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DEATHS IN WINTER: CAN BRITAIN LEARN FROM EUROPE?

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There is a substantial increase in the number of deaths in winter in the United Kingdom. This is also seen in some, but not all, European countries. Almost 60% of the the variation among countries can be explained by the minimum average monthly temperature and the gross national product per capita. Seasonal variation is lowest in those countries with cold winters, suggesting that insulation may be important. It is also low in the more wealthy countries. The implications for health service policy of these finding are discussed.
Some of the residual variation may be explained by known factors, such as low cost geo-thermal energy in Iceland, but much remains unexplained. There is a need for more research in this field.

INTRODUCTION

Seasonal variation in mortality has been described in many countries throughout the ages. In ancient Greece, Hippocrates (17) described the occurrence of sudden deaths and strokes when a cold spring followed a mild winter.

Per Wargentin, a Swedish astronomer who studied parish records in Sweden and Finland in the 18th century (32) showed that mortality was highest in spring. Nayha has recently reviewed this data and suggested that this was due to the seasonal reduction in available food, and the consequent increase in deaths from pneumonia and tuberculosis (25). Farr (10) in some of the earliest studies of English mortality data noted an increase in deaths after a spell of cold weather, especially among the old. The excess winter mortality among the elderly and from respiratory disease was also noted in 1881 by Guy (14).

Rogers (28) in 1925, described a relationship between wide diurnal variations in temperature with low minimum values and the incidence of pneumonia in India. Several studies of mortality in the United Kingdom during the twentieth century have shown an association between cold and deaths, but these have been complicated by the possible role of air pollution (22).

Many countries experience an increase in deaths during winter. The magnitude of the increase varies widely and it is greater in the British Isles than in some other European countries (13). Published data for England and Wales indicates that excess winter mortality is greatest among the elderly (9).

The extent to wich deaths in winter varies widely among countries. This suggests that high levels observed in the British Isles may be avoidable. Discussion has centred around the importance of indoor temperatures as a factor associated with the additional deaths.

This study examines routinely published data from a number of European countries in order to identify any factors that may be associated with the variation. It also considers ways in which health promotion might reduce the impact of cold on the elderly in the United Kingdom.

METHODS

A study of routinely published data was undertaken to examine some of the factors which may be associated with the international variation in excess winter mortality.

Data relating to Western and Central European

countries was examined. These countries form a compact geographical area but they are subject to a wide range of climatic and economic factors. Data on monthly mortality for the period 1976-1984 was extracted from the 1986 United Nations Demographic Year Book. Data was unavailable for certain years in some countries. These are indicated in Table 1. Excess winter mortality was defined as the percentage by which observed deaths exceeded those which would be expected if the death rate during June to September pertained throughout the year. Climatic data was extracted from a publication of the United Kingodom Meteorological Office (23) which includes average monthly temperature and rainfall from almost all meteorological stations in the world over a period of approximately 30 years. In each case the data for the capital city averaged over this period was taken as representative of the entire country. The wealth of each country was taken as the 1982 Gross National Product (GNP) per capita expressed in United States dollars (33).

The association of excess winter mortality with national wealth, annual temperature range, minumum average monthly temperature and national wealth was examined using stepwise multiple linear regression.

TABLE 1. -

Country	Excess winter deaths (%)	Minimum monthly temperature (°C)	GNP per capita (US$)	Years for which mortality data available
Austria	7.8	-1.4	9880	1976-84
Belgium	13.9	3.2	10760	1976-84
Denmark	6.2	-0.1	12470	1976-84
Finland	3.8	-6	10870	1976-84
France	6.8	-3.5	11680	1976-82
Hungary	8.6	-1.1	2270	1976-84
Iceland	-0.2	-0.4	12727	1976-84
Ireland	14.6	5.5	5150	1976-83
Italy	11.6	7.7	6840	1976-80
Netherlands	5.4	2.8	10930	1976-84
Norway	3.9	-4.7	14280	1976-84
Portugal	13.7	10.8	2450	1976-83
Spain	12.3	4.9	5430	1976-79
Sweden	5.4	-3.1	14040	1976-84
Switzerland	7.5	-1.2	17010	1976-82
United Kingdom	13.1	4.3	9660	1976-84
West Germany	5.4	2.4	12460	1976-84
Yugoslavia	12.4	-0.2	2800	1976-84

Sources: see text

RESULTS

Excess winter mortality was highest in the Republic of Ireland, Belgium, Portugal and the United Kingdom. The Scandinavian countries, Switzerland, West Germany and Netherlands exhibited the lowest excess winter mortalities, and there was virtually no seasonal trend in Iceland.

The range of average monthly temperatures varied considerably, with less annual variation in Atlantic countries such as the British Isles than in those countries in central Europe.

