Papers

Vulnerability to winter mortality in elderly people in Britain: population based study

Paul Wilkinson, Sam Pattenden, Ben Armstrong, Astrid Fletcher, R Sari Kovats, Punam Mangtani, Anthony J McMichael

Abstract

Objective To examine the determinants of vulnerability to winter mortality in elderly British people.
Design Population based cohort study (119 389 person years of follow up).
Setting 106 general practices from the Medical Research Council trial of assessment and management of older people in Britain.
Participants People aged ≥75 years.
Main outcome measures Mortality (10 123 deaths) determined by follow up through the Office for National Statistics.
Results Month to month variation accounted for 17% of annual all cause mortality, but only 7.8% after adjustment for temperature. The overall winter:non-winter rate ratio was 1.31 (95% confidence interval 1.26 to 1.36). There was little evidence that this 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 winter:non-winter ratio in women compared with men was 1.11 (1.00 to 1.23), and those with a self reported history of respiratory illness had a winter:non-winter ratio of 1.20 (1.08 to 1.34) 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.
Conclusion Except for female sex and pre-existing respiratory illness, there was little evidence for vulnerability to winter death associated with factors thought to lead to vulnerability. The lack of socioeconomic gradient suggests that policies aimed at relief of fuel poverty may need to be supplemented by additional measures to tackle the burden of excess winter deaths in elderly people.

Introduction

In the United Kingdom mortality greatly increases in winter.[1] This is apparent at all ages but is greatest in relative and absolute terms in elderly people.[2 3] Much of the excess seems to be related to cold,[4 5] yet Britain has a larger seasonal fluctuation in mortality than many other countries of continental Europe and Scandinavia despite having milder winters.[6] Behavioural factors may partly explain this,[7] but poor housing may also be important.[2] To date, there have been few opportunities to examine the personal factors that predispose to increased mortality in winter.

We studied mortality in people aged ≥75 years, focusing on individual determinants of vulnerability, including socioeconomic factors, sex, home heating, and previous health.

Methods

The study was based on the Medical Research Council trial of the assessment and management of older people in the community,[8] which involved 106 practices selected from the MRC general practice research framework as representative of the British population. All patients aged ≥75 years on practice lists were invited to participate unless they were in a long stay hospital or nursing home or were terminally ill. Participants, recruited in 1995-8, underwent a brief multidimensional assessment.

The brief assessment included questions on physical symptoms, number of medications, feelings of depression, activities of daily living, perceived health, and physical activity. Patients were asked about their current alcohol intake, smoking, sociodemographic factors (including marital status, living circumstances, financial difficulties), and home heating ("In the last year have you had difficulty keeping your home warm?"). To provide socioeconomic data for the full sample, we used the home postcode to assign a Carstairs deprivation score to each individual.[9]

We followed up mortality (to 30 March 2001) through the Office for National Statistics. We obtained figures for daily minimum, maximum, and mean temperature from one meteorological station per region from the British Atmospheric Data Centre.

Statistical methods

We used Poisson time series models to assess overall effects of season (month of years as categorical variable), temperature, and influenza (see also bmj.com). To analyse excess mortality in the winter

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season, we defined winter as December to March. For the main results, the Poisson models included age (four groups), sex, and region and interactions of these with winter. Thus, we tabulated the winter:non-winter ratio for each level (group) of each explanatory variable, and then the ratio of these winter:non-winter ratios relative to that of the baseline group. The latter can be thought of as "relative risks" of excess winter death.

Results

Month to month variation in mortality (adjusted for region and time trend) accounted for 17% of annual all cause mortality, but only 7.8% after adjustment for the effects of low temperatures in the daily time series model (figure). It accounted for 12.6% when we adjusted for influenza A counts without adjustment for low temperature, and 5.2% when we adjusted for both. Thus, most of the seasonal fluctuation seems to be related to cold, with smaller components attributable to influenza A and other risk factors.

