Deprivation and mortality in Scotland, 1981 and 1991

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Abstract

Objective—To compare the mortality experience of Scottish postcode sectors characterised by socioeconomic census variables (Carstairs scores) in 1980-2 and 1990-2.

Methods—Variables derived from the 1981 and 1991 censuses were combined according to the method devised by Carstairs and Morris⁶ to obtain Carstairs scores for 1010 postcode sectors in Scotland in 1981 and 1001 sectors in 1991. For most analyses, these scores were grouped into seven deprivation categories ranging from affluent (category 1) to deprived (category 7) localities.

Main outcome measures—Death rates and standardised mortality ratios for localities according to deprivation category.

Results—Postcode sectors in Scotland that were categorised as deprived in 1981 were relatively more deprived at the time of the 1991 census; the mortality experience of deprived localities relative to either Scotland or affluent neighbourhoods worsened over this period, with a 162% difference between the most affluent and most deprived categories in 1991-2. Although the age and sex standardised mortality for ages 0-64 in Scotland declined by 22% during the 1980s, the reduction in the deprived categories was only about half that of the affluent groups. Increases in the death rate for men (29%) and women (11%) aged 20-29 in the deprived groups were largely attributable to an increase in the rates of suicide. Death rates from ischaemic heart disease and carcinoma of the lung and bronchus at ages 40-69 were lower in all deprivation categories in 1990-2, but the reduction was greater in more affluent areas; the difference in rates for these conditions between affluent and deprived groups therefore increased over the decade. The observed worsening of the standardised mortality ratio for Glasgow relative to Scotland could be explained on the basis of these mortality differentials and the concentration of deprived postcode sectors in Glasgow.

Conclusions—Differences in mortality experience linked to relative poverty increased in the 10 years between 1981 and 1991 censuses. Although mortality for Scotland as a whole is improving, the picture is one of an increasing distinction between the experience of the majority and that of a substantial minority of the population.

Introduction

An awareness of the relation between poverty and the risk of mortality is as old as epidemiology itself, but it was given new emphasis by the publication of the Black report in 1980.¹ The debate that ensued centred mainly on the continuing validity of the registrar general's social classes as a general measure of relative affluence or poverty in a society where other correlates of poverty (such as unemployment, single parenthood, and old age) were increasingly prevalent.^{2,3} Several

different ways of combining variables taken from the census or elsewhere were then developed as a means of categorising the populations of small geographically defined areas (census enumeration districts, local government wards, or postcode sectors). The methods in most common use are those of Townsend *et al*,⁴ Jarman,⁵ and Carstairs and Morris.⁶ All use methods of combining variables to generate a summary score, which, it is argued, reflects the socioeconomic status of a locality relative to the distribution of scores obtained for all localities. The approach to the choice of variables used by these authors differs, but their statistical methods are essentially the same. All three probably reflect a principal component of the full census dataset which describes a socioeconomic dimension in these data.^{7,8} We used the method of Carstairs and Morris⁶ to investigate deprivation and mortality in Scotland around the time of the 1981 and 1991 censuses. This categorisation was first used for analyses based on the 1981 census in Scotland and has been repeated for the 1991 census.⁹

Methods

Deprivation scores were created by combining four variables derived from the small area statistics tables of the 1991 census¹⁰ according to Carstairs and Morris.⁶ These were the proportions of the population in households without access to a car, in overcrowded households, with the head of household in social class IV or V, and in households with unemployed men. Data for all Scottish postcode sectors were included in the analysis; 1010 postcode sectors were included in the 1981 analysis and 1001 in the 1991 analysis. The variables had the same definition in 1991 as in 1981, with the exception that in 1981 the computation of the number of rooms in a household excluded ancillary kitchens, but in 1991 kitchens that were at least two metres wide were included. The effect of this change in definition (which brought Scotland into line with the definition used in England and Wales) was to reduce the mean proportion of overcrowded households from 25.3% in 1981 to 7.4% in 1991. For the remaining three variables, there was a small reduction in the mean proportion of the population with heads of households in social class IV or V (3%) and in the proportion of the population in households without access to a car (7%). The mean proportion of unemployed men rose slightly (0.4%), but variation between postcode sectors increased from a standard deviation of 7.3 in 1981 to 8.4 in 1991. The Carstairs scores were constructed by the *z* score method,⁶ which entailed standardising each variable to have a population weighted mean of zero and a variance of one. Standardising the variables in this way meant that each had an equal influence on the resulting scores which were then created by adding together the standardised values for each postcode sector.

