Sociology of Health & Illness Vol. 20 No.5 1998 ISSN 0141–9889, pp. 694–709

Changing the map: health in Britain 1951–91

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Abstract It is accepted that within Britain there are persistent and growing inequalities in mortality between groups of people as defined by their social class. This paper shows that similar persistent and growing inequalities prevail between groups of people defined by district of residence. Although there is some confusion between these two ways of grouping people – there is a slight tendency for people of the same class to live in the same district.

This paper reviews the geographical literature which may shed light on why inequalities in mortality are widening between districts in Britain. We present new data for a set of 293 unchanging districts by amalgamating published reports from the 1950s, 60s and 70s with individual postcoded mortality records from the 1980s and 90s, aggregated to the 293 districts using a Geographic Information System and Census data from 1971, 1981 and 1991 (including estimates of the residence of the 'missing million'). We find that a growing proportion of premature deaths in Britain can be attributed to some aspect of rising spatial inequalities. Changing geographical inequalities in health are not simply a passive reflection of social inequalities. To begin to investigate them, however, we first need to measure them properly.

Keywords: mortality, inequality, geography, area-effects, Britain

Introduction

While it is undoubtedly true that we are all going to die, some of us will die sooner rather than later – our life chances are intimately connected to our social and economic circumstances, which are inextricably linked to influ-

ences of behaviour and intergenerational advantages and disadvantages. As well as *social* inequality in health, there is also an interlinked *geographical* dimension to health: people living in different places have differing life chances, irrespective of their social status. In this paper we briefly review the literature on the geographical distribution of health in Britain as gauged by mortality data. This body of literature suggests that not only is there inequality in health between regions and areas in Britain but that the extent of this inequality is increasing. Possible explanations for the geographical patterns observed are briefly discussed. A unique analysis of national mortality data for local areas is then presented. Attention focuses upon the methodological issue of changing geographical boundaries, and how this process of area redefinition may have obscured the observation of underlying patterns of inequality. Constant geographical boundaries are constructed to allow for the comparison of standardised mortality ratios (SMRs) over the period 1951–1991. The results indicate that changes in the definition of boundaries have led to the underestimation of geographical inequalities in health (at least in terms of mortality) in contemporary Britain.

Geographical patterns in health

Mortality has traditionally been, and continues to be, the most commonly used indicator of the geographic distribution of health. In this country, the topic has been investigated since the publication of vital statistics, including information on area of residence, were first collected in England and Wales in 1837 (Britton, 1990). Patterns can be observed on a number of geographical levels: between countries, between regions and also between districts and wards. There are quite remarkable differences between the mortality and life expectancy of groups of different countries – the World Bank reports that life expectancy in Sub-Saharan Africa stands at 52 years, whereas in 'established market economies' it reaches 76 years (World Bank 1993). Large differences are also apparent between the countries of the European Community (Kaminski *et al.* 1986). Generally, mortality is lower in richer countries (Curtis and Taket 1996). However, as Wilkinson (1992) asserts, it appears that the health of a nation is determined not only by its level of economic development but also by the distribution of health services and the distribution of wealth – the more equal the society economically, the better the overall health of that society.

Many researchers have reported regional inequalities in mortality within the UK. Patterns have been documented for over a century in Britain, and it has been consistently found that mortality rates are higher in the north and in Scotland and lower in the south. Similar evidence of a north/south divide is presented by Britton (1990) who, looking at data up to 1983, argued that there was a continuation, and if anything a worsening of the

regional gradient in mortality, from high in the north and west to low in the south and east for both men and women. This is the case for almost all the main causes of death. Regarding particular causes of mortality, Strachan *et al.* (1995) report regional variations in cardiovascular disease and stroke with a southeast to northwest gradient in mortality, the northwest having the higher mortality. Similarly, Howe (1986) found regional differences in heart disease and lung cancer for males; for females the number of deaths overall from these conditions was less, however, the pattern of regional differences was similar to that for males. As observed in the Black Report Britain can be divided into two zones of relatively high and low mortality (DHSS 1980). Howe (1986) proposes an imaginary line reaching from the Bristol Channel to the estuary of the Humber separating those experiencing favourable and unfavourable life chances, whereas Britton (1990) suggests a divide from the Severn to the Wash separating areas of low and high mortality.