There was a negative correlation between GNP per capita and minimum average monthly temperature (Table 2), reflecting the greater affluence of Northern Europe.

Table 2. - Correlation matrix of variables

	MIN	RANGE	GNP	RAIN
XS	.677	-.267	-.653	-.052
MIN		-.696	-.511	-.024
RANGE			.031	-.267
GNP				.317

XS = percentage excess winter mortality (see text)
MIN = minimun average monthly temperature
RANGE = annual temperature range (average monthly temperatures)
GNP = gross national product per capita (US$, 1982)

Minimum average monthly temperature was negatively associated with excess winter mortality and explained 46% of its variation (r=0.677). There was a positive relationship with GNP per capita, inclusion of which increased the explanatory power of the equation to 58% (r=0.766). There was no significant association with annual temperature range and rainfall. Examination of the standardised residuals indicates that the excess winter mortality in Iceland was 2.2 standard deviations (SD) less than predicted. All other countries were within 2 SDs of expected values. The United Kingdom and Ireland experienced observed values wich were 1.2 and 0.8 SDs respectively above predicted values. There was a large difference between Belgium and the Netherlands which were, respectively, 1.8 SDs above and 1.1 SDs below predicted values.

Because of the large difference between the observed and predicted value for Iceland, the analysis was repeated using the data from the remaining countries only. In this case minimum average monthly temperature explained 53% of the variation (r=0.725) and inclusion of GNP per capita increased the explanatory power to 64% (r=0.803).

DISCUSSION

The observation that there is a large variation in excess winter mortality among countries suggests that it may be possible to reduce it in those countries where it is high.

In this brief study an association has been demonstrated between minimum average monthly temperature, GNP per capita and excess winter mortality. The use of aggregated data and the assumption that climatic conditions in capital cities reflect those in the country as a whole will tend to reduce the strength of the observed association. McFarlane has demontrated how the association between temperature and mortality increases when daily data in small geographical areas is used (22).

Empirical observation suggests that houses in countries experiencing extremely low temperatures in winter have better insulation than those in countries with mild winters. This may result in higher indoor temperatures in the former countries. There is very little comparative international data on indoor temperatures, but indirect evidence in support of this hypothesis is the large variation in heat retaining capacity of houses built to the current standards of European countries. Energy requirements are about 75% higher in the United Kingdom than in Scandinavia to achieve the same level of heating for houses of comparable overall design (5).

Comparative data on the distribution of wealth to the elderly is also difficult to obtain. Crude data on income distribution was available for all of the countries except Austria and Iceland for certain years around 1980 (33). The percentage share of household income going to the poorest 20% of the population varied between 5.2% and 8.3%. Although the percentage share in Portugal, which has a higher than expected winter death rate, was low, the percentage share in the United Kingdom, Ireland and Belgium was above average. There is a general trend of increased income for the poor, many of whom will be elderly, with increasing GNP per capita. This may permit them to spend a greater amoung on fuel.

These results could be interpreted as suggesting that maintenance of high indoor temperatures through increased income for the elderly and improved housing would result in a decrease in seasonal mortality.

Uncertainty has been expressed about the effect that can be expected from maintenance of high indoor temperatures. If warm indoor invironments do not prevent increases in deaths during winter it will be necessary to examine other approaches. This hypothesis is suggested by a study which showed that the seasonal trend in deaths persisted among those living in residential accomodation with unlimited heating (20). However night time indoor temperatures were not measured and the residents admitted to turning their heating off at night and sleeping with the windows open, possibly exposing themselves to low nocturnal air temperatures. Further work comes from Alderson who showed no difference between the proportion of people living in centrally heated houses and the excess winter mortality in eight English regions and Wales (2). Seasonal variation was highest in the East Midlands and the North West, and lowest in Wales and the South West. In the same paper he compared the seasonal variation in deaths from various causes among people dying in long-stay institutions - who would presumably have been in a controlled environment prior to their death - wiht allo other deaths, many of which would represent people who had been at home in the weeks prior to death. No difference was found in the seasonal variation between the two groups. These studies are subject to the same problem of not directly measuring the indoor temperature.

An alternative view is that the cold conditions in which many elderly people live are of major importance (8). There is evidence from other countries that improvements in housing and domestic heating over time can reduce the excess deaths in winter (29). Nayha has argued that the substantial fall in seasonality of mortality in Finland during the last 50 years has corresponded with improved housing conditions (25). There is a contrast between Chile, a country without widespread central heating, and more developed countries where insulation and central heating are common such as Canada (3) or Finland (25). In Chile there is a clear increase in seasonality of mortality wiht increasing latitude (15) which is not seen in Canada or Finland, where the seasonal effect is less in the north than in the south although the outside temperatures in winter are considerably lower in the north of each region.