Carstairs and Morris restructured the distribution of deprivation scores for postcode sectors to create a

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categorical variable ranging from deprivation category 1 (the most affluent) to deprivation category 7 (the most deprived). This division was performed on an arbitrary basis and, for this reason, the 1991 scores were divided into the same number of deprivation categories, each including the same proportion of the population as in 1981. Doing so had the effect of changing the proportion of postcode sectors in each category (table I).

TABLE I—Percentages of population and postcode sectors in each deprivation category^a in Scotland

Deprivation category	Population 1981 and 1991	Postcode sectors	
		1981	1991
1*	6	10	9
2	14	18	17
3	22	25	23
4	25	22	23
5	15	12	12
6	11	9	10
7†	7	4	6

*Most affluent. †Most deprived.

Data on all Scottish deaths for 1980-2 and 1990-2 were provided by the General Register Office for Scotland and included postcode sector of residence at the time of death. Standardised mortality ratios were estimated for all postcode sectors by the indirect method and death rates for each deprivation category were standardised by the direct method to the World Health Organisation European standard population. Because there was some change in the allocation of postcode sectors between 1981 and 1991, we used 1981 deprivation categories to compare changes in mortality in the same groups of areas between the two periods. Changes in the boundaries of postcode sectors in the Grampian region in 1990 meant that this region was excluded from the analysis.

The Carstairs scores for 1981 and 1991 were strongly correlated ($r=0.958$) and had similar ranges and standard deviations (3.6 in 1981 and 3.5 in 1991); 76% of the postcode sectors had 1991 scores within 1.5 of their 1981 scores. The z score method results in each standardised variable having the same variance in both years. Given the very similar distributions of scores in both years, a meaningful comparison of deprivation scores was not possible because the method effectively constrains the variance of the distribution. To answer the question whether relative deprivation was greater or less in 1991 than in 1981 we therefore had to adopt other methods of comparison. One option was to add the actual value of each variable for each postcode sector together and to divide this total by the mean value of this addition for all postcode sectors.⁹ Deprivation ratios created in this way were closely correlated with the scores ($r=0.992$ in 1981 and 0.997 in 1991).

To simplify their presentation, the data for over 1000 postcode sectors in each census year are shown as locally weighted regression (LOWESS) curves¹¹ in figures 1 and 2. This is a weighted iterative technique that estimates a predicted value centred at each value of the independent variable using cases that have similar values. Points close to the one being estimated are assigned greater weight in the procedure. It thus provides a robust, locally weighted description of the relation between two variables.

Results

CHANGES IN DEPRIVATION SCORES

Relative to the Scottish mean (except for social class) each of the variables used in constructing the scores showed greater variation in 1991 than in 1981. Figure 1 shows the divergence of the deprivation ratios for each year plotted against Carstairs scores for 1981. The

FIG 1—Locally weighted regression (LOWESS) curves showing relation between deprivation ratios and Carstairs 1981 deprivation scores (Scotland = 1 in 1981 and 1991)

ratios for postcode sectors at the more affluent end of the distribution remained about the same, but postcode sectors with 1981 scores greater than zero—the more deprived—show a progressive increase in their 1991 deprivation ratios as their 1981 scores increases.

Figures 2 shows the relation between all cause standardised mortality ratios for postcode sectors in 1980-2 and 1990-2 for those aged 0-64 and the 1981 Carstairs scores. The two lines cross at about the Scottish average. By 1990-2 standardised mortality ratios had improved for the more affluent half of the postcode distribution and deteriorated for those in the more deprived half; the two lines diverge noticeably as postcode sectors become more deprived. When considered in terms of deprivation categories the more affluent categories show small improvements and those that were more deprived (except category 7) show a slight worsening. The most striking feature, however, is the deterioration in the standardised mortality ratio for the most deprived category, which increased from 144 to 165 over this time. Standardised mortality ratios for men and women considered separately showed a similar pattern, except that the increase in the standardised mortality ratio for women in deprivation category 7 (27) was greater than that for men (18).

FIG 2—Locally weighted regression (LOWESS) curves showing relation between age (0-64 years) and sex standardised mortality ratios and Carstairs 1981 deprivation scores (Scotland = 100 in each period)

CHANGES IN AGE SPECIFIC AND CAUSE SPECIFIC MORTALITY

Between 1980-2 and 1990-2 the age and sex standardised mortality for ages 0-64 in Scotland declined by 22% from 400 per 100 000 to 311 per 100 000. Table II shows the extent to which this general improvement was shared by different age and sex groupings within the categories.

