

Report to O'Hara Inquiry - Comparison of mortality due to 'Hyponatraemia' between Northern Ireland and other European countries

Introduction

1. This purpose of this paper is to compare mortality statistics relating to hyponatraemia in Northern Ireland with those in other European countries. The paper details issues relating to analysis of hyponatremia mortality statistics and proposes further work to validate the preliminary findings outlined in this initial analysis.
2. The process of death registration is broadly similar across Europe. After a death a qualified medical practitioner notes the cause of death of the deceased, including any secondary/associated causes of death, on the medical cause of death certificate.
3. In Northern Ireland all deaths are subsequently registered with the General Register Office (GRO) on the civil registration system. The GRO issue a separate death certificate, for which provision of a medical cause of death certificate is a pre-requisite. All the information on causes of death (underlying and secondary) from the medical cause of death certificate is recorded on the GRO death certificate. The GRO death certificate currently contains space for up to five causes of death; this number can vary internationally.
4. The World Health Organisation International Statistical Classification of Diseases, Injuries, and Causes of Death (ICD) is used to classify this information. This classification system is used across the developed world. The ICD is used to identify – from those recorded by the medical practitioner - the (single) underlying disease or circumstances, which initiated the train of events leading to death. Most published mortality statistics are based on the underlying cause of death, that is, there is one cause death per person. However, analyses based on all recorded causes are possible, although the ease with which such analyses can be performed is dependent on the recording system.
5. In Northern Ireland since 2001 and in line with the rest of the UK, the tenth revision of the International Statistical Classification of Diseases, Injuries and Causes of Death (ICD10) is used to classify cause of death. The codes used for “hyponatraemia” and “fluid overload” deaths are E87.1 and E87.7 respectively. In the period 1979 to 2000 the ninth revision of the International Statistical Classification of Diseases, Injuries and Causes of Death (ICD9) was used to classify cause of death. The ICD9 codes used for “hyponatraemia” and “fluid overload” deaths were 276.1 and 276.6.

Issues relating to the monitoring of hyponatremia related mortality statistics

6. There are a number of important caveats which need to be detailed before undertaking any analysis relating to hyponatremia related deaths.
7. Firstly, the way in which or indeed the number of causes of death recorded on the medical certificate may vary from country to country. Therefore different recording practices could result in some countries relatively under-recording or over-recording the number of deaths that are hyponatraemia related. In simple terms, a change to a reporting system that increased the number of causes of deaths recorded could induce an apparent increase in the number of cases for a given cause of death.
8. Secondly, the knowledge, awareness and tendency to record hyponatremia may vary across the European medical profession. For example specialists in one country may be more aware of/more likely to record hyponatremia than in another. This point is even

more important when considering causes of death such as hyponatremia that have relatively few cases.

9. Thirdly, it is not known when, or in some cases if, the countries in the following analysis changed from using ICD9 to ICD10. The definitions for the relevant codes in ICD9 and ICD10 are the same but the introduction of ICD10 may have affected the comparability of the data over time.
10. Fourthly, most European countries use an automated system for cause of death coding. The introduction of this automated coding system has occurred over the last decade and this may have affected the comparability of data over time and between countries.
11. Fifthly, NISRA previously noted that the number of cases of hyponatremia related deaths seems to be rising over time. As discussed above this may be an artefact of reporting/recording. Whatever the cause, it means that international comparisons across different time-periods may be further distorted by this possible increase in hyponatremia related deaths.
12. Finally, comments made by Statistics Netherlands (CBS) in their response to the Inquiry relating to statistics for hyponatremia mortality are also important. These include
 - *“it is possible that hyponatremia or fluid overload will not be written down on the death certificate if it occurs in the course of treatment of a severely ill patient”*
 - *“in complicated or terminal cases, it is likely that the mentioned hyponatremia or fluid overload will not be ICD coded. If it appears to be a common or obvious consequence or complication of other mentioned diseases, conditions or treatments, it is not coded.”*
 - *“we do not consider the numbers in the attached table a reliable or even mediocre estimator of the number of persons who died in or soon after a hyponatremic or hyper-hydrated state”*

Northern Ireland data

13. There were 68 deaths registered in Northern Ireland between 1984 and 2004 where hyponatraemia or fluid overload were recorded as a cause of death. Of these 8 were coded as the underlying cause of death (none of which were children). For the remaining 60 deaths, hyponatraemia / fluid overload was recorded as a secondary cause of death and 4 of these deaths were to children aged under 15.