However, this pattern is not all-encompassing. Illsley and Le Grand (1993) used the large standard regions to look at specific age groups and found that it was only in adults aged 45–64 that the inter-regional variation in mortality conformed to the familiar north/south gradient; differences were greater for men than for women. Others have also found that the regional gradient in mortality does not hold for all age groups. For example, Britton (1990) found that the only exception to the continuing inequalities in health was for post-natal mortality (28 days to one year). Gordon and Sutherland (1987) state that there has also been a disappearance of the north/south differentials in neonatal mortality (less than 28 days), although this is disputed by Britton (1990).

Comparisons of rural and urban places also have a long history – urban/rural differences in mortality have been manifest since the production of vital statistics by area in Britain. William Farr (1885) found that average life expectancy at birth in the 1840s in rural areas was in the upper 40s, but in urban areas, such as Liverpool and Manchester, it was 20 years below this. More recently, rural/urban differences in Britain have been reported by Bentham (1984), Britton (1990) and Watt *et al.* (1994) who found that mortality rates are lower in rural areas and higher in conurbations and larger towns. However, there is some variation to this pattern. Phillimore and Reading (1992) found that inequalities in mortality between more and less deprived wards were more extreme in urban areas than in rural areas. Looking at specific causes of death, Saunderson and Langford (1996) investigated the geographical variation of suicide rates in England and Wales and found that both males and females experience a high rate in densely populated urban areas, but that males also experience high rates in agricultural (rural) regions. Whilst the recent pattern in Britain has generally been that mortality rates are higher in urban than rural areas, there have been exceptions to this in the past, most notably in the Pennines in the 1930s and the Great Irish Famine of the 1840s. Likewise in other countries, there are examples of rural death rates exceeding those of urban areas.

A number of studies have reported variations in mortality on a more local level, looking at counties, wards and neighbourhoods. For example, Britton (1990) found differences between counties within the UK, with north and west and also metropolitan areas having higher mortality. Townsend *et al.* (1988) present data on differences by ward. Differences were such that the worst ward had (proportionately) almost five times as many deaths as the best ward. Interestingly, Congdon (1995) found that ward level differences in health were stronger in metropolitan suburbs and inner city areas than in rural areas and Eames *et al.* (1993) found that the association between deprivation at the ward level and mortality depended upon the Regional Health Authority in which the ward was situated. Townsend *et al.* (1984) and Townsend *et al.* (1988) also found that local neighbourhood was more strongly associated with health than was region. Skrimshire (1978) suggested that a working class person was at greater disadvantage if living in a predominantly working class area than in a mixed area, indicating that the localities themselves had an effect upon a person's health. However, Ben-Shlomo *et al.* (1996) in a study of mortality and deprivation by ward, found that variations in mortality were least in the most affluent and most deprived areas.

Intra-urban differences in health have also received some attention. For example, Howe (1986) reports a clear core-periphery pattern for SMRs in London. For heart attacks in males, for example, SMRs range from 51 in Sutton in Inner London to 122 in Dagenham in Outer London. Howe (1986) notes that the mortality ratio for Glasgow as a whole is one-third above the UK average, but that in some parts of Glasgow SMRs are well below this level, whereas in other areas SMRs are in excess of 170. Areas with the highest mortality tend also to be the most deprived areas. A number of studies have compared areas on the basis of their socio-economic characteristics. McCarron *et al.* (1994) found substantial differences in mortality between the most and least deprived areas of Glasgow. In a study of infant mortality within the city of Southampton, with areas divided according to socio-economic characteristics, Robinson and Pinch (1987) found that there were four times as many child deaths in the worst areas compared with the best areas – there was a clear division of mortality and social deprivation in the city. Such comparisons of places according to socio-economic characteristics and in particular the degree of deprivation are common. Differences between rich and poor areas (as defined by a material deprivation index based on factors such as car ownership and housing tenure) have also been found by Townsend *et al.* (1988). They found that, in the main, deprivation in an area was linked to high mortality rates, although some equally deprived areas had differing rates.

