

## Summary report for Inquiry into Hyponatraemia-related Deaths in Northern Ireland

### *Introduction*

1. The purpose of this report is to update information previously supplied to the Inquiry in June 2005 which compared mortality statistics relating to hyponatraemia in Northern Ireland with those in other European countries. The paper also details issues relating to analysis of hyponatraemia mortality statistics.
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 formal 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.
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 the death. Most published mortality statistics are based on the **underlying cause** of death, that is, there is one cause of 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 of “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 hyponatraemia related mortality statistics*

6. There are a number of important caveats which need to be detailed before undertaking any analysis relating to hyponatraemia 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. For example, in the Netherlands one underlying cause of death is recorded plus up to three secondary causes while in Northern Ireland and Sweden in recent years up to 20 causes can be recorded including the underlying cause<sup>1</sup>. This variation will result in some countries relatively under-recording or over-recording the number of deaths that are hyponatraemia related. In

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<sup>1</sup> Since the last paper, there has been a change to the civil registration system used by the General Register Office (GRO) in Northern Ireland. A new electronic system has been implemented. One improvement is there is now space available for up to 20 causes of death; previously only five causes could be recorded on the death certificate.

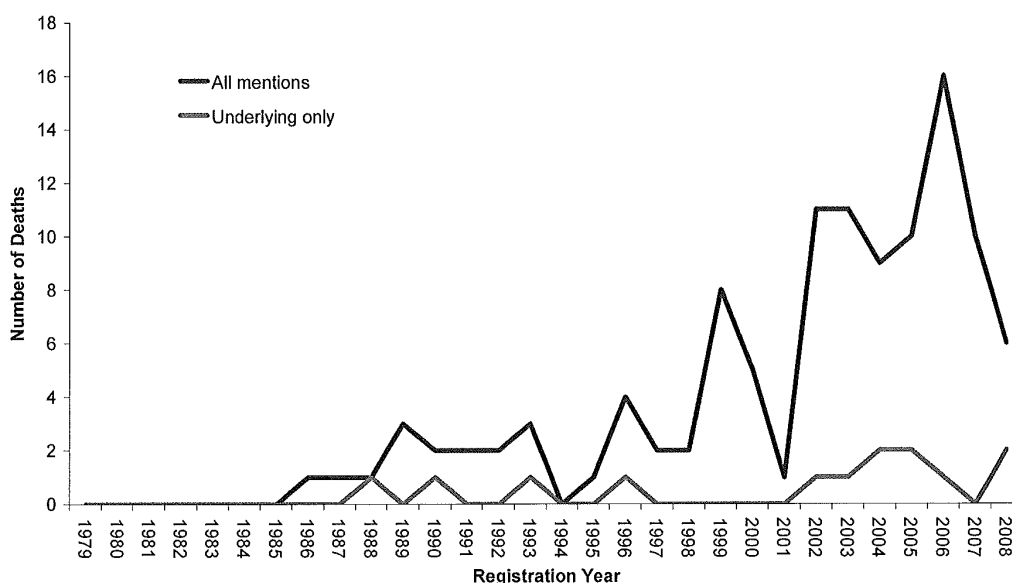
simple terms, a change to a reporting system that increased the number of causes of deaths recorded could induce an apparent increase in the number of cases for a given cause of death.

8. Secondly, the knowledge, awareness and tendency to record hyponatraemia may vary across the European medical profession. For example specialists in one country may be more aware of/more likely to record hyponatraemia than in another. This point is even more important when considering causes of death such as hyponatraemia that have relatively few cases. Indeed in Northern Ireland with the formation of the Inquiry into hyponatraemia-related deaths, medical practitioners may be more aware of the condition and therefore be more likely to record hyponatraemia.
9. Thirdly, it is important to be aware if and when 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 hyponatraemia 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 hyponatraemia related deaths.
12. Finally, comments made by Statistics Netherlands (CBS) in their response to the Inquiry relating to statistics for hyponatraemia mortality are also important. These include
  - “it is possible that hyponatraemia 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 hyponatraemia 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.”; and
  - “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 hyponatraemic or hyper-hydrated state”.
13. Annex B gives more detailed responses to the questions asked of the European countries with regards to provision of death coding.

#### ***Northern Ireland data***

14. There were 111 deaths registered in Northern Ireland between 1979 and 2008 where hyponatraemia or fluid overload was recorded as a cause of death. Of these 13 were coded as the underlying cause of death (none of which were children). For the remaining 98 deaths, hyponatraemia / fluid overload was recorded as a secondary cause of death and 5 of these deaths were to children aged under 15.

Number of Hyponatraemia-Related Deaths Registered in Northern Ireland, 1979-2008



15. The chart above shows the trend in hyponatraemia-related deaths in Northern Ireland between 1979 and 2008. It clearly shows an increase in the number of deaths with hyponatraemia / fluid overload mentioned on the death certificate in more recent years however the number of cases with hyponatraemia / fluid overload as the underlying cause of death has remains largely constant.

**European comparisons**

16. 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+)*

17. 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 hyponatraemia / fluid overload for those aged 15 and over**

Country	Number of years data available	Number of deaths with hyponatraemia/fluid overload mentioned (15+ years old)	Latest population estimate ('000) (15+ years old)	Annualised death rate per 100,000 population
France	15	7,184	51,846	0.92
Scotland	30	382	4,318	0.29
<i>Northern Ireland</i>	30	106	1,419	0.25
England and Wales	16	1,684	44,892	0.23
Sweden	21	336	7,564	0.21
Switzerland	13	162	6,326	0.20
Netherlands	30	207	13,470	0.05

18. 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.

