PRACTICE OBSERVED

Practice Research

Association between mortality among women and socioeconomic factors in general practices in Edinburgh: an application of small area statistics

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Abstract

Women aged 45-64 in 78 general practices in the city of Edinburgh were followed up for five to seven years and all cause mortality noted. Standardised mortality ratios were calculated for the individual practices. Postcodes were available for a 20% sample of these women and were used to retrieve relevant measures of social class and deprivation from the 1981 census for the smallest division, the enumeration district. Weighted averages gave socioeconomic variables at the level of the general practice. High positive correlations were found between standardised mortality ratios and the socioeconomic variables, with the highest being for percentage overcrowding.

This study established that the relation between deprivation and excess mortality can be shown in general practices in one large city and gave a direct relation for women without reference to their husbands' occupations, thus obviating problems of assigning social class. The data also partially refute the "social drift" hypothesis as an explanation of the association between mortality and social class.

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Introduction

It has been recognised for a long time that differences in social class are associated with differences in mortality, with lower rates in the higher social classes. This was extensively documented in the Black report.[1] These differences are particularly evident in young children[2,3] but are also seen in people of middle and old age[4-6] and in both sexes.[7] Reports have used personal occupational data obtained from death certificates[6] and census data on this and other socioeconomic factors where the units were counties or county boroughs.[2,4,5] Small area statistics now provide census data from smaller geographical units, but mortality data are not readily available.

The design of the Edinburgh randomised trial of breast cancer screening provided an opportunity of collecting both mortality data and a limited amount of socioeconomic information at the level of general practices.[8] Standardised mortality ratios and socioeconomic variables were derived and compared.

Methods

In the Edinburgh randomised trial of breast cancer screening women aged 45-64 were randomly assigned to one of two groups: the intervention group, who were offered regular screening over a seven year period, and a control group. These two groups are being followed up; after seven years their mortality from breast cancer will be compared for the first time.

The precise definition of the study population depends on general practice lists. Most of the general practices in Edinburgh are participating in the trial (87, 88%). These practices were entered into the study in turn between November 1978 and December 1981; at each practice the women on its roll aged 45-64 were enrolled.[8] The unit of randomisation was the general practice and so for each practice the women enrolled are being followed up as a cohort for seven years.

All cause mortality is being collected for the entire study population in two

ways. Firstly, a complete list of deaths of women born between 1914 and 1942 that have occurred in the Lothian Health Board area is received weekly from the National Health Service central register for Scotland, vital statistics branch; this list is matched against the register of the study population by name and date of birth. Secondly, each woman in the study population is "flagged" at the National Health Service central register for Scotland or the National Health Service central register (Southport); in the event of her death a copy of the death certificate is made available, and this is matched against the register of the study population by name, date of birth, and NHS number. These data were at least 90% complete after the first six months of the study. The method of collection ensures that no bias arises between general practices.

Standardised mortality ratios were calculated by the method of indirect standardisation as follows[9]: to allow for the six month delay in recording deaths mortality was always calculated for the period from entry to the trial to 30 June 1986 (or the end of the seven years of follow up if that was earlier). Age specific mortality for the whole study population was computed and taken as the index rate. For each general practice the observed deaths in this period were counted and the number of woman years of experience at each age computed. The index mortality was applied to these to yield the number of expected deaths. The standardised mortality ratio was then the ratio of observed to expected deaths and its standard deviation was approximated by the formula of Armitage.[9] Examination of the number of woman years at risk for each practice gave a range of values from 541 to 8022. We excluded from this study the nine practices that had fewer than 1000 woman years at risk. Seventy eight practices were finally included with a total follow up of 236 670 woman years and 2231 deaths. Fortran 77 programs were used on a PDP11/44 minicomputer.

The register of the study population contained current names and addresses but no postcodes. As we wished to use small area statistics[10] a random 20% sample of the population from each general practice cohort was selected and the postcode obtained and put into the computer. (The postcode could not be found for 3·6%.) The enumeration district for each postcode was then determined from the postcode directory for Scotland held on the Edinburgh regional computing centre's VAX computer. Selected small area statistics for each enumeration district were subsequently retrieved from the British population census data held by the regional centre with the small area statistics package. The statistics we extracted were from the small area statistics tables 2, 5, 10, and 52. For each enumeration district this provided numbers and proportions of either households or people who were advantaged or disadvantaged in some relevant respect. Most information referred to households: in particular, we extracted the proportions of all households that did not have a car, that had a room occupancy >1·5 people per room ("overcrowded") or <1·0 people per room ("occupancy better than normal"), and in which the head of the household was in social classes I and II or IV and V. All households were included; no attempt was made to isolate those that contained women. It was more appropriate to use people rather than households for other information, in particular for total unemployment (men and women) and the social class of economically active women. In the census social class is not assigned to women who are not economically active. The proportion of women aged 45-64 who were married was also extracted.

This information applied primarily to enumeration districts. For each woman we had information relating to the enumeration district in which she lived. To derive corresponding variables for each general practice the individual values from the sample of women in that practice were averaged, using as weights the number of women in the appropriate enumeration districts. The details of the computations and the stability of the general practice variables will be discussed elsewhere. The socioeconomic variables were calculated completely independently of the standardised mortality ratios.