International comparisons

14. Following a request from the Inquiry, data has been obtained for a number of European countries on deaths involving hyponatraemia / fluid overload. Annex A summarises the information supplied by each country. The analysis below is split into two sections (adults and children) based on the data made available to the Inquiry.

Adults (aged 15+)

15. Table 1 below compares crude mortality rates, based on all mentions of hyponatraemia and fluid overload; that is aggregating cases where hyponatraemia / fluid overload is the underlying cause and cases where it is a secondary cause. The time period covered varies across the countries, and the rates have therefore been annualised to make comparison easier.

Table 1: Crude annualised death rates for deaths due to hyponatremia/fluid overload for those aged 15 and over

Country	Annualised death rate of those aged 15+ (per 100,000 population) for deaths due to hyponatremia/fluid overload
France	0.39
Scotland	0.30
England and Wales	0.24
<i>Northern Ireland</i>	<i>0.23</i>
Switzerland	0.17
Sweden	0.16
Netherlands	0.05

16. As noted above these figures should be interpreted with caution. Moreover, the data have not been standardised for the effect of populations with different age or gender structures and the mortality data relates to different time-periods. That said the crude mortality rates do suggest that Northern Ireland is firmly in the main body of European countries.

17. Age-at-death information is available for countries within the UK, enabling comparisons of age-standardised mortality rates. Table 2 below shows the results of applying age-specific mortality rates from England & Wales for the period 1993-2003 to the Northern Ireland population.

Table 2: Age-standardised Mortality Ratios (SMR) for Northern Ireland for persons aged 15+ (based on the England and Wales experience)

	Northern Ireland
Actual deaths (1993-2003)	44
Expected deaths if England and Wales mortality rates applied to Northern Ireland population	30
Age-standardised mortality ratio, England & Wales =100 (95% confidence interval)	145 (109,181)

18. Table 2 shows that if the population of Northern Ireland had experienced England and Wales age-specific mortality rates, the expected number of deaths in the period 1993-2003 would have been 30; the observed number was 14 higher at 44 deaths. Thus, Northern Ireland age-standardised mortality is 45 per cent higher than the England and Wales picture and this difference is statistically significant ($p < 0.05$). When compared to the results of Table 1 this result shows the importance of age-standardisation.

Children (aged 15+)

19. The second analysis relates to children. Again, looking at only the countries that were able to provide information on all mentions of hyponatremia, the crude death rate for children (aged 0-14) is shown in Table 3 below. The data was provided for different time periods for each country so the mortality rates have been annualised.

Table 3: Crude annualised death rates of those aged 0-14 for deaths with hyponatremia/fluid overload recorded on the death certificate

Country	Number of years data available	Number of deaths with hyponatremia/fluid overload mentioned (0-14 year olds)	Latest population estimate ('000) (0-14 year olds)	Annualised death rate per 100,000 population
<i>Northern Ireland</i>	21	4	361	0.05
England and Wales	11	18	9,685	0.02
Sweden	16	3	1,584	0.01
France	21	15	11,636	0.01
Scotland	20	1	878	0.01
Switzerland	8	0	1,215	0.00
Netherlands	6	0	2,926	0.00

20. As noted previously these figures should be interpreted with caution. The caveats noted above still apply. Moreover, this analysis should be treated with even more caution, as the number of registered deaths in Northern Ireland (4) is small. That said, this initial analysis indicates a higher rate of child mortality in Northern Ireland than in selected other European countries, where hyponatremia/fluid overload is a factor in the cause of death.

Further analysis

21. This paper details analysis of initial results of data collected by the O'Hara Inquiry regarding deaths related to hyponatremia/fluid overload. The results are very much preliminary and further research would be required to present a more definitive position.