19. A straight comparison of crude death rates between areas may present a misleading picture because of differences in the sex and age structure of the respective populations. The technique of standardisation is used to remedy this. In general, standardisation involves a comparison of the actual number of events occurring in an area with the aggregate number expected if the age/sex specific rates in the standard population were applied to the age/sex groups of the observed population.

20. 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 and Wales for the period 1993-2008 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 (1993-2008)	94
Expected deaths if England and Wales mortality rates applied to Northern Ireland population	47
Age-standardised mortality ratio, England and Wales = 100 (95% confidence interval)	202 (173,231)

21. 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 1993-2008 would have been 47; the observed number was double at 94 deaths. Thus, Northern Ireland age-standardised mortality is 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 under 15)*

22. The second analysis relates to children. Again, looking at only the countries that were able to provide information on all mentions of hyponatraemia, 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 hyponatraemia / fluid overload recorded on the death certificate**

Country	Number of years data available	Number of deaths with hyponatraemia/fluid overload mentioned (0-14 years old)	Latest population estimate ('000) (0-14 years old)	Annualised death rate per 100,000 population
<i>Northern Ireland</i>	30	5	356	0.05
France	15	24	11,768	0.01
England and Wales	16	20	9,548	0.01
Scotland	30	1	850	0.00
Sweden	21	1	1,550	0.00
Netherlands	30	2	2,936	0.00
Switzerland	13	-	1,183	-

23. As noted previously these figures should be interpreted with caution. The caveats noted above still apply and indeed are more relevant as the number of registered deaths in Northern Ireland (5) is very small indeed. That said, this initial analysis indicates a higher rate of child mortality in Northern Ireland than in selected other European countries, where hyponatraemia / fluid overload is a factor in the cause of death.

***Anomalies in the data***

24. When processing the European data some inconsistencies were discovered.

- The data from the Republic of Ireland and Germany only included cases where the underlying cause of death and not the secondary cause was hyponatraemia / fluid overload therefore we have omitted these countries from the analysis.
- The figures provided for more recent years for France seem very large in comparison to data provided for the original paper. Indeed there is discrepancy between the data in the original data supply in 2005 and the most recent data files for the years which overlap (1993-1999). Further investigation into the reason for these differences would be necessary to ensure the data is accurate and therefore data provided for France within with paper should be treated with caution.

25. A further issue is the standard of reporting of cause of death. Evidence from health officials suggest that relatively junior hospital doctors tend to fill out death certificates and there is limited training on this for new doctors. This could affect the quality of the statistics presented. All parts of the United Kingdom are considering further safeguards on death certification. These changes should include improved training or re-training for doctors in this important public health resource.

26. However it is important to note that the results presented in this paper coupled with comments from the countries that responded to the Inquiry suggest that further analysis of hyponatraemia related death should be concentrated on children. Given the relatively small number of cases, a case study approach using more detailed hospital information

may be more informative. This would require gathering information from hospital records of those children whose death was hyponatraemia related. This information could then be used to identify the circumstances that caused the death and, if possible, using this information to make comparisons and guidance on best practice.

**NISRA**  
**April 2010**

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

<b>Country</b>	<b>Cause of Death</b>	<b>Time Period</b>
Germany	Underlying cause of death only	1993-2007
England and Wales	All mentions (after 1993)	1984-2008
Scotland	All mentions	1979-2008
Northern Ireland	All mentions	1979-2008
Republic of Ireland	Underlying cause of death only	1980-2007
France	All mentions	1993-2007
Switzerland	All mentions	1995-2007
Sweden	All mentions	1987-2007
Netherlands	All mentions	1979-2008

**Annex B: Additional Information asked of participating countries for post 1992**

Questions	England & Wales	France	Netherlands	Northern Ireland	Scotland	Sweden	Switzerland
Did you use ICD09 When	Yes 1993-2000	Yes 1993-1999	Yes 1993-1995	Yes 1993-2000	Yes 1993-1999	Yes 1993-1996	No ICD08 To 1994
Did you use ICD10 When	Yes 2001-2008	Yes 2000-2008	Yes 1996-2008	Yes 2001-2008	Yes 2000-2008	Yes 1997-2008	Yes 1995
Did you use manual coding When	Yes 1993-2000 and prior cases which have had a coroner's inquest or neonatal deaths	Yes 1993-1999	Yes 1993-2008	Yes 1993-2000	Yes 1993-1995	No -	Yes 1993-2007
Did you use automatic coding When	Yes 2001-2008	Yes 2000-2008	No	Yes 2001-2008	Yes 1996-2008	Yes 1993-2008	No
Is cause available for underlying and/or secondary When	Yes both 1993-2008	Yes both 1993-2008	Yes 1993-2008	Yes both 1993-2008	Yes both 1993-2008	Yes 1993-2008	Yes 1995-2007
How many ICD10 codes are used	-	-	1 underlying plus up to 3 secondary	pre-2005 – 5 causes 2005 onwards – 20 causes	pre 1996 - 3 causes 1996 onwards - 9 causes	ICD09 - 12 causes ICD10 - 20 causes	-
Other information	-	-	-	-	Data doesn't have distinction between underlying or secondary	Data doesn't have distinction between underlying or secondary	-