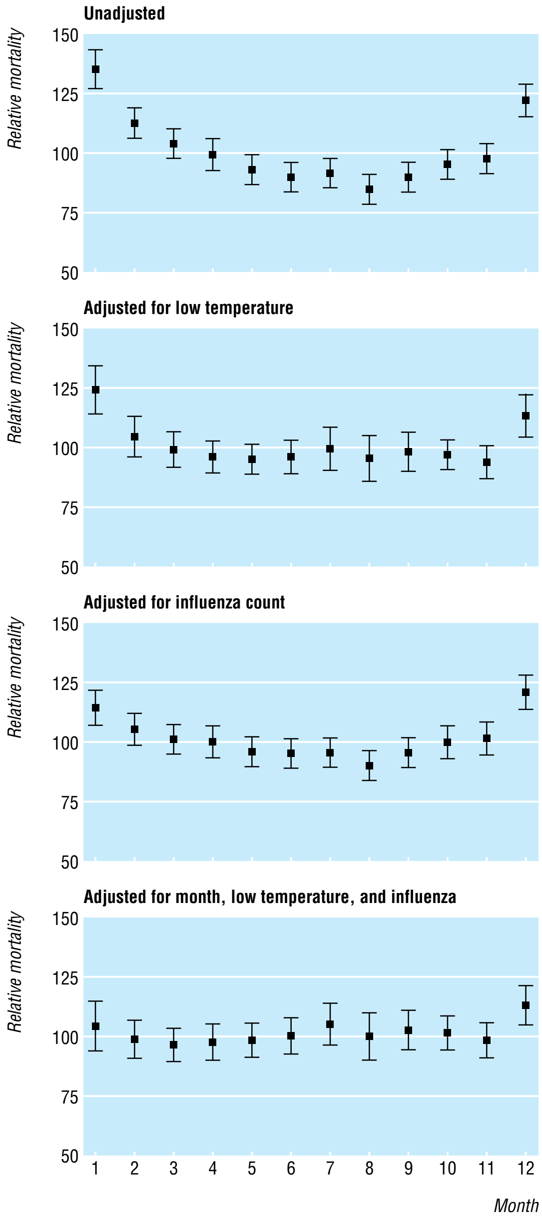
Overall, there were 4221 deaths in 42 162 person years of follow up in winter months (100.1 deaths per 1000 person years, 95% confidence interval 97.1 to 103.1) and 5902 in 77 227 person years of follow up in other months (76.4 deaths per 1000 person years, 74.5 to 78.4).

The table shows the rates of death, ratio of rates, and relative changes in ratios according to potential modifying factors. The overall winter:non-winter rate ratio was 1.31 (1.26 to 1.36), which is slightly higher than that found in this age group in the country as a whole.[2] There was little evidence that this ratio varied by geographical region (see bmj.com) or age. Women, however, had a larger winter:non-winter ratio than men for reasons other than their greater age, previous health status, social isolation, or socioeconomic position. The rate ratio for all cause excess winter death in women compared with men was (1.11, 1.00 to 1.23).

There was little evidence of a trend of increasing risk of excess winter death with socioeconomic group, housing tenure, or reported difficulty in making ends meet or in keeping the house warm. Nor was there clear evidence that the combination of low socioeconomic group and reported difficulty in keeping the house warm (a combination expected to identify people least able to heat their home properly) was associated with excess risk (see bmj.com). Those who lived alone seemed no more vulnerable than others.

Of the various markers of illness and activity status (table), only a history of respiratory illness was associated with winter death; the relative risk adjusted for age, sex, and region being 1.20 (1.08 to 1.34). There was no evidence that excess winter death was associated with current smoking, total pack years of cigarettes smoked (not shown), or alcohol consumption.

For most variables, the confidence intervals provide evidence against a substantial increase in risk (most exclude increases above 10%). Pre-existing respiratory disease (asthma, emphysema, or pneumonia diagnosed by a doctor, or a positive response to questions on chronic cough or phlegm) was the single strongest predictor of excess winter death (see bmj.com).



Fraction of deaths attributable to monthly variation, adjusted for region, time trend, and stated covariates

Discussion

The results confirm a substantial (around 30%) increase in mortality in winter in people of ≥75 years, but, remarkably, they point to few of the analysed factors being markers of vulnerability except pre-existing respiratory disease and female sex. The higher risk in women is not fully explained but does not seem to be due to clinical or socioeconomic differences.