For most deprivation categories there was a reduction in the standardised mortality rates for all the age groups shown in table II (fig 3). The exception was the rate for categories 6-7 at ages 20-29, in which the rate for men increased by 29% and that for women by 11%. The reduction in rates for men aged between 30 and 39 shows little difference between deprivation categories, but the decrease at these ages is well below

FIG 3—Percentage change in standardised mortality rates between 1980-2 and 1990-2 by age group and sex

the average reduction at older ages. Among women, the least reduction (5%) was in the most affluent areas and the greatest (26%) in the most deprived. Among those over 40 the pattern of reduction for men was generally similar—that is, the proportionate decline in rates for deprivation categories 6-7 was roughly half that for categories 1-2. The pattern among women was less clear, but deprivation categories 6-7 also had less favourable reductions in the rates for deaths over age 40 so that the reduction in death rates among women in

this group of postcode sectors was only about a third of the reduction seen in the other categories.

Table III shows the changes in death rates between the ages of 20 and 29. The rate for deaths due to suicide increased in each deprivation category and by 45% overall. This increase was paralleled by an increase in the rate of deaths whose cause was undetermined as to whether it was accidental or self inflicted (codes E980-989 of the International Classification of Diseases). This rate increased by 62% while the rate of deaths from accidents declined by 23% in Scotland in this age group. The increase in death rates in deprivation categories 6-7 was largely explained by a disproportionate increase in suicides and undetermined deaths combined with a smaller than average decline in the rate for accidents. Although observed for both sexes, these changes were much more pronounced for men than for women. The suicide rate for men aged 20-29 in the deprivation categories 6-7 increased by 78% from 18 to 32 per 100 000.

In Scotland two thirds of deaths between the ages of 40 and 64 are attributed either to ischaemic heart disease (ICD 410-414) or to malignant neoplasms (ICD 140-208). Table IV shows the standardised mortality for selected causes for the three deprivation categories in 1980-2 and 1990-2 and the proportionate change in each. Although the rates for ischaemic heart disease and carcinoma of the lung and bronchus declined for all categories, the differential between categories 1-2 and 6-7 increased. For ischaemic heart disease, the rate for deprivation categories 6-7 was 74% above that for categories 1-2 in 1980-2 but 130% greater in 1990-2. Similar changes were seen for carcinoma of the lung and bronchus: in 1980-2 the rate for categories 6-7 was 120% greater than that for categories 1-2 but was 170% greater in 1990-2.

TABLE II—Death rates (SE) per 100 000 for selected age groups (years) and deprivation categories by sex in 1980-2 and 1991-2

	20-29		30-39		40-49		50-59		60-69		20-69	
	1980-2	1990-2	1980-2	1990-2	1980-2	1990-2	1980-2	1990-2	1980-2	1990-2	1980-2	1990-2
Deprivation category*:												
1-2	82 (7)	78 (6)	94 (7)	81 (6)	288 (14)	220 (11)	965 (26)	691 (22)	2858 (51)	2195 (41)	700 (10)	532 (8)
3-5	106 (4)	105 (4)	152 (5)	135 (5)	451 (10)	356 (8)	1349 (17)	976 (14)	3389 (29)	2828 (26)	906 (6)	727 (5)
6-7	123 (8)	159 (9)	250 (13)	223 (12)	668 (21)	589 (22)	1878 (35)	1505 (35)	4196 (58)	3785 (58)	1199 (12)	1050 (12)
Scotland	108 (3)	110 (3)	155 (4)	135 (4)	455 (7)	350 (6)	1356 (13)	991 (11)	3404 (22)	2824 (20)	911 (4)	728 (4)
Deprivation category*:												
1-2	38 (5)	30 (4)	62 (6)	58 (5)	194 (11)	160 (9)	559 (19)	470 (17)	1569 (34)	1262 (29)	398 (7)	327 (6)
3-5	42 (3)	35 (2)	94 (4)	82 (4)	275 (7)	213 (6)	789 (12)	585 (11)	1895 (20)	1669 (18)	516 (4)	426 (4)
6-7	57 (5)	63 (5)	144 (10)	107 (8)	403 (16)	355 (17)	1001 (25)	898 (26)	2332 (40)	2255 (42)	663 (9)	614 (9)
Scotland	43 (20)	40 (2)	94 (3)	80 (3)	282 (6)	218 (5)	775 (9)	605 (8)	1897 (15)	1662 (14)	516 (3)	431 (3)

*In 1981.