Looking at the concept of 'place' on a more micro level, there are also differences in health according to housing tenure; indeed, Jones and Goldblatt (1996) claim that tenure is a better predictor of mortality than area. Fox and Goldblatt (1982) report that owner occupiers have lower

mortality than those in rented accommodation; Britton (1990) found higher mortality in council estates, in particular low-status urban or inner city estates, with mortality rates 20 per cent over the national average for council house renters compared with near average mortality rates for owner-occupiers in the same areas. Tenure, in conjunction with car access, is increasingly used as a measure of social position in preference to the traditional marker of occupation. Goldblatt (1990) found a connection between mortality and both tenure and car ownership. Tenure, of rather the lack of tenure, is also important in that homelessness has been found to be linked with a number of health problems – the life expectancy of the street homeless has been estimated to be 42 years (Grenier 1996), lower than in Sub-Saharan Africa. It should also be noted that while there has been a dramatic rise in the number of owner occupiers in Britain in the last two decades, there has also been a striking increase in the number of homeless people (Dorling 1995).

To summarise the findings of this literature, although patterns are not entirely the same for different causes of death, for males and females and for different age groups, these studies of the geographical patterns of mortality in Britain clearly indicate that there is a strong north/south and urban/rural divide in health in Britain. These patterns in mortality are also generally reflected in patterns in morbidity (Blaxter 1990, Haynes 1991, Gould and Jones 1996). Moreover, several studies indicate that in recent years the difference is becoming greater – that there is polarisation of mortality between areas. Britton (1990) notes that over the period 1979–1983 the familiar north-west/southeast gradient in mortality was becoming more pronounced, and other authors have also reported this pattern of polarisation (Phillimore *et al.* 1994, Staines and Cartright 1994, Congdon 1995). Bryce *et al.* (1994) report that although mortality as a result of coronary heart disease is falling overall, geographical inequalities are increasing, at least for older people. In reporting widening mortality differentials within the city of Glasgow between 1980–2 and 1990–2, McCarron *et al.* (1994) quantify the extent of polarisation – for men, mortality increased in the most deprived areas by nine per cent whereas in the least deprived areas it *decreased* by 18 per cent. In this paper we update these studies by considering geographical changes in mortality rates at the local area level for the whole of Britain over the past forty years.

Explanations of geographical patterns in health

Various explanations have been proposed for the geographical patterning of mortality in Britain. A significant debate surrounds the issue of whether these differences are because of people or places, or in other words, the relative contribution of compositional and contextual factors (MacIntyre *et al.* 1993). A number of studies have considered this question. Sloggett and Joshi (1994) used data from the ONS Longitudinal Study to look at

whether high mortality in deprived wards was caused by the aggregate effect of personal factors or a community level factor. In terms of years of life lost they found that (what they chose to term) individual factors (such as car access and housing tenure) were stronger predictors than ward of residence. They report:

> For men, the increased risks of death associated with living in such [deprived] areas were entirely explained by the levels of personal disadvantage experienced by the individual. The deprivation effect was therefore entirely due to the concentration of disadvantaged men in the area. (1994: 1471)

Thus they found no residual area effect at ward level. However, they do find higher excess mortality in the North as compared with the South, even after controlling for individual factors, a finding which they chose not to highlight. A number of other studies also report a residual area effect. The Alameda county study in the US reported a residual area effect (Haan *et al.* 1987), as well as various British studies (Charlton *et al.* 1983, Carstairs and Morris 1991, Humphreys and Carr-Hill 1991, Duncan and Jones 1995, Shouls *et al.* 1996). Langford and Bentham (1996) used the technique of multi-level modelling and found that

> . . . even after adjusting for such factors [level of deprivation and area type] there is a distinct regional contrast with areas to the North and the West of an approximate line between the Severn and the Wash showing high levels of all-cause mortality. (1996: 907)

These findings thus lend support to the contextual argument – that health is not only a product of individual characteristics but also determined by the context in which a person lives. Phillimore and Morris (1991) suggest that we need a deeper socio-cultural understanding of what constitutes a 'place' in order to take this further. From their study of two towns with similar levels of social deprivation but varying premature mortality rates, Middlesbrough and Sunderland, they conclude that we need to look beyond general explanations of health inequalities and more closely examine the social and economic histories of particular localities, such as the pattern of deprivation over a number of decades and the provision of social housing. Phillimore (1993) suggests that the characteristics of a place may be as important as the characteristics of people when trying to understand health. He specifically mentions such factors as the industrial environment, internal inequality and lifestyles in a broad sense, including fears, values and beliefs. MacIntyre *et al.* (1993) likewise suggest that it is not just the *level* of deprivation that is important to a place, but the *experience* of that deprivation. However, few have looked at the features of particular places – the social, cultural or economic environment – that affect health by area (MacIntyre *et al.* 1993).