The role of socioeconomic status

Some of the factors that were unrelated to excess winter death merit comment, especially as many of them were associated with overall mortality, so poor validity is unlikely to explain the lack of association. Perhaps most surprising is socioeconomic status, which showed no gradient in risk, despite the fact that the Carstairs score was a predictor of death rates overall (table), as

Rates of death in winter and non-winter months, ratio of rates, and relative change in winter:non-winter ratios with levels of potential modifying factors

Variable (potential modifiers of winter:non-winter ratio)	Rate per 1000 person years (No of deaths)		Winter:non-winter ratio (95% CI) Unadjusted	Winter:non-winter ratio relative to ratio of baseline group (95% CI)*
	Winter	Non-winter months		
Sociodemographic factors and personal behaviours				
Age (years):				
75-79	62.1 (1318)	48.5 (1874)	1.28 (1.19 to 1.38)	1.00
80-84	102.5 (1343)	80.2 (1928)	1.28 (1.20 to 1.36)	0.99 (0.91 to 1.09)
85-89	175.0 (1050)	124.8 (1390)	1.40 (1.29 to 1.52)	1.09 (0.98 to 1.21)
≥90	279.1 (510)	207.3 (710)	1.35 (1.20 to 1.51)	1.03 (0.92 to 1.16)
Sex:				
Male	115.3 (1745)	92.7 (2578)	1.24 (1.17 to 1.32)	1.00
Female	91.6 (2476)	67.3 (3324)	1.36 (1.29 to 1.44)	1.09 (1.01 to 1.17)
Fifths of Carstairs deprivation group:				
1 (least deprived)	92.9 (881)	66.5 (1151)	1.40 (1.26 to 1.55)	1.00
2	97.1 (1014)	77.5 (1483)	1.25 (1.15 to 1.36)	0.90 (0.78 to 1.02)
3	96.4 (743)	76.1 (1076)	1.27 (1.15 to 1.40)	0.90 (0.78 to 1.05)
4	99.1 (552)	81.1 (826)	1.22 (1.08 to 1.39)	0.86 (0.72 to 1.04)
5 (most deprived)	121.4 (464)	83.7 (591)	1.45 (1.31 to 1.61)	1.02 (0.87 to 1.19)
Current smoker:				
No	97.4 (3711)	73.7 (5144)	1.32 (1.26 to 1.38)	1.00
Yes	127.1 (476)	101.7 (702)	1.25 (1.11 to 1.41)	0.96 (0.85 to 1.07)
Alcoholic drinks (units)/week:				
0	113.5 (2205)	85.8 (3059)	1.32 (1.23 to 1.42)	1.00
1-6	84.6 (1098)	65.9 (1564)	1.28 (1.18 to 1.39)	0.99 (0.89 to 1.11)
≥7	90.9 (716)	68.7 (991)	1.32 (1.19 to 1.48)	1.04 (0.91 to 1.19)
Markers of illness and activity status				
Shortness of breath†:				
No	90.6 (3255)	70.2 (4616)	1.29 (1.22 to 1.36)	1.00
Yes	166.5 (728)	122.9 (996)	1.35 (1.22 to 1.51)	1.04 (0.92 to 1.17)
Swelling of legs:				
No	94.9 (3567)	72.2 (4968)	1.31 (1.25 to 1.39)	1.00
Yes	155.3 (478)	119.8 (679)	1.30 (1.15 to 1.46)	0.96 (0.84 to 1.10)
Sad, depressed, or miserable:				
No	96.1 (3661)	73.4 (5118)	1.31 (1.25 to 1.37)	1.00
Yes	135.3 (465)	104.0 (658)	1.30 (1.17 to 1.45)	0.98 (0.88 to 1.10)
Not very or not at all active:				
No	76.4 (2601)	57.6 (3577)	1.33 (1.25 to 1.40)	1.00
Yes	201.6 (1581)	155.8 (2275)	1.29 (1.21 to 1.39)	0.95 (0.87 to 1.04)
Takes >5 medicines:				
No	88.3 (3085)	67.1 (4287)	1.32 (1.24 to 1.39)	1.00
Yes	160.7 (960)	122.5 (1349)	1.31 (1.21 to 1.42)	0.99 (0.90 to 1.09)
Home circumstances				
Lives alone:				
No	100.5 (2257)	76.2 (3135)	1.32 (1.25 to 1.39)	1.00
Yes	97.2 (1871)	74.8 (2636)	1.30 (1.22 to 1.38)	0.94 (0.88 to 1.02)
Difficulty making ends meet:				
No	99.3 (3541)	75.2 (4910)	1.32 (1.26 to 1.39)	1.00
Yes	96.0 (547)	75.2 (786)	1.28 (1.16 to 1.40)	0.96 (0.88 to 1.06)
Difficulty keeping house warm:				
No	99.2 (3507)	75.7 (4891)	1.31 (1.25 to 1.38)	1.00
Sometimes	96.9 (487)	75.0 (696)	1.29 (1.14 to 1.46)	0.98 (0.87 to 1.11)
Often	109.8 (135)	73.0 (166)	1.50 (1.19 to 1.89)	1.14 (0.89 to 1.46)
Markers of illness				
Frail‡:				
No	51.5 (516)	41.4 (752)	1.24 (1.13 to 1.37)	1.00
Yes	133.0 (1211)	103.2 (1719)	1.29 (1.18 to 1.41)	1.03 (0.89 to 1.19)
Respiratory illness§:				
No	75.0 (691)	66.4 (1114)	1.13 (1.03 to 1.24)	1.00
Yes	119.6 (1374)	88.8 (1861)	1.35 (1.24 to 1.46)	1.20 (1.08 to 1.34)
Cardiovascular illness¶:				
No	87.7 (1403)	68.6 (1995)	1.28 (1.17 to 1.40)	1.00
Yes	140.7 (663)	113.3 (980)	1.24 (1.10 to 1.40)	0.97 (0.84 to 1.13)

