Increased Winter Mortality - Background

Introduction

This note provides background information on some of the causes of increased winter mortality and briefly describes the findings of some research studies of increased winter mortality. The main points to note are:

- the increased winter mortality index for Scotland is, at most, a little above the overall European level. One study found that, averaged over nine years, the winter mortality index for Scotland was 14.8% compared to an overall value of 13.9% for 31 European countries. Another study found that (averaged over an earlier nine year period) the index was 16% both for Scotland and overall for 14 European countries;
- 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 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 adequately for cold weather.

The seasonal increase in mortality in the winter in Scotland

The seasonal increase in mortality in the winter is defined as the difference between the number of deaths in the 4-month 'winter' period (December to March, inclusive) and the average number of deaths in the two 4-month periods which precede winter (August to November, inclusive) and follow winter (April to July, inclusive).

National Records of Scotland (NRS) publications show that the seasonal increase in winter in Scotland has fluctuated over the years. For example, it was 5,190 for winter 1999/2000, 1,420 for winter 2011/12, 4,810 for winter 2017/18, and averaged around 2,750 per winter over the 19 winters from 1999/2000 to 2017/18.

Some medical causes of increased winter mortality

Excess 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. The European Commission (European Commission [EC] 2010) has reported that half the additional deaths are due to cerebrovascular diseases and ischaemic heart disease, and the other half to respiratory disorders. The seasonal fluctuation seems to be most closely associated with low environmental temperatures, with some deaths attributable to influenza and other risk factors.

Lower outdoor temperatures are associated with increases in cardiovascular disease risk factors including hypertension, blood lipids and hyper-viscosity (Sartini 2017). Direct effects of cold, such as hypothermia, are not major causes of excess winter mortality. In addition, the EC noted that:

- many deaths from ischaemic heart disease take place in the 48 hours 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 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 are more frequent 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 EU countries with mild climates.

Underlying factors influencing increased winter mortality

The clear relationship between death rates and the outside temperature, with more deaths in colder months, was shown for Scotland using averages for the period 1989 to 2000 (General Register Office for Scotland [GROS] 2002). 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 for a given fall in temperature in regions with warmer 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 fall in temperature below 18°C was 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°C, the mean living-room temperature was 19.2°C in Athens and 21.7°C in south Finland. The percentages of people in those regions who wore hats when outdoors at 7°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 outdoors, and inactivity and shivering when outdoors at 7°C.

The association between mortality and low indoor temperature observed by the Eurowinter Group was also found by Wilkinson (2001) in a study on excess winter deaths in England. This used postcodes to link data on characteristics of over 21,000 houses (in 1991) with the records of around 180,000 deaths (between 1986 and 1996). The study concluded that winter-summer differences in mortality were related to indoor temperature, and to dwelling characteristics that affected it. Indoor temperatures appeared to influence the strength of association between low outdoor temperatures and cardiovascular death. People living in colder houses had a substantially larger seasonal swing in death rates and a greater percentage rise in mortality for each degree Celsius fall in outdoor temperature.

In a Scottish study, Gemmell et al (2000) concluded that the strength of the relationship between temperature and mortality was a result of the population being unable to protect themselves adequately from the effects of temperature rather than the effects of temperature itself.

Donaldson and Keatinge (2002) noted that epidemics of influenza were associated with increases in mortality and morbidity, but pointed out that cold weather alone caused striking short term increases in mortality, mainly from thrombotic and respiratory disease, adding that non-thermal seasonal factors such as diet might also affect mortality. They estimated that only 2.4% of excess winter mortality in south east England was attributable to influenza.

Wilkinson et al (2004) examined factors associated with winter mortality in elderly British people. Between 1995 and 1998, around 32,000 people aged 75 and over provided a range of information about their personal circumstances, medical conditions and home heating. The study concluded that there was little evidence that the ratio of winter to non-

winter mortality varied by geographical region, age or any of the personal, socioeconomic or clinical factors examined, other than being higher among women and those with a history of respiratory illness. The authors noted that, although disadvantaged socioeconomic groups had high absolute rates of cardiovascular disease, it was not obvious that they should also have a high relative increase in cardiovascular disease in winter. The homes of more disadvantaged socioeconomic groups in this study were not substantially cooler than those of less disadvantaged socioeconomic groups, perhaps because of when they were constructed or due to efforts by local authorities to ensure adequate heating in social housing stock.