Another debate surrounds the role of migration as a possible explanatory factor of spatial differences in mortality although there are only a few studies which address this issue. It is proposed that geographical differences in health could be produced as a consequence of healthy or unhealthy people being more or less likely to migrate. Britton (1990) reports Longitudinal Study data over the period 1971–1981, finding that migrants who had moved within a county had excess mortality (5–10 per cent) but migrants who moved a longer distance had 10 per cent less mortality, so, in general, the greater the distance moved the lower the mortality. Britton notes that socio-demographic characteristics affect the propensity to move, those with more economic and educational resources tending to move further. Strachan *et al.* (1995) have also used the Longitudinal Study to look at the possibility that regional differences in mortality from ischaemic heart disease and stroke could be the result of migration. They conclude that region of origin and region of adult life were equally related to mortality. Bentham (1984) has also looked at migration as a possible explanation of rural/urban patterns in mortality. He found that there was not a simple gradient of mortality according to whether areas were rural or urban, but that the urban and the most rural places had higher mortality rates than semi-rural areas. This could be explained by certain types of people migrating from rural areas – the young, healthy and better qualified. Thus when considering the relationship of migration to mortality we need to consider not only the individual characteristics of migrants, but also where they move from and where they move to.

Finally, as in the debate regarding inequalities in health in general, there has been some discussion of the artefact explanation – that observed differences are due to measurement. A number of methodological issues have been discussed and investigated in the literature on health inequalities, such as numerator/denominator bias and the ecological fallacy, the use of mortality as an indicator of health, and so on (see for example, Davey Smith *et al.* 1994). The geographical debate has its own measurement issues, such as the need for longitudinal data in order to look at the causes and effects of migration in relation to health. For instance, there is virtually no information on the characteristics of people who have emigrated from Britain.

There is also the issue of changing area boundaries; just as disease classifications change over time, so do geographical boundaries. Administrative boundaries are altered continuously, but the most serious changes were in 1965 to London and in 1974 to the rest of Britain. Within the geographical literature the problem of changing boundaries is addressed many times. (For a summary of the difficulties faced when analysing data by area see Openshaw 1992.) In essence, the problem is that different results are obtained when different boundaries are used to calculate statistics. For instance, if we were to compare changing mortality rates between England and Scotland with Wales, we would assume Britain was becoming more equal, whereas between England and Wales as compared with Scotland,

mortality rates are diverging. It is also possible to obtain very different results through only minor changes. The basic solution adopted by most studies is to choose a single geographical definition of areas and freeze that over time. This can only be done if data are available for units small enough to be able to reconstitute the old areas from the new small areas. Fortunately, this is possible in studies of mortality in Britain because since 1981 in England and Wales (and 1974 in Scotland) all mortality records have been stored on computer, with the postcode of the last residence of the deceased attached. Thus mortality rates can be calculated for very small areas, once data from the population censuses are added, and these rates can be combined to produce statistics for administrative areas that no longer exist, but for which statistics were calculated in the past. The main disadvantage of this method is that the areas for which statistics are calculated are no longer in administrative use. However, without taking this approach, no robust comparisons over time can be made.

Data and methods

For this study, changing levels of mortality were calculated for a consistent set of local areas in England, Wales and Scotland for the period from 1950 onwards using official records. The areas used are County Boroughs, and urban and rural remainders of counties existing in 1951. A Geographical Information System was used to monitor boundary changes. The 1971 Census provides a link between 1971 and 1974 administrative geographies for every 1971 enumeration district. This was the main source of information used, along with the manual digitising of other boundaries. Further details are given in a short report published by the Joseph Rowntree Foundation (Dorling 1997) which also gives more details of the statistics quoted here. These are usually either mortality rates expressed as a percentage, or rates standardised to allow for the age-sex structure of the population.

