INCREASED WINTER MORTALITY - BACKGROUND

Introduction

This note gives information about some of the medical causes of increased winter mortality, describes some research studies' findings on factors that influence increased winter mortality, reports on a comparison of the figures for a number of European countries, mentions previous publications on this topic by one of the predecessors of the National Records of Scotland (NRS), the General Register Office for Scotland (GROS), and provides references to the sources of the material. The main points to note are:

- high cold-related mortality is associated with low indoor temperatures, and with people not wearing appropriate clothing when outdoors in cold weather;
- increased winter mortality was at the same level in Scotland as the overall mean for the 14 European countries covered by a comparative study; and
- increased winter mortality is higher in countries with a warmer winter climate, probably because their homes tend to be poorly insulated and their populations tend not to dress well for cold weather.

Some medical causes of increased winter mortality

The information in this and the following paragraph is taken from an European Commission (EC) Public Health web page entitled ‘Cold can kill - excess winter deaths’ (refer to References). In a section titled ‘studies on excess winter deaths in the European Union (EU)’, this states that winter mortality is a well-reported phenomenon throughout the world, and most countries have a winter death toll which is 5% to 30% higher than usual. Half the additional deaths are due to cerebrovascular diseases and ischemic heart disease, and the other half to respiratory disorders. The seasonal fluctuation seems to be mostly due to the cold, with some deaths attributable to influenza A and other risk factors.

Other parts of the page refer to a number of ways in which cold weather can affect health, including the following: cardiovascular problems; arterial hypertension, hyper viscosity and thrombosis (possibly leading to stroke); respiratory diseases; hypothermia; peripheral vascular diseases; endocrinal diseases; and asthma. There are more detailed comments on some of them - for example, the page says that:

- many deaths from ischaemic heart disease take place hours or a day or two after exposure to cold, suggesting thrombosis starting during or shortly after exposure to cold. Rapid death from thrombosis can be explained by the fact that the composition of the blood changes in the cold: the red cell count, plasma cholesterol and plasma fibrinogen all increase – all factors known to contribute to thrombosis;
- the impact of a cold spell on the number of deaths due to cardiovascular problems can be felt anything from 7 to 14 days later;
- respiratory and other viral and bacterial infections, which mostly occur in winter, may trigger coronary heart disease or stroke, as they affect blood coagulation factors, cause damage to vessel walls and may promote atherosclerosis;
- the impact of a cold spell on deaths due to respiratory problems can be felt anything from 15 to 30 days later; and
- hypothermia-related deaths are rare in the EU – probably around 1% of the total number of deaths attributable to cold in mild EU countries.

Factors influencing increased winter mortality

There is a clear relationship between death rates and the outside temperature, with more deaths in colder months. This was shown for Scotland (using averages for 1989 to 2000) in Charts 1 and 2 of the Occasional Paper 'The Raised Incidence of Winter Deaths' (available on the NRS website), and Curwen (1997) concluded that when the effects of influenza were disregarded there was a significant correlation between 'excess winter mortality' and temperature.

Using data for various parts of Europe, The Eurowinter Group (1997) concluded that mortality increased to a greater extent with a given fall in temperature in regions with warm winters, in populations with cooler homes, and among people who wore fewer clothes and were less active outdoors. It found that the percentage increase in all-cause mortality per 1 C deg fall in temperature below 18 deg C were greater in warmer regions than in colder regions - for example, 2.15% for Athens compared with 0.27% for south Finland. At an outdoor temperature of 7 deg C, the mean living-room temperature was 19.2 dec C in Athens and 21.7 deg C in south Finland; the percentages of people in those regions who wore hats when outdoors at 7 deg C were 13% and 72% respectively. High indices of cold-related mortality were associated with high mean winter temperatures, low living-room temperatures, limited bedroom heating, low proportions of people wearing hats, gloves and anoraks, and inactivity and shivering when outdoors at 7 deg C.