TABLE III—Death rates (SE) per 100 000 for both sexes at ages 20-29 for selected causes and deprivation categories with percentage changes from 1980-2 to 1990-2

Deprivation category*:	Suicide (ICD E950-959)			Undetermined (accidentally or purposely inflicted) (ICD E980-989)			Accidents (ICD E800-949)			All other causes		
			% Change (SE)			% Change (SE)			% Change (SE)			% Change (SE)
	1980-2	1990-2		1980-2	1990-2		1980-2	1990-2		1980-2	1990-2	
1-2	9.1 (1.7)	12.4 (1.8)	37 (32)	2.2 (0.8)	3.4 (0.9)	56 (73)	24.4 (2.7)	13.8 (1.9)	-43 (10)	24.3 (2.8)	24.3 (2.5)	0 (15)
3-5	9.9 (0.9)	14.6 (1.0)	47 (17)	3.5 (0.5)	4.9 (0.6)	40 (27)	28.1 (1.5)	21.3 (1.2)	-24 (6)	32.5 (1.6)	29.4 (1.4)	-10 (6)
6-7	12.0 (1.7)	19.1 (2.1)	59 (29)	8.1 (1.4)	17.0 (2.0)	109 (44)	24.2 (2.4)	21.8 (2.2)	-10 (13)	45.4 (3.4)	52.9 (3.5)	17 (12)
Scotland	10.5 (0.7)	15.2 (0.8)	45 (12)	3.9 (0.4)	6.3 (0.5)	62 (22)	28.0 (1.1)	21.5 (0.9)	-23 (5)	33.1 (1.2)	32.0 (1.1)	-3 (5)

*In 1981.

TABLE IV—Changes in age and sex standardised* mortality (SE) for selected causes and deprivation categories from 1980-2 to 1990-2

Deprivation category†:	Ischaemic heart disease (ICD 410-414)			Malignant neoplasm of trachea, bronchus, and lung (ICD 162)			Malignant neoplasm of female breast (ICD 174)			Other neoplasms			All other causes		
			% Change (SE)			% Change (SE)			% Change (SE)			% Change (SE)			% Change (SE)
	1980-2	1990-2		1980-2	1990-2		1980-2	1990-2		1980-2	1990-2		1980-2	1990-2	
1-2	223 (6)	135 (4)	-40 (2)	67 (3)	48 (2)	-28 (5)	69 (4)	64 (4)	-8 (8)	133 (4)	142 (4)	7 (5)	228 (6)	167 (5)	-27 (3)
3-5	311 (4)	215 (3)	-31 (1)	92 (2)	76 (2)	-17 (3)	74 (2)	63 (2)	-14 (4)	159 (3)	153 (2)	-4 (2)	325 (4)	236 (3)	-27 (1)
6-7	388 (7)	312 (7)	-20 (2)	147 (4)	130 (4)	-11 (4)	69 (4)	56 (4)	-19 (8)	178 (5)	197 (5)	11 (4)	492 (8)	407 (8)	-17 (2)
Scotland	303 (3)	210 (2)	-31 (1)	96 (1)	77 (1)	-20 (2)	71 (2)	62 (2)	-13 (3)	157 (2)	157 (2)	0 (2)	334 (3)	246 (2)	-26 (1)

*Ages 40-64. †In 1981.

TABLE V—Standardised mortality ratios (95% confidence intervals) for ages 0-64 for deprivation categories in Greater Glasgow, Lothian, and rest of Scotland

Deprivation category in 1981	Greater Glasgow Health Board	Lothian Health Board	Rest of Scotland
1-2 { 1980-2	71 (67 to 75)	71 (67 to 74)	77 (75 to 80)
{ 1990-2	71 (67 to 76)	68 (64 to 72)	75 (72 to 78)
3-5 { 1980-2	103 (100 to 107)	96 (93 to 99)	100 (99 to 101)
{ 1990-2	109 (104 to 113)	99 (96 to 103)	97 (96 to 99)
6-7 { 1980-2	139 (135 to 142)	123 (115 to 132)	123 (119 to 127)
{ 1990-2	159 (155 to 164)	141 (130 to 153)	131 (126 to 136)
1-7 { 1980-2	115 (113 to 117)	91 (89 to 93)	99 (98 to 101)
{ 1990-2	124 (121 to 126)	93 (91 to 96)	97 (96 to 98)

*Excluding Grampian.