Results

Table 1 below lists those areas where standardised mortality ratios were above average in 1981 and are still rising, showing how many fewer people would have died in those areas in the latest period (1990–92) if the national mortality rates had applied. These are some of the areas being left behind by the general improvement in mortality. Only areas where the ratio has been rising steadily in recent years have been included. The ratios for the early 1950s are included so that a comparison can be made with the past. Exactly the same geographical areas are being considered in each case. The ratios in this study have been constructed on a consistent basis using twelve

Table 1 *Places where Standardised Mortality Ratios are high and rising in Britain 1981–1992*

Area	*Standardised Mortality Ratio*				*Excess deaths*
	1950–53	*1981–85*	*1986–89*	*1990–92*	*1990–92*
Oldham	120	121	124	131	1102
Salford	121	125	126	131	1161
Greenock	120	123	127	130	696
Manchester	118	117	119	121	3390
Birkenhead	112	112	116	121	1001
Clydebank	112	116	119	120	312
Newcastle upon Tyne	112	112	115	119	1461
Bolton	117	112	113	118	926
Nairn County	102	109	113	117	76
Liverpool	118	115	116	117	3033
Falkirk	108	106	116	117	241
Sunderland	112	107	111	117	693
Hackney	99	109	110	116	581
Smethwick	98	103	110	115	249
rural Stirling County	108	109	113	115	755
Southwark	116	103	110	114	250
Edinburgh	109	108	112	114	2192
Huddersfield	109	110	112	114	646
Bermondsey	104	106	109	114	212
Lambeth	102	110	112	113	632
Zetland County	110	105	107	112	88
Perth Burgh	102	108	111	112	168
rural Durham	108	109	110	111	1475
Great Yarmouth	102	107	110	111	235
Islington	104	105	106	108	350
rural Perth County	98	102	104	106	240
Plymouth	105	102	103	104	237
Total					22400

age and sex groups to classify the population. This has been done because these are the only groups for which sufficient information was available from past publications. If more detailed population breakdowns are used, the results in terms of inequality, become more dramatic. The same is true if smaller geographical areas are used.

The three areas with the highest mortality rates in the 1990s, Oldham, Salford and Greenock, had mortality ratios only a fifth higher than the national average in the early fifties. Table 1 shows that their rates are now

rising towards being a third higher than the national rate. The table shows that almost a thousand deaths a year would be avoided, were the mortality rates not excessive, in just these three places. Here excess deaths are calculated as deaths above the average rate, not deaths above the best rate, which would produce far higher numbers and a much more dramatic summary. At the other extreme, the ratio in Plymouth was fairly average at the start of the 1980s but is rising, although it is still less than it was in the early 1950s. Nevertheless, 237 deaths would not have occurred in 1990–92 had the mortality rates in this town been the same as the average rates for England and Wales as a whole.

The figure at the end of the table shows the total number of excess deaths in these areas, deaths which wouldn't have occurred in the last three-year period (1990–92) had the mortality rates not been higher than average. The 22,400 deaths represent 16 per cent of all mortality in these areas. Nationally there were 77,000 such excess deaths representing about four per cent of all mortality.

The total proportion of excess deaths in the country can be calculated for each period for which data are available on a consistent basis using identical areas and population groups for each period. This is done in Table 2 for each of the six periods considered, for the whole population and for the two sub-groups in which most premature deaths occur: men and women aged 45–64. The table shows that the overall proportion of excess deaths has remained fairly stable over time at between 4.1 per cent and 4.3 per cent of all deaths. However, for both men and women aged between 45 and 64, the proportion of excess deaths has risen steadily, particularly in the 1980s, after having fallen in the 1960s. A growing proportion of premature deaths in Britain can be attributed to some aspect of rising spatial inequalities. Now almost 10 per cent of deaths to men of these ages occur in areas as an excess over the national mortality rates. The 'all groups' figure conceals this concentration in mortality because of the large and rising proportion of deaths occurring over the age of 65.

Within Britain, premature mortality is becoming more concentrated in certain areas as it also becomes more rare at young ages across Britain

Table 2 *Excess mortality in Britain by local areas (figures are per hundred deaths)*

Period	*All groups*	*Men 45–64*	*(change)*	*Women 45–64*	*(change)*
1950–1953	4.3	7.5		5.6	
1959–1963	4.1	6.9	(−0.6)	5.4	(−0.2)
1969–1973	4.2	7.1	(+0.2)	6.8	(+1.4)
1981–1985	4.2	8.8	(+1.7)	7.8	(+1.0)
1986–1989	4.3	9.8	(+1.0)	8.4	(+0.6)
1990–1992	4.1	9.6	(−0.2)	8.9	(+0.5)

nationally. The overall picture is not a simple one: more people are living in areas of average overall mortality, but more are also living in areas of relatively high mortality; the 1980s have seen a deterioration in equality for many age and sex groups although for some (such as women aged 45–65) geographical inequality began to increase earlier.