Socioeconomic variables and standardised mortality ratios were combined in the statistical analysis; both had a distribution that was roughly normal. To stablise the variance of the standardised mortality ratio, however, the analyses were applied to its square root; the socioeconomic variables were examined for an association between size and accuracy but none was found. Thereafter the relation between the standardised mortality ratios and the socioeconomic variables was examined by correlation and multiple regression by the statistical package for the social sciences (SPSSX).

Results

Figure 1 shows the standardised mortality ratio in each general practice while table I gives the median values of the socioeconomic variables together with their quartiles; both show considerable variation between the practices. The standardised mortality ratios were highly and significantly correlated with the socioeconomic variables: higher mortality was always associated with "worse" socioeconomic indicators (table II).

TABLE I—*Socioeconomic variables at the level of general practice. Values are percentages*

Variable	Median	Lower quartile-upper quartile range
Social class I/II:		
All households	35·5	28·75-46·75
Married economically active women	22·5	17-31
Single, widowed, or divorced economically active women	27	20·75-34
Social class IV/V:		
All households	20·5	14-26
Married economically active women	28	20-36·25
Single, widowed, or divorced economically active women	17	12·75-21
Unemployment of economically active people over 16	7	5-8
No car (all households)	54·5	45·75-59·25
Overcrowding (all households)	7	5-9
Room occupancy better than average (all households)	69·5	64·75-77
Married (all women 45-64)	71	69-79

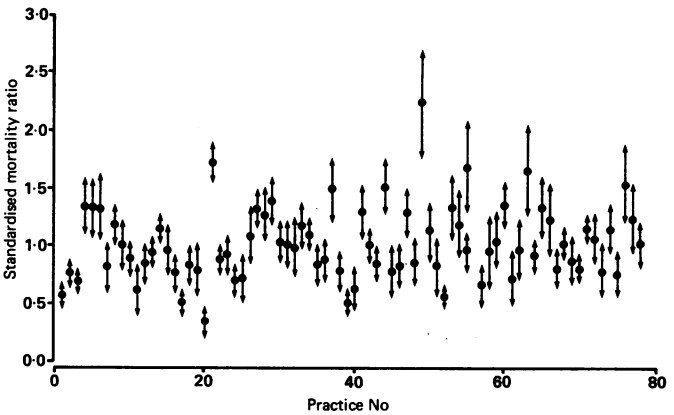

FIG 1—Mean (SD) standardised mortality ratios for 78 general practices. (Practice number corresponds to order of entry to trial.)

TABLE II—*Correlations of socioeconomic variables with standardised mortality ratios*

Variable	Correlation coefficient (p value)
Social class I/II:	
All households	−0·47 (<0·001)
Married economically active women	−0·42 (<0·001)
Single, widowed, or divorced economically active women	−0·43 (<0·001)
Social class IV/V:	
All households	0·57 (<0·001)
Married economically active women	0·47 (<0·001)
Single, widowed, or divorced economically active women	0·51 (<0·001)
Unemployment	0·60 (<0·001)
No car (all households)	0·55 (<0·001)
Overcrowding (all households)	0·61 (<0·001)
Room occupancy better than average (all households)	−0·55 (<0·001)
Maried (all women 45-64)	−0·23 (0·02)

When a multiple regression analysis was used to investigate the relation between the combined socioeconomic variables and the standardised mortality ratios the single measure of overcrowding was found to be almost as good a predictor of standardised mortality ratios as any combination and explained 38% of the variation; the association was highly significant ($p<0·0001$). No other socioeconomic variable made a significant independent contribution to the standardised mortality ratios. Figure 2 gives a plot of the standardised mortality ratios against percentage overcrowding. The distribution of overcrowding among the practices was: 0-2%, one practice; 2-4%, nine; 4-6%, 15; 6-8%, 18; 8-10%, 21; 10-12%, 10; 12-14%, two; and 14-16%, two. The socioeconomic variables were of course highly correlated among themselves; this explains why a combination was little better than one alone. Though overcrowding was the best single predictor of the standardised mortality ratios, the others that measured deprivation directly were nearly as good. The full multiple regression model in which all the variables were used explained 43% of the variation in the standardised mortality ratios; it combined the variables into a single socioeconomic score,

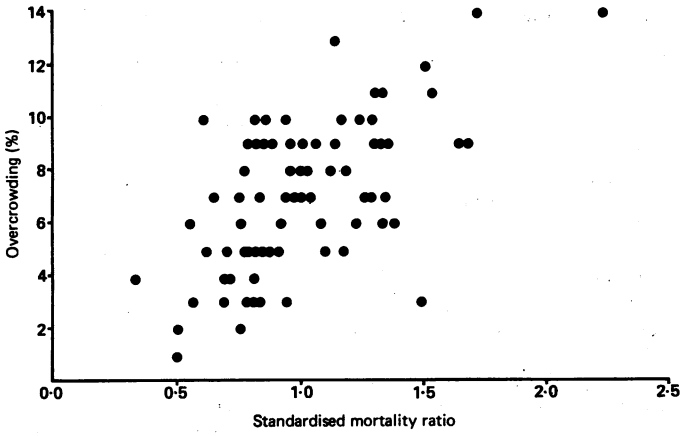

FIG 2—Standardised mortality ratios plotted against percentage overcrowding.