A different picture was evident for deaths from carcinoma of the breast. In 1980-2 death rates between the deprivation categories varied little, but by 1990-2 deaths from this cause were less frequent in deprivation categories 6-7 than in categories 1-2. Postcode standardised mortality ratios for this cause did not correlate with Carstairs scores ($r=0.008$ in 1980-2 and -0.070 in 1990-2). This observation is in line with other reports,¹² and the lower rate observed for deprivation categories 6-7 may be related in Scotland to other geographical factors.

The differential in death rates for other causes between deprivation categories 1-2 and 6-7 showed little change; the ratio between these rates was 1:2.2 in 1980-2 and 1:2.4 in 1991-2. The reduction in rates within these categories, however, was less for categories 6-7 (17%) than for the remaining categories (27%). In both 1980-2 and 1990-2 other causes comprised a greater proportion of deaths in deprivation categories 6-7 (38% in 1990-2) than in categories 1-2 (32% in 1990-2).

GEOGRAPHICAL DIFFERENCES

In Scotland 52% of the postcode sectors of deprivation categories 6-7 are within the area of the Greater Glasgow Health Board and so the question of whether these differences in mortality reflect an effect of social deprivation or a more local effect of being in Glasgow is important in interpreting these data. Table V compares the standardised mortality ratios of the three deprivation categories for ages 0-64 in 1980-2 and 1990-2 for the populations of Greater Glasgow Health Board, Lothian Health Board (which includes Edinburgh), and the rest of Scotland, excluding the Grampian region. For both time periods the standardised mortality ratios for deprivation categories 1-2 and 3-5 were essentially the same in all three areas and very similar for the two periods. The divergence in death rates between affluent and deprived localities shown in figure 2 was evident for each of these three parts of Scotland.

This increasing discrepancy is most obvious in the area of the Greater Glasgow Health Board, where the standardised mortality ratio for deprivation categories 6-7 (which was higher than that for these categories in other areas in 1980-2) increased from 139 to 159. The standardised mortality for Greater Glasgow was 34% higher than that for Lothian in 1990-2 and, relative to Scotland, increased during the 1980s. The difference between the two cities is that half of Glasgow's population were resident in localities included in deprivation categories 6-7 compared with only 10% of the Lothian population so that a major part of the unfavourable comparison with Lothian is explained by the high proportion of the Glasgow population who live in deprived localities.

Discussion

INDIVIDUALS AND POPULATIONS

When interpreting these changes in death rates it is important to appreciate the distinction between measures of socioeconomic status based on individual

attributes (such as the registrar general's social classes) and those derived from census variables, which generally relate to the proportions of people with or without selected characteristics in populations of geographically defined areas. Carstairs scores for local populations created by combining selected census variables are thus partly dependent on the ways in which areas are defined and partly on the homogeneity or heterogeneity of the populations within them in respect of these variables. This means that it is possible for localities with average scores to include more poor or affluent people (or both) than areas at the extremes of the distribution of scores and that the distribution of scores is heavily dependent on the link between the geography of small areas and their social structures. The practical consequence is that the Carstairs scores identify relatively affluent (middle class) urban localities as deprivation categories 1 and 2 and relatively deprived urban areas—such as the peripheral local authority housing estates of Glasgow—as categories 6 and 7. The populations of rural areas are more mixed in their socioeconomic characteristics and, for this reason, their scores are more likely to be towards the middle of the range.

It is difficult to derive hypotheses about the causes of inequalities measured on the basis of the geographical variation of census variables; the most obvious problem is that these methods do no more than describe the range of variation in the experience of health.¹³ Given the present availability of appropriate data, it is simply not possible to distinguish between socioeconomic effects acting across the whole population and effects which relate only to the populations of areas categorised as affluent or deprived. This is not to say, however, that methods such as the Carstairs categorisation do not have value in focusing attention on the extent of inequalities either across Scotland or within the smaller geographical areas of health boards.

