Changes in seasonal mortalities with improvement in home heating in England and Wales from 1964 to 1984

W.R. Keatinge, S.R.K. Coleshaw, and J. Holmes
Department of Physiology, The London Hospital Medical College, Turner Street, London E1 2AD, UK

Abstract. Changes in summer (July–September) and winter (January–March) mortalities of people aged 70–74 in England and Wales from 1964 to 1984 were compared with possible causal factors. Summer mortalities were little affected by annual temperature or influenza epidemics and fell from 1972–1975 for all causes, coronary and respiratory causes, while cerebrovascular mortality fell more rapidly from that time. Cigarette consumption also fell from 1972–1975; falling consumptions of total fat from 1970 and saturated fat from 1972–1975 probably also contributed to the fall in arterial deaths, and likewise falls in prescription rates for tranquillisers and sedatives from 1976–1978 to the fall in respiratory deaths. From 1964 to 1984 use of central heating increased from 13% to 69% of households, domestic fuel consumption increased, and excess mortality in winter from respiratory disease declined by 69%, even relative to summer mortality and when adjusted for varying coldness of winters. The improvement was partly explained by a decline in influenza epidemics. By contrast, excess mortalities in winter from coronary and cerebrovascular disease, although rising in some early influenza epidemics, did not fall significantly as home heating improved. These thrombotic deaths together accounted for 56% of the total excess winter mortality by 1984. The findings support other indications that most of the excess mortality from arterial thrombosis in winter in England and Wales is due to brief excursions outdoors rather than to low indoor temperatures.

Key words: Coronary – Cerebral – Thrombosis – Cold – Respiratory

Introduction

Mortality in Britain rises by about 50% in the coldest compared to the warmest weeks of the year, mainly due to deaths of elderly people from arterial thrombosis and respiratory disease (Bull and Morton 1978; Curwen 1981; Alderson 1985). Exposure to cold causes increases in platelet, red cell and white cell counts, cholesterol and arterial pressure, which may explain the increase in arterial thrombosis (Keatinge et al. 1984). Since these develop within an hour, outdoor excursions in cold weather could cause them in everyday life and could explain why excess mortality in winter can be high even among people in fully-heated homes (Keatinge 1986). Reduced air pollution and improved home heating provided possible reasons why excess winter mortality in Britain tended to fall after 1950 (McDowall 1981), but air pollution ceased to be important by 1964 (Macfarlane 1977).

The present study was designed to assess how winter mortality from arterial and respiratory disease changed during the two decades after 1964, during which central heating was widely installed in British homes. Data from direct surveys of indoor temperature indicate that UK homes were warmer in 1980 than 1960, but are too erratic for detailed analysis (Hunt and Steel 1980). We therefore used data for central heating and fuel consumed to assess changes in home heating. Since influenza and other infections cause much of the winter increase in respiratory mortality (Curwen 1981; Alderson 1985), and airborne cross-infection on public transport may be important in spreading respiratory infections in winter (Damms 1959; Andrewes and Glover 1941), we also obtained data on car ownership.

We compared excess mortality rate in the 3 winter months in which mortality is highest (January–March) with that in the 3 summer months in which it is lowest (July–September) rather than with that over the whole year (e.g. Alderson 1985); this was because we found that year-to-year mortality rates in July–September were not significantly affected by variations in temperature or by influenza epidemics and so provided more stable base-
line mortality rates than annual rates did. A fall in annual coronary mortality for entire years since 1973–1974 in England and Wales has been attributed largely to reduced smoking and reduced consumption of animal fat (Florey et al. 1978). Our summer mortality data provided an opportunity to compare changes in baseline summer rates with changes in smoking, total and saturated fat intake, and with prescriptions of antibiotics, antihypertensives and sedatives.

Methods

We calculated excess mortality rate in winter as a percentage increase over the mortality rate in summer. This percentage increase was adjusted for the coldness of the winter by dividing it by the amount (°C) by which the temperature (mean of daily minima, °C) was colder in winter (January–March) than in summer (July–September) of that year; deaths from arterial disease and all causes (Bull and Morton 1978; Curwen 1981; Alderson 1985) increase linearly with fall in outside temperature. In most cases, we analysed only a narrow age band of 70–74 years, to avoid the uncertainties in attempting to adjust seasonal mortalities for changes in the age-structure of the population.

Monthly data from 1964 to 1984 for populations and mortality rates were obtained from the Office of Population Censuses and Surveys (OPCS). Values up to 1967, when the 8th Revision of the International Classification of Disease was adopted, were adjusted using the dual classification of values reported for 1967. Data for 1984, when the weight given to the immediate cause of death was reduced, were similarly adjusted to the basis used before 1984. Three broad categories of respiratory (460–519), coronary artery (410–414), and cerebrovascular (430–438) mortality were studied (codes in 9th Revision of International Classification of Disease, ICD). We used mortality data, and when possible other data, for England and Wales rather than for the whole of the UK because the smaller area provides more uniform temperatures. Rates of influenza diagnosed clinically in 40 general practices, 38 in England and Wales, and 1 each in Scotland and Northern Ireland (Fleming and Crombie 1985), were obtained from the Birmingham Research Unit, Royal College of General Practitioners. Minimum daily temperatures in London (Kew), Birmingham (Edgbaston) and Bradford were obtained from the Meteorological Office. Figures from nearby Heathrow and Leeds replaced some missing temperatures for Kew and Bradford.

Numbers of manufactured cigarettes, plain and filter, sold in the UK each year to 1975 were provided by the Tobacco Research Council, and from 1977 by the Customs and Excise Office, from duty levied. Surveys by the Tobacco Research Council and General Household Survey (GHS) gave data on handrolled cigarettes (with interpolation when necessary) to obtain total cigarettes smoked, and also gave limited information on cigarettes smoked by people aged 70–74. Estimates of total fat (from 1964) and saturated fat (from 1972) taken into the home were obtained from the National Food Survey (Ministry of Agriculture). The Department of Health and Social Services (DHSS) provided numbers of National Health Service (NHS) prescriptions for different categories of drugs from retail surveys. Cost (in 1972) of NHS prescriptions in the UK (£265 × 10⁶) was provided through personal communication by the DHSS, and of private pharmaceuticals (£179 × 10⁶) by OPCS. NHS prescriptions therefore represented 60% of all pharmaceuticals by cost, and probably a much higher proportion of all prescribed pharmaceuticals. Definitions of hypnotics changed in 1976; later values were adjusted to the pre-1976 basis. The GHS provided percentages of households with central heating from 1973, and Building Services Research and Information Association, and Audits of Great Britain Ltd. provided earlier surveys. Data on car ownership from 1973 was provided by the Department of Employment. The Department of Energy's Digest of United Kingdom Energy Statistics provided annual domestic consumptions of fuels; 1964 values were obtained by linear interpolation between 1960 and 1965.

Significance of changes with time, of differences in rates of change, and of correlations with mortality data delayed by up to 4 years, were assessed by linear regression and the t-test. Slowness of changes in data with time made time series analysis inappropriate.

Results

Summer mortalities

Figure 1a shows that summer mortality rates from all causes and from respiratory, coronary and cerebrovascular diseases, in people aged 70–74 years, all improved in about 1974. Summer mortality from all causes did not change significantly from 1964 to 1974, then fell (P<0.001) from 1974 to 1984. Mortalities from respiratory and coronary