The Eurowinter Group report said that the associations between mortality and protection against cold 'strongly suggest that excess winter mortality could be reduced substantially by improved protection from the cold - particularly in countries with warm winters where the need for cold-avoidance was less obvious, and measures taken against it less effective, although we know that the middle-aged and elderly should wear protective clothing and keep active in cold weather outdoors, our surveys show that in relatively warm countries they often fail to do so'. In a Scottish study, Gemmell et al (2000) expressed a similar view, concluding that 'the strength of this relationship [between temperature and mortality] is a result of the population being unable to protect themselves adequately from the effects of temperature rather than the effects of temperature itself'.

The association between mortality and low indoor temperature observed by the Eurowinter Group was also found in a study on excess winter deaths in England. This used postcodes to link data on over 21,000 houses (from a survey conducted in 1991) with the records of almost 180,000 deaths (between 1986 and 1996), in order to analyse the seasonal pattern of death from cardiovascular disease (chosen because this 'has the closest relationship to the ambient temperature') in relation to the characteristics of the housing in the same location. Wilkinson et al (2001) concluded that 'the results provide evidence that the substantial winter-summer difference in mortality is indeed related to indoor temperature and to dwelling characteristics that are determinants of indoor temperature. Moreover, indoor temperatures produced from household and dwelling characteristics appear to influence the seasonal pattern of mortality and, more specifically, the strength of association between low outdoor temperatures and cardiovascular death. People living in dwellings that are intrinsically cold had a substantially larger seasonal swing in death rates and a greater percentage rise in mortality for each degree Celsius fall in outdoor temperature. Although not conclusive, these findings suggest that indoor temperature and markers of thermal efficiency of dwellings, including property age, are determinants of vulnerability to winter death from cardiovascular disease'.

Donaldson and Keatinge (2002) commented that 'epidemics of influenza are associated with increases in mortality and morbidity. Health professionals and the media, therefore, have often focused their attention on influenza as a cause of increased mortality and

demands on health services in winter. Cold weather alone causes striking short term increases in mortality, mainly from thrombotic and respiratory disease. Non-thermal seasonal factors such as diet may also affect mortality'. It was estimated that, on average over the latest ten years, only 2.4% of excess winter mortality in south east England was attributable to influenza (by multiple regression, using daily data, for 1970 to 1999, for deaths from all causes, influenza deaths and the mean temperature at Heathrow Airport).

Wilkinson et al (2004) looked at factors associated with winter mortality in elderly British people. Between 1995 and 1998, around 32,000 people aged 75 and over (patients at 106 general practices) provided a range of information about their personal circumstances, medical conditions and home heating. Those who had died up to March 2001 (10,123) were then identified from death registration records. The analysis also used other data, including the postcode's 'Carstairs' deprivation score, influenza counts and regional temperatures. The study found 'little evidence that [the mortality rate winter: non-winter ratio] varied by geographical region, age or any of the personal, socioeconomic or clinical factors examined, with two exceptions: after adjustment for all major covariates the [ratio] in women compared with men was 1.11 and those with a self-reported history of respiratory illness had a [ratio] of 1.20 times that of people without a history of respiratory illness. There was no evidence that socioeconomic deprivation or self-reported financial worries were predictive of winter death'. However, the report noted that 'the interrelationships between poverty, home temperature and mortality are complex. First, although lower socioeconomic groups have high absolute rates of cardiovascular disease it is not obvious that they should also have a high relative increase in cardiovascular disease in winter. Second, temperature measurements suggest that lower socioeconomic groups do not have substantially cooler homes than higher socioeconomic groups. This may in part be behavioural, but it also appears that temperatures in housing association and local authority dwellings are higher than in owner-occupied and privately rented dwellings. This may relate to the year of construction of the homes and to efforts by local authorities to ensure adequate heating in social housing stock'.

Lawlor et al (2000) had also concluded that excess winter mortality is not associated with deprivation, and Davie et al (2007) found 'no evidence to suggest that patterns of EWM differed by ethnicity, region or local-area based deprivation level' (in New Zealand). The latter study also reported 'the young and the elderly to be particularly vulnerable' and that 'after adjusting for all major covariates, the winter: non-winter mortality rate ratio from 1996-2000 in females was 9% higher than in males'.