A possible uncertainty about these data is whether some part of the differences we report might result from inaccuracies in denominator populations arising from undercounting in the 1991 census. In Scotland the extent of the census undercount has been estimated at 2%,¹⁴ but this proportion is thought to be greater among those aged 20-34, particularly among men. To make allowance for possible bias the denominator populations used in this analysis were adjusted for each age and sex group on the basis of the relation between estimates of the undercount in Scottish local government districts, their population density, and their mean Carstairs scores. Comparisons of death rates derived in this way with rates based on unadjusted populations did not change the patterns we describe, but the underlying uncertainty about undercounting could mean that small area rates for younger age groups are unreliable. For the rates we report for ages 20-29 in 1990-2 to be the same as those for 1980-2, however, the undercount for deprivation categories 6-7 would need to be of the order of 35% for men and 24% for women. The adjusted denominators used in calculating the rates we report for these ages in categories 6-7 assumed an undercount of 16% for men and 6% for women.

EFFECT OF AGE, SEX, AND GEOGRAPHY

The two central features of this analysis are those illustrated in figures 1 and 2. With standard census variables, figure 1 shows an increase in relative deprivation in localities identified as deprived in 1981 and figure 2 that these changes are mirrored by a deterioration in rates of relative mortality, being most pronounced in the most deprived localities. At ages 0-64 the death rate of the most deprived postcode sectors (deprivation category 7) was 162% greater than that of the most affluent category (deprivation category 1) in 1991-2 and 65% greater than the rate for the whole

of Scotland. This pattern of diverging mortality is evident across most of the age and sex groupings shown in table II; although the overall reduction in Scottish mortality is impressive, the major part of this decline has been in the affluent or average categories. The most disturbing feature of table II, however, is the increase in death rates for deprived categories 6-7 for both sexes at ages 20-29.

Explanation of these increases (which are largely attributable to suicide and related causes) clearly requires a more detailed analysis than is possible in this paper; given the urban geography of Scotland and the geographical distribution of deprivation categories, it is possible to speculate about the effects of long term unemployment among young people, about the consequences of drug taking,¹⁵ or about the risk of suicide after discharge from psychiatric hospitals.¹⁶ It is relevant, for example, that much of the increase in the death rate for other causes in deprivation categories 6-7 shown in table III is explained by an increase in death rates from drug related causes (ICD 304-5) and from disorders of the immune mechanism (ICD 279). One other feature of table III, however, is that although gradients with deprivation categories are evident for all the causes shown, rates for suicide and for the "undetermined" group have increased in all categories. Male suicide rates have been rising in Scotland since the mid-1970s.^{17 18}

The changes in death rates between the ages of 40 and 64 shown in table IV have several specific features but the common characteristic (with the exception of breast cancer) of a strong gradient across the deprivation categories which was not lessened between 1980-2 and 1990-2. The gradients for ischaemic heart disease and lung cancer worsened over this period because the proportionate reduction in deaths from these causes in deprivation categories 1-2 was about a third greater and that for categories 6-7 about a third less than that for Scotland as a whole. The Scottish Office Home and Health Department's target for deaths from coronary heart disease at these ages is for a reduction of 40% between 1990 and 2000.¹⁹ On the basis of trends during the 1980s, this target will probably be achieved for the affluent and average deprivation categories but the improvement will not be shared by the populations of the deprived categories 6-7. A similar conclusion might apply to the target for deaths from cancer, which is for an overall reduction of 15% between 1986 and 2000.

The differential in death rates between Edinburgh and Glasgow has been the subject of recent reports²⁰⁻²³ and is, as Watt has commented,²² "a massive public health problem." The standardised mortality ratios for the different deprivation categories reported in table V suggest that the problem is chiefly a reflection of the prevalence of socioeconomic deprivation within Glasgow and its contribution to the overall mortality experience of the city. When translated back to the health care needs that this excess mortality represents, these differences must have important implications for the policies of the NHS in Scotland, particularly with regard to considerations of the equity of service provision.

CONCLUSIONS

An understanding of why mortality differentials persist as they do can be approached in various ways. Firstly, there is a level of epidemiological mechanisms which might postulate differences in lifestyle and behaviours (such as smoking). Such explanations might take in Barker's hypothesis about the long term outcomes of the intrauterine environment²⁴ and could imply complex cohort effects²¹ in the simpler patterns of mortality we describe.