* Adjusted for age, sex, region. Ratios are “relative risks” of excess winter death compared with baseline group. Specifically, they are exponentiated coefficients of interaction terms of listed variable with “winter” indicator (with age, sex, and region and their interactions with “winter” also in model).
†When sitting or talking.
‡Poor perceived health, not very/at all active, in lowest fifth of body mass index, or unable to do ≥2 activities of daily living.
§Asthma, emphysema, or pneumonia diagnosed by doctor, or positive response to questions on chronic cough or phlegm.
¶Heart attack or stroke diagnosed by doctor, or positive result on Rose angina questionnaire.

would be expected from other published studies.[10] Scrutiny of the literature, however, shows that the lack of socioeconomic gradient with winter death has been a consistent finding of UK studies.[2 11 12–14] If there is a gradient in risk, it is small.

This is a conclusion that policy makers may find unexpected and at odds with current notions of vulnerability from fuel poverty. The explanation may be complex. Firstly, although lower socioeconomic groups have high mortality in absolute terms, it is not obvious that they should also have a high relative increase in deaths during winter months unless they are more exposed to the principal causes of it—specifically low ambient temperature. But we have previously shown that people in lower socioeconomic groups do not on average have cooler homes than people in higher socioeconomic groups.[2] This may reflect behavioural influences, but also the fact that housing association and local authority dwellings are often as well, or better, heated than owner occupied dwellings,[2] reflecting the relatively recent construction of much social housing and efforts by local authorities to improve home energy efficiency. Poverty is associated with poorer home heating when heating costs are high, so the lack of increased risk among those reporting difficulty in making ends meet and difficulty in keeping the home warm is surprising, although the results are compatible with an appreciable increase in risk in relation to the latter variable. It could be argued that reported difficulty in keeping the home warm is not a good indicator of low indoor temperatures (though in fact we have found it predictive in a previous study),[2] and that reported difficulty in making ends meet might not be sensitive for poverty. However, Keatinge and colleagues place more emphasis on personal behaviours and have argued that much excess winter mortality is related to exposure to cold from "brief excursions outdoors rather than to low indoor temperatures."[7 15] The observed lack of socioeconomic gradient suggests that the risk of excess winter death is quite widely distributed in elderly people, which therefore may limit the potential health impacts of initiatives that are targeted only at low income households. Of course, the situation may be different in other age groups, but it is relevant to recall the relative flatness of excess winter mortality with socioeconomic status in other UK studies not specific to this age group.

The role of pre-existing illness

The fact that frailty and pre-existing cardiovascular illness were unrelated to excess winter death was also surprising as most winter deaths are from cardiorespiratory causes. Paradoxically, respiratory disease seemed to be a strong determinant of cardiovascular but not respiratory death. The specificity of association may have been obscured by misclassification of cause of death, but analyses (not shown) of deaths with any mention of respiratory causes also did not show an association with pre-existing respiratory illness.