22. In addition information would need to be gathered on the following issues:

- although not easily quantified most countries have experienced an increase in the number of conditions recorded on the death certificate. It would be important to know when different versions of ICD/ automated coding were used. These issues would need to be considered more fully in any more detailed analysis;
- the number of ICD codes allowed for in the death registration system in each country (e.g. in Northern Ireland a maximum of five ICD codes have been used up until 2003);
- in their response to the inquiry the Swiss Statistical Office questioned the particular ICD codes used. In particular they questioned whether ICD10 codes Y63.0, Y63.1, Y65.1 and T80.0 should also be included. These codes are related

to complications of medical treatment and are not included in the analysis noted here. It is noted that no cases have been coded to these causes in Northern Ireland in the period of analysis, since 1984. This issue should be addressed in any more detailed analysis;

- data from a wider selection of European countries (or indeed in other developed countries) would also be beneficial; and
- the comments noted by Statistics Netherlands would need to be considered further by medical experts - research would be required on the likelihood of doctors recording hyponatremia on death certificates and other related issues.

23. To assist the Inquiry attached, as Annex B, is an outline of the additional data that would be required to develop the analysis shown above further. This additional data would enable the calculation of age and gender standardised mortality ratios for hyponatremia related death and would thus ensure that any differences due to population age and gender structures were not distorting the statistics presented. In addition it would be beneficial to discuss and further document the issues raised with the countries that responded to the initial request for information from the Inquiry.

24. However it is important to note that the initial results presented in this paper coupled with comments from the countries that responded to the Inquiry suggest that further analysis of hyponatremia related death should be concentrated on children. Given the relatively small number of cases, a case study approach using more detailed hospital information on hyponatremia related deaths of children rather than death certificate information may be more informative. This would require gathering information from hospital records of those children whose death was hyponatremia related. This information could then be used to identify the circumstances that caused the death and, if possible, using this information to make comparisons.

NISRA
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Annex A: Information supplied to the O'Hara Inquiry

Country	Cause of death	Time Period
Germany	Main cause of death only	1998-2003
England and Wales	All mentions (after 1993)	1984-2003
Scotland	All mentions	1984-2003
Northern Ireland	All mentions	1984-2004
Republic of Ireland	Main cause of death only	1980-2003
France	All mentions (except for last 2 years – main cause of death only)	1979-2001
Switzerland	All mentions	1995-2002
Sweden	All mentions	1987-2002
Netherlands	All mentions	1980, 1985, 1990, 1995, 2000 and 2003

Annex B: (Further) information required by O'Hara inquiry from European/developed countries

Deaths where the following ICD cause of death codes are recorded on the death certificate (either as main or secondary cause of death)

- (i) *Hyponatraemia*
 - ICD10 E87.1
 - ICD9 276.1
- (ii) *Fluid Overload*
 - ICD10 E87.7
 - ICD9 276.6
- (iii) *Complications of medical treatment*
 - ICD10 Y63.0, Y63.1, Y65.1 and T80.0
 - ICD9 E873.0, E873.1, E876.1 and 999.1

Time period

All deaths registered in period 1993 to 2003 (inclusive) – by individual year

Age-Groups and Gender

For the following twelve age-groups (age at death)

Males aged 0-14, 15-29, 30-44, 45-59, 60-74, 75+

Females aged 0-14, 15-29, 30-44, 45-59, 60-74, 75+

Ideally this would be best supplied in the form of the following tables

Table: Number of deaths related to ICD codes noted above for deaths registered in 1993

Age-Group	Male	Female	Total
0-14	X	X	X
15-29	X	X	X
30-44	X	X	X
45-59	X	X	X
60-74	X	X	X
75 and over	X	X	X
Total	X	X	X

With similar tables for years 1994.... 2003. Note include all deaths registered even those of non-residents.

Further information

In addition it would be beneficial to have some detailed contextual information

- (i) In the period 1993-2003 did you use ICD9? If so when?
- (ii) In the period 1993-2003 when did you use ICD10? If so when?
- (iii) In the period 1993-2003 did you use manual cause of death coding? If so when?
- (iv) In the period 1993-2003 did you use automatic cause of death coding? If so when?
- (v) Is cause of death data available for underlying or underlying and secondary cause of death? If for underlying and secondary for which years?
- (vi) How many ICD cause of deaths codes are used?
- (vii) Any other information that would be relevant.