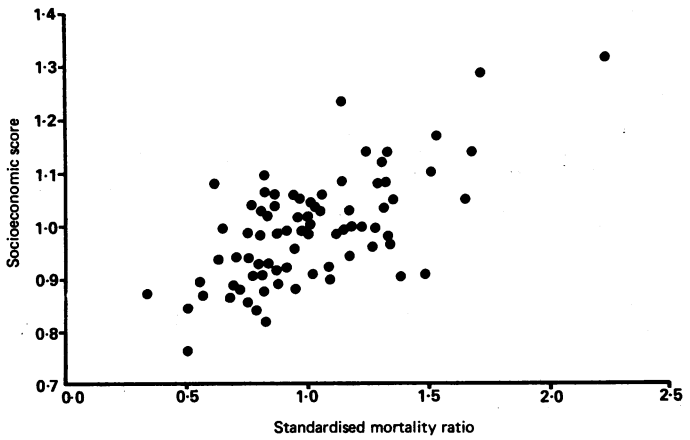

FIG 3—Standardised mortality ratios plotted against socioeconomic score.

whose correlation with the standardised mortality ratios was particularly high (0·66, $p<0·0001$). Figure 3 gives a plot of this score with the standardised mortality ratios. Being a composite score, this is to be preferred as a measure of the socioeconomic state of a general practice or those aspects of it that predict mortality.

Discussion

This study used the very precise design of the main trial[8] to investigate the relation between all cause mortality in middle aged women and socioeconomic variables at the level of general practices. The associations that we found were strong—for example, they were considerably stronger than those found in a similar study of English county boroughs.[4] The first and perhaps main conclusion is that we have provided further and more recent evidence to support the existing reports of disturbing inequalities in health related to the economic differences existing within the United Kingdom and indeed within one city.[1-7]

Social class data are normally based on the Registrar General's classification of the occupation of the head of the household. This leads to general problems[11] and to particular problems for married women.[12] The social class derived from the husband's occupation may well not be the same as that derived from the wife's occupation if she is employed; for both working and non-working wives the husband's occupation is not a good indicator of his wife's environment and background. Thus it is specially interesting that this study related mortality among women to a more direct measure of socioeconomic state.

Several, often complementary, explanations of the relation between low social class and excess mortality have been proposed.[1] Many of these suggest a causal relation whether direct or indirect, but one that does not is the "drift" hypothesis, whereby people who are already unhealthy drift towards a lower social state before death.[13] Our findings are a partial argument against this hypothesis, primarily because the study was longitudinal, taking socioeconomic state from the beginning of the follow up period, and also because the hypothesis would have to assume that husbands were also downwardly mobile as most of the women were married; this seems highly unlikely.

The second conclusion is that these differences operate between general practices. To compute prospective mortality for each practice would be entirely impractical; the socioeconomic variables and score can readily be derived from knowledge of the postcodes of a sample of the general practice list. Thirdly, these socioeconomic variables can perhaps be used as objective criteria that can be applied to individual general practices for the purpose of resource and policy decisions; they can certainly be used as methodological tools both directly in research related to general practice and whenever adjustment is required in the analysis of a study, such as our own, that is randomised by general practice.

The standardised mortality ratios were obtained by an entirely standard approach and applied to the whole population. The socioeconomic variables, on the other hand, were obtained in a novel way, which at best used only 20% of the population and for these replaced personal data with enumeration district data. Although we have some measure of the stability of these measures, random noise might have obscured genuine differences. As the standardised mortality ratios were obtained entirely independently it is most unlikely that the random noise contributed to the strong association that we found. We conclude that the method of deriving socioeconomic variables for general practices is useful despite the noise and that the true association between socioeconomic factors and all cause mortality among women in this town must be very strong. Our findings support each other against any methodological criticisms.

The Edinburgh breast screening project is funded by the Scottish Home and Health Department and the Cancer Research Campaign. We are grateful to the members of the project committee for their consistent help and encouragement: Professor Sir Patrick Forrest (chairman), Dr T J Anderson, Dr M M Andrew, Professor J J K Best, Dr C Brough, Mr U Chetty, Dr W Forbes, Dr R Gruer, Dr A Huggins, Dr L Kinlen, Dr A E Kirkpatrick, Dr N B Loudon, Mr W Lutz, Dr U Maclean, and Dr M M Roberts (clinical director). We particularly wish to record the work of Dr M M Roberts and Mr W Lutz in the design stages of the Edinburgh randomised trial, without which this study could not have been undertaken. We also thank Dr S Hunt of the Unit of Health and Behavioural Change for her helpful comments. This paper was approved by the general practice subcommittee of the area medical committee.

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(Accepted 8 July 1987)