Conclusion

The lack of socioeconomic gradient in particular has implications for public heath policies aimed at reducing the burden of winter death, as fuel poverty relief alone may be only partially successful. The fact that the risk of excess winter death seems to be widely distributed in elderly people suggests that additional measures are needed to reach all those at risk.

What is already known on this topic

Britain has a large burden of excess winter deaths, much of which is attributable to the effects of cold

Around 1.4 to 2 million households in England are in fuel poverty—that is, they would have to spend more than 10% of their income to heat the home to an adequate temperature

What this study adds

Socioeconomic factors are not strongly associated with winter death in elderly people

Female sex and a history of respiratory illness may confer vulnerability

The risk of winter death seems to be widely distributed in elderly people rather than being heavily concentrated in the most disadvantaged groups

Public heath policies to reduce the burden of winter death in Britain will need to be broad based and to consider measures additional to those aimed at tackling fuel poverty

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Effectiveness of adenotonsillectomy in children with mild symptoms of throat infections or adenotonsillar hypertrophy: open, randomised controlled trial

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Abstract

Objective To assess the effectiveness of adenotonsillectomy in children with mild symptoms of throat infections or adenotonsillar hypertrophy.
Design Open, randomised controlled trial.
Setting 21 general hospitals and three academic centres in the Netherlands.
Participants 300 children aged 2-8 years requiring adenotonsillectomy.
Intervention Adenotonsillectomy compared with watchful waiting.
Main outcome measures Episodes of fever, throat infections, upper respiratory tract infections, and health related quality of life.
Results During the median follow up period of 22 months, children in the adenotonsillectomy group had 2.97 episodes of fever per person year compared with 3.18 in the watchful waiting group (difference −0.21, 95% confidence interval −0.54 to 0.12), 0.56 throat infections per person year compared with 0.77 (−0.21, −0.36 to −0.06), and 5.47 upper respiratory tract infections per person year compared with 6.00 (−0.53, −0.97 to −0.08). No clinically relevant differences were found for health related quality of life. Adenotonsillectomy was more effective in children with a history of three to six throat infections than in those with none to two. 12 children had surgery related complications.
Conclusion Adenotonsillectomy in children with mild symptoms of throat infections or adenotonsillar hypertrophy has no major clinical benefits over watchful waiting.

Introduction

Tonsillectomy, with or without adenoidectomy, is a common procedure in children in Western countries, yet the indications for surgery remain uncertain. Although frequent throat infections and obstructive sleep apnoea are considered adequate indications for adenotonsillectomy in children,[1–6] evidence for the benefits of surgery in children with milder symptoms is lacking.[7–11] We carried out a randomised controlled trial to assess the effectiveness of adenotonsillectomy in children with mild symptoms of throat infections or adenotonsillar hypertrophy.

Participants and methods

Our open, multicentre, randomised controlled trial was carried out between March 2000 and February 2003 with the help of otorhinolaryngologists from 21 general hospitals and three academic centres in the Netherlands. They completed a questionnaire on all their patients aged 2 to 8 years with indications for adenotonsillectomy according to current medical practice. They were asked to give the indication they considered most important for surgery.

We excluded children with a history of seven or more throat infections in the preceding year, with five or more in each of the previous two years, or with three or more in each of the previous three years,[1] and children with suspected obstructive sleep apnoea (Brouillette's obstructive sleep apnoea score >3.5).[12] Other exclusion criteria were Down's syndrome, craniofacial malformations, and immunodeficiency, other than that of IgA or IgG_2.

Randomisation

Children were randomly assigned to either adenotonsillectomy or watchful waiting according to a computer generated list. At entry to the study, a disease specific questionnaire was completed for information on the number of throat infections and upper respiratory tract infections experienced by the children in the previous year; obstructive symptoms during sleep[12]; eating patterns; ear, nose, and throat operations; and risk factors for upper respiratory tract infections.

The parents completed two generic health related quality of life instruments: the TNO-AZL preschool children quality of life questionnaire and the child health questionnaire parental form.[13 14] The children

The participating hospitals and members of the executive steering committee are on bmj.com

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