estimated 28% of all adult

drownings were intentionally self-inflicted (Cairns et al 1984)

In the absence of specific guidelines on the contents of the free text field, it seems likely that the estimates produced here are underestimates since limited space may have precluded mention of injury diagnosis in some cases. Adding a mandatory diagnostic field that addresses the type of injury causing death would address this problem. Some indication of the potential significance of further hidden drownings is provided by reference to the New Zealand Water Safety Councils estimates. These are produced by reference to a variety of sources throughout New Zealand. For the period 1980-1992, inclusive they estimated, there were 2278 drownings. The comparable figure from our analyses using free text is 1706, 25% fewer. From a national perspective this discrepancy is of considerable concern. Future research in this area should give priority to matching the two data files with a view to producing a more accurate estimate of the prevalence of all drownings and specific drowning types.

Given the foregoing, the proposed ICE drowning study should avoid comparing countries on their total drowning rate but rather compare countries on each of the specific drowning codes within ICD.

References

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Table 1: Drowninings in New Zealand 1977-1992

Distrubtion of cases identified by electronic search on the word "drown" according to assigned E code

Assigned E codes		Freq	Percent
Drowning Codes			
E830:	Accident to watercraft causing submersion	412	17.8
E832:	Other accidental submersion or drowning in water transport accident	99	4.3
E910:	Accidental drowning and submersion	1024	44.1
E954:	Suicide and selfinflicted injury by submersion [drowning]	277	11.9
E964:	Assault by submersion [drowning]	7	0.3
E984	Submersion [drowning] undetermined whether accidentally or purposely inflicted	94	4.1
Subtotal		**1913**	**82.4**
Non drowing codes			
E810-E819	Motor vehicle traffic accidents	264	11.4
E820-E825	Motor vehicle non traffic accidents	16	0.7
E831, E833-E838	Water transport accidents	16	0.7
E840-E848	Air and space transport accidents	16	0.7
E880-E888	Accidental falls	19	0.8
E900-E909	Accidents due to natural and environmental factors	12	0.5
E950-E953, E955-E959	Suicide and self-inflicted injury	30	1.3
Others		35	1.5
Subtotal		**408**	**17.6**
Total		**2321**	**100.0**

Table 2: Drowninings in New Zealand 1977-1992
Distrubtion of hidden drownings by most common 3 digit E codes

Assigned E codes		Freq	Percent
E816	Motor vehicle traffic accident due to loss of control, without collision on the highway	220	53.9
E815	Other motor vehicle traffic accident involving collision on the highway	31	7.6
E957	Suicide and self inflicted injuries by jumping from a high place	22	5.4
E825	Other motor vehicle nontraffic accident of other and unspecified nature	14	3.4
E838	Other and unspecified water transport accident	11	2.7
E884	Other fall from one level to another	11	2.7
E841	Accident to powered aircraft, other and unspecified	10	2.5
Miscellaneous (none greater than n=9)		89	21.8
Total		**408**	**100.0**

Figure 1: Dronings in New Zealand 1977-1994
Percentage of hidden drownings by year

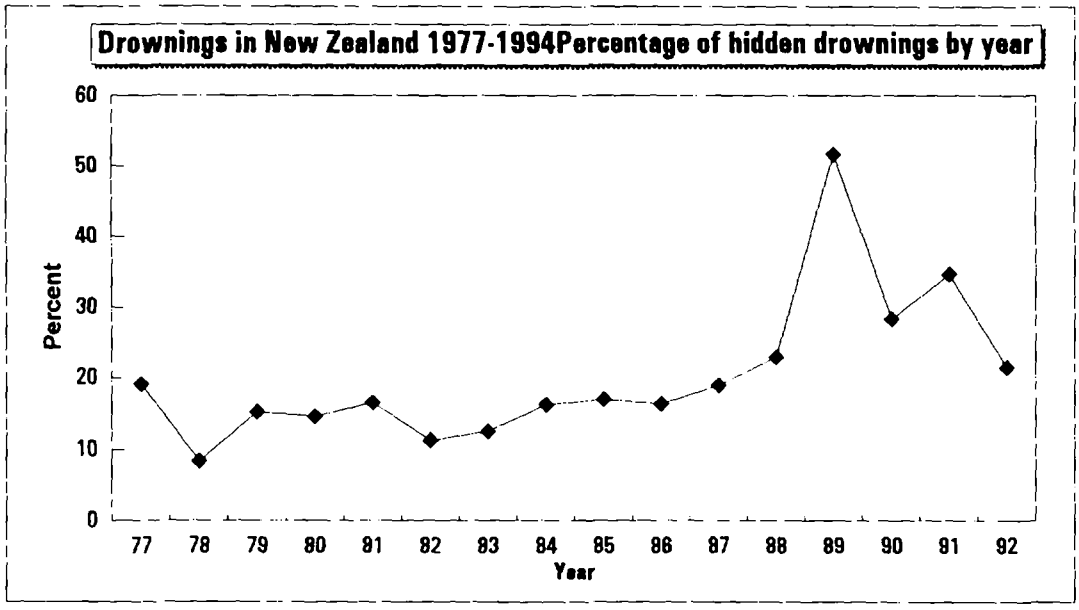

Figure2: Drownings in New Zealand 1977-1994
Percentage of MVTC's by year