The hypothesis that indoor temperature are an important factor in winter deaths is also supported by the absence of seasonal variation in Iceland where the average temperature in winter is below freezing point but there is widespread availability of low cost geothermal energy.

Clearly there are other factors involved in the production of excess winter mortality. Further studies in this area required, and it may be useful to investigate some of the unexpected findings, such as the considerable difference in seasonal mortality between Belgium and the Netherlands.

This paper suggests that poor insulation and low income contribute to cold indoor environments for the elderly in the United Kingdom. It is important to confirm that the elderly are exposed to cold. The World Health Organization (34) recommend a minimum indoor temperature of 18°C, and advise that it should be 2-3° C higher in rooms occupied by sedentary elderly people. A number of studies in the United Kingdom have demonstrated that this is rarely achieved by many elderly people, and although some manage to keep their living room warm, many have unheated halls, bathrooms and bedrooms (19). One large study carried out in 1972 showed that 75% of

elderly people were exposed to an indoor temperature of under 18.3° C in the morning, and in 10% the temperature was below 12° C (12). The elderly are more likely than other groups to live in homes without central heating (8). They may also be reluctant to turn on central heating because of worries about payment of bills. Other factors may also be important. There is a decrease in thermoregulatory function and appreciation of cold with increasing age (7). This may be impaired further by injudicious use of drugs such as phenothiazines. Heating of only one room may lead to considerable fluctuations in temperature as the person moves about the house and this may be more dangerous than maintaining a lower level of overall heating because of the effect of perceived warmth on central thermoregulation (21).

The findings in this paper are not surprising, and have been implicitly recognised despite the arguments referred to previously. Health promotion in the United Kingdom has emphasised the importance of maintaining an adequate indoor temperature and has focused on three principal areas; efficient energy use, insulation, and difficulties with payments (1). In the winter of 1987/88 a campaign entitled "Keep warm, keep well" was launched by the Department of Health and Social Security. This is based upon leaflets, press articles, advertisements and broadcasts.

Previous British government policies have concentrated upon providing financial assistance with heating bills and making available grants for insulation. Insulation grants could be expected to yeld considerable benefits (24), and local programmes to increase uptake of government grants by the elderly have been undertaken in some parts of the country (11). Uptake increased approximately ten fold between 1980 and 1983 (18). Neighbourhood action schemes can undertake insulation projects with the help of government sponsored job schemes (30).

The record in the United Kingdom has not been one of success. There is evidence that many campaigns do not reach those in greatest need (27). These activities are the responsibility of different government departments and there is little monitoring of effectiveness. There is a strong case for co-ordinated action between the departments.

Britain does has room to improve its record on winter deaths, but the lessons to be learnt from Europe can only be suggested from this brief study. There is a need to examine comparative international data on the real level of income of the elderly, allowing for differences in fuel costs, and data on the quality and insulation levels of the existing housing stock. In the absence of co-ordinated action to improve the quality of the housing stock and to increase the income of the elderly it is necessary to examine other ways, within current financial constraints, which can reduce the number of excess deaths. There are a number of measures which can be taken to alleviate the effects of cold. Otty (26) showed that a doctor who visited elderly at risk and provided them with advice on heating was able to produce an improvement in their environment. One particular response was a reduction of 80% in those who slept with their windows open. This was during a period when the outside temperature during the day was 3°. She has suggested that this is a task which could appropriately be performed by a health visitor (nurse specialising in prevention in the community).

The ability of health visitors to perform this role remains uncertain. In many areas the current numbers of health visitors have difficulty in providing comprehensive services for children. Although several studies have shown that health visitor surveillance of the elderly is effective (16, 31), it has been calculated that if implemented nationally it would require between 3,000 and 6,000 more health visitors in addition to the 9,000 currently in post (4). It is therefore unlikely that health visitors will be able to make a significant contribution in the short term, but there is pressure to increase their numbers in the long term to meet this need (6). They may have a role in those areas where there is some spare capacity.

Health education departments, in association wiht pressure groups for the elderly can act as a stimulus and a resource centre to those who come into regular contact with the elderly. They can also use the opportunities provided by day centres and lunch clubs to provide advice. The increasing numbers of primary care facilitators can enable action by general practitioners.

Lloyd has suggested that cold impairs postural control in old age (21). As this will increase the probability of a fall due to uneven flooring this aspect of prevention should also be included in any programme of health promotion.

In conclusion, high levels of excess winter mortality are not inevitable. Levels tend to be lowest in those countries with very cold winters and a high GNP per capita. This is consistent with the suggestion that indoor temperatures, maintained by insulation and affordable fuel, are important. Further studies of international data are required, but the observations that many of the elderly in the United Kingdom are exposed to low temperatures indoors indicate that this is an important area for health promotion. This study has also demonstrated high levels of winter mortality in several other European countries. This is an area which requires much more attention than it has previously had.

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