Commenting on Wilkinson et al (2004), Keatinge and Donaldson (2004) stated that 'elderly people in sheltered housing that was fully heated, but who often went outdoors, had as much winter mortality as the general elderly population', and that 'surveys in Europe and Siberia provided statistical evidence that [dressing warmly, with hats and with windproofs and waterproofs when necessary], as well as warm homes, is associated with low winter mortality. We have found [media] advice on these lines well received by elderly people, provided that they are also given the evidence that outdoor cold accounts for much of Britain's winter mortality'.

Comparisons with other European countries

Healy (2003) is described, by the European Commission (EC) Public Health web site, as 'the most extensive study on excess winter mortality in Europe'. The research used data for 14 European Union (EU) countries (those which were member states during the years 1994 to 1997) for 1988 to 1997 (data for later years were not available for all countries), and for each expressed the number of 'additional' winter deaths as a percentage of the average number of deaths in a four-month 'non-winter' period (a statistic which is called the 'Increased Winter Mortality index' in Table 3 of National Records of Scotland's (NRS's) current release). The results were as follows (listing the countries in order of their index values):
10% - Finland
11% - Germany, Netherlands
12% - Denmark, Luxembourg
13% - Belgium, France
14% - Austria
16% - Italy, overall mean for the 14 countries
18% - Greece, UK
21% - Ireland (Republic), Spain
28% - Portugal
The paper also gave figures for the countries within the UK: England 19%; Wales 17%; Northern Ireland 17% and Scotland 16%. Therefore, in percentage terms, increased winter mortality in Scotland was the same as the overall figure for the 14 EU countries covered by the study.

The EC Public Health web page comments on these results as follows: 'the premature death toll is higher in countries with a warmer winter climate. Housing standards are a potential factor behind this paradox. Houses in countries with comparatively warm climates all year round tend to lose heat easily, so people find it hard to heat their homes when winter arrives. This is especially true in Portugal, Spain, and Ireland, where winter temperatures are comparatively mild and excess mortality rates in winter very high. Conversely, houses in countries with severe climates – such as Scandinavia – have to be thermally efficient to retain warmth'.

The study used a range of monthly data for each country, including climatic (temperature, humidity and precipitation), socioeconomic and macroeconomic indicators, lifestyle risk factors (smoking and obesity rates), measures of healthcare provision (e.g. GPs per 1,000 population) and the percentages of the housing stock with various types of thermal insulation. Regression analysis identified a number of associations with increased winter mortality. Healy (2003) noted that there were 'a number of limitations cross country analyses are often problematic as standardised datasets are difficult to obtain. A number of assumptions and approximations have to be made', but concluded that 'although this study has not proved causality, the strong, positive relationship with environmental temperature' (the warmer the climate, the greater the increase in winter mortality) 'and the equally strong association with thermal standards in housing' (the lower the percentage of the housing stock with insulation, the greater the increase in winter mortality) 'indicate that improving the thermal efficiency of housing in southern and western Europe could play a strong part in reducing the large seasonal variations in mortality found in these countries'.

Elsewhere, the EC Public Health web page states that 'Coronary events (anything from slight angina pectoris to a serious heart attack) increase during comparatively cold periods, especially in warm climates. In colder climates there is less increase, suggesting

that some events in warmer climates are preventable. People living in warm climates, particularly women, should keep warm on cold days'.

Previous General Register Office for Scotland (GROS) and, now, National records of Scotland (NRS) publications on this topic

In April 2002, GROS published an Occasional Paper entitled 'The Raised Incidence of Winter Deaths'(available on the NRS website). As well as reviewing the various definitions used to assess the extent of increased winter mortality, this paper showed that additional winter deaths were particularly associated with respiratory and circulatory diseases and that few deaths were caused by hypothermia. It also demonstrated that, though not all increased winter mortality is related to influenza, there was a clear link between the number of additional deaths and the level of influenza activity.

With effect from October 2006, GROS and, now, NRS has published annually its estimates of increased winter mortality (the first such publication referred to 'excess winter mortality', and the most recent publications refer to 'the seasonal increase in mortality in the winter'), in releases which are more up-to-date than the Occasional Paper, but without its detailed analysis.

References

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(NB: a more detailed version of this paper, including more information about some aspects of the data and analysis, and scatter diagrams of the seasonal variation in mortality against various factors, forms Chapter 9 of*:*
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