Secondly, there is a view (on which the strategies set

Key messages

- In Scotland relative deprivation increased between the 1981 and 1991 censuses and was mirrored by a worsening of relative death rates
- Changes in relative mortality were explained by differences in the decline in death rates according to the affluence of an area; among men the decline in deprived areas was only about half that in affluent areas and among women it was only about a third
- Death rates in deprived areas increased at ages 20-29, mainly because of an increase in the suicide rate
- The worsening standardised mortality ratio for Glasgow could be explained by the concentration of social deprivation in that city

out in *Scotland's Health: A Challenge to Us All*²⁵ and *The Health of the Nation*²⁵ seem to depend) that differences of the kind we describe arise from a lag in the process of lifestyle change in which the more affluent are simply ahead of the deprived in leading healthier lives. There is, of course, value in both perspectives, but neither is satisfactory as a basis for explaining the general and consistent relation between relative deprivation and relative mortality both over time and in different populations.²⁶⁻²⁸ A further illustration of such differences is contained in a recent report from northern England that used similar methods to ours over the same time period and reached comparable conclusions.²⁹ Davey Smith and Egger³⁰ are probably right in their conclusion that "attempting to explain inequalities in any simple sense may be futile, while the concept of 'cause' used in its usual epidemiological sense is probably inadequate."

One reason for supporting this view is that inequalities in health reflect other inequalities of social experience and are, in any case, relative to population norms at any given time. Attempts to explain—or to resolve—inequalities in health by means of interventions directed towards specific aspects of lifestyle (such as smoking or diet) ignore the question of whether disadvantaged populations are able to act on advice about healthy living in the wider context of their social circumstances. Using mortality as its measure, this paper describes the growing marginalisation of a substantial minority of the Scottish population and suggests the need for fundamental change in social policy if such marginalisation is to be reversed.

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Higher mortality in deprived areas: community or personal disadvantage?

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See editorials by Davey Smith and Judge and pp 1465, 1475, 1481, 1487

Abstract

Objective—To investigate the association between level of social deprivation in electoral wards and premature mortality among residents, before and after allowing for levels of personal deprivation.

Design—Longitudinal study of the Office of Population Censuses and Surveys.

Setting—England.

Subjects—Random sample of nearly 300 000 people aged between 16 and 65 at the 1981 census and followed up for nearly nine years.

Main outcome measure—Death from all causes between ages of 16 and 70.

Results—Without allowance for personal disadvantage, both sexes showed a clear, significant, and roughly linear positive relation between degree of deprivation of the ward of residence in 1981 and premature death before 1990. For men, this association was effectively explained away once allowance was made for individual socioeconomic circumstances. For women living in wards of above average deprivation, the association was also effectively removed, but the situation for other women was less clear.

Conclusion—The excess mortality associated with residence in areas designated as deprived by census based indicators is wholly explained by the concentration in those areas of people with adverse personal or household socioeconomic factors. Health policy needs to target people as well as places.

Introduction

Indicators of social deprivation, as pioneered by Townsend,¹ have been shown to be useful in explaining differences in mortality.^{1,2} A recent study confirmed a positive association between levels of social deprivation in a ward and premature mortality.³ But studies based entirely on data aggregated at a particular geographical level (ecological studies) necessarily assume homo-

geneity among individuals or households within the area of study. This study investigates the association between mortality and deprivation at ward level in a longitudinal study and how that association is affected when information about deprivation is also known at the personal level.

The longitudinal study managed by the Office of Population Censuses and Surveys is a record linkage study based on a sample of the population of England and Wales. Sampling was started at the time of the 1971 census and includes anyone born on one of four dates of any year. This yields a sample of roughly 1% of the population, effectively randomly selected, with at any one time records of about 500 000 living people in England and Wales (the study members) and records of former members who have died or emigrated. The sample is regularly updated to include new members. Details of deaths of study members are incorporated with the help of the NHS central register. At the time of this analysis deaths up to the end of 1989 were recorded. A range of small area statistics are available on the dataset, from which deprivation measures for the ward of residence of each study member can be calculated. The study is available to academic researchers subject to strict confidentiality.

Methods

The survival status of study members aged between 16 and 65 on the day of the 1981 census was analysed in a multiple logistic regression model. This model estimated summary risks of dying (estimated by odds ratios) stratified by age (eight age groups) and time period (1984-6 and 1987-9). Deaths during 1981-3 were excluded to diminish health selection effects existing at time of enumeration.⁴ Residents in institutions were excluded from the analysis. Certain older age groups were excluded in the second time period to approximate censoring on reaching age 70. This statistical model was developed by Weatherall and has been satisfactorily tested with data from the longitudinal study.^{5,6} Age specific risks of dying, calculated

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