A number of studies have reported that excess winter mortality is not associated with deprivation, including those by Shah (1999) and Lawlor et al (2000). In a New Zealand study, Davie et al (2007) found no evidence to suggest that patterns of excess winter mortality differed by ethnicity, region or local-area based deprivation level – but it was higher in females than males, a finding consistent with that of Wilkinson et al (2004).

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".

Comparisons with other European countries

Healy (2003) used data for 14 EU countries (the members during the years 1994 to 1997) for winter 1988/89 to winter 1996/97, and expressed the number of additional winter deaths as a percentage of the average number of deaths in a four-month non-winter period (the ‘Increased Winter Mortality index’). 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
18% - Greece, UK
21% - Ireland, Spain
28% - Portugal

The figures for UK countries were: England 19%; Wales 17%; Northern Ireland 17% and Scotland 16%. Increased winter mortality in Scotland was therefore below the level of the UK as a whole (18%), and the same as the overall average for the 14 EU countries covered by the study (16%).

The study found a strong, positive relationship between environmental temperature and winter mortality (the warmer the climate, the greater the increase in winter mortality) and an 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).

More recently, Fowler et al (2015) calculated a 9-year average of the ‘Excess Winter Death Index’ (EWDI - another name for the Increased Winter Mortality index) for each of 31 European countries using data for winter 2002/03 to winter 2010/11, inclusive. Grouped

on the basis of United Nations sub-regions, they are listed in order of their 9-year average EWDI values, which were:

Northern	Western	Eastern	Southern
• 8.5% - Iceland • 9.2% - Finland • 10.6% - Lithuania • 11.5% - Latvia • 11.9% - Estonia • 12.0% - Denmark • 12.2% - Norway • 12.9% - Sweden • 13.9% - Ireland • 15.9% - UK	• 11.9% - Germany • 12.3% - Netherlands • 12.8% - Lichtenstein • 13.0% - Luxembourg • 13.2% – Austria • 13.5% - France • 14.4% - Switzerland • 15.7% - Belgium	• 7.8% - Slovakia • 10.2% - Czech Republic • 10.2% - Poland • 11.3% - Hungary • 15.7% - Romania • 17.0% - Bulgaria	• 9.8% - Greece • 11.3% - Slovenia • 15.2% - Italy • 18.6% - Spain • 19.4% - Cyprus • 25.9% - Portugal • 28.3% - Malta

The average of the EWDI values for Scotland for the same 9-year period (winter 2002/03 to winter 2010/11) was 14.8%: slightly below that for the UK as a whole (15.9%); but slightly higher than the overall average for the 31 European countries in the study (13.9%).

Again, a study found higher levels of excess winter death in the more temperate southern European countries than in the cooler northern ones. The researchers also noted substantial variation in countries of similar climate (for example between Mediterranean countries), suggesting many winter deaths could be amenable to public health action. They mentioned that their analysis did not take into account countries' differing age profiles, that EWDI is not an age-standardised index and that the increased vulnerability of older people over winter conditions might contribute to higher mortality in countries (like the UK and Belgium) which have higher proportions of older people.

Implications for public health

These findings have some important implications for public health. The Eurowinter Group (1997) concluded 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 recommended that middle-aged and elderly people should wear protective clothing and keep active in cold weather outdoors.

In line with the findings of Wilkinson (2001), the EC (2010) has identified housing standards as an additional important factor, noting that thermally efficient housing is associated with lower excess winter mortality rates. In the UK, the National Institute for Health and Care Excellence (NICE 2015) has produced guidance on reducing the health risks associated with living in cold homes. These include ensuring that buildings meet required standards. Measures to address fuel poverty are also important (Public Health England 2014). Fowler et al (2015) suggested tackling cold housing and increasing influenza immunization uptake in vulnerable groups to reduce excess winter deaths.

Previous NRS (and GROS) publications on this topic

In April 2002, GROS published an Occasional Paper entitled 'The Raised Incidence of Winter Deaths'. 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.

From October 2006, NRS (and, before it, GROS) has published annual estimates of winter mortality (first titled 'excess winter mortality' and then 'increased winter mortality').

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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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