The Department of Social Security in the publication on households below average income (1996) divides the population into 10 equal sized groups based on income. The same methodology is used here but the population is divided by SMR rather than income. These decile groups can then be compared, and the relative changes in their mortality charted over time. Because the subject of this paper is area inequalities, the population of Britain is divided into 10 groups of areas at each period. Areas are selected according to the standardised mortality rate for people below the age of 65. They do not have to be made up of contiguous areas, nor do they need to be the same areas over time. What is important is that each of the 10 decile areas contains a tenth of the population at the time it was created. Table 3 shows the absolute mortality rate in each of 10 geographically defined equal population sized areas of the country over the study period, not adjusted for their age and sex distribution. Even without allowing for population structure, it is evident that by the end of the period the mortality rate of those aged under 65 living in the worse decile of areas, at 3.25 per thousand, is more than two-thirds higher than that in the best (it was 56 per cent higher in the 1950s and fell to 43 per cent higher in the early 1960s). This rate is still worse than that experienced by people living in the best areas 20 years earlier (3.07 per thousand). There has thus been no convergence in mortality rates between these equal sized groups of the population.

When the mortality rates are corrected to allow for the differences in the population structure of each group, the divergence in mortality rates by

Table 3 *Absolute mortality rate per 1000 of the population at risk aged under 65 by decile area*

Population decile	*1950–53*	*1959–63*	*1969–73*	*1981–85*	*1986–89*	*1990–92*
1	5.72	5.20	5.01	4.10	3.61	3.25
2	5.22	4.86	4.46	3.58	3.20	2.89
3	5.13	4.52	4.30	3.48	3.05	2.68
4	4.71	4.49	4.06	3.31	2.88	2.56
5	4.64	4.25	3.96	3.12	2.73	2.45
6	4.46	4.08	3.72	2.93	2.62	2.27
7	4.17	3.73	3.58	2.79	2.45	2.27
8	4.01	3.82	3.41	2.68	2.44	2.19
9	3.86	3.70	3.31	2.60	2.29	2.05
10	3.68	3.64	3.07	2.38	2.15	1.94

Table 4 *Age Sex Standardised Mortality ratio for deaths at ages under 65 by decile area*

Population decile	*1950–53*	*1959–63*	*1969–73*	*1981–85*	*1986–89*	*1990–92*
1	131.0	135.5	131.2	135.0	139.2	142.3
2	118.1	123.0	115.6	118.6	120.9	121.4
3	112.1	116.5	112.0	114.2	113.9	111.3
4	107.0	110.7	108.1	109.8	106.9	104.9
5	102.5	104.5	103.0	102.1	102.2	99.0
6	98.6	97.4	96.9	95.7	95.6	93.5
7	93.1	90.9	91.8	91.6	91.9	90.9
8	88.7	87.6	88.9	89.3	89.1	86.5
9	85.7	83.1	87.0	84.3	83.0	80.4
10	81.8	77.1	83.0	79.2	78.1	76.2

area becomes even more evident, as Table 4 shows. The 10 per cent of people living in the highest mortality areas of the country have the worst ever recorded relative mortality rates in the most recent period, with an SMR of 142.3. Since 1981 the standardised mortality ratio of this group has risen by 7.4 percentage points and that of the second decile of the population has risen by 2.7 per cent. All other decile groups have seen their relative mortality rates fall over this period. When standardised for age and sex distributions, people living in the worst tenth of areas of Britain are 42 per cent more likely to die before age 65 than the average person. In the 1950s they were 31 per cent more likely to die than average, while people in the best areas were 18 per cent better off in terms of their relative life chances. Mortality rates are now 24 per cent below average for people living in the best decile area. The gap is clearly growing.

Conclusion

This study supports the findings of the studies cited above. By using a consistent and detailed national geography we have found that in recent years mortality rates by area have been polarising in Britain and, further, that this pattern of excess mortality is very similar for men and women. Indeed, the extent of inequality in mortality in Britain is so strong that, if the Registrar General of 1951 were to repeat the study of mortality carried out then, he would no doubt be shocked by the extent, persistence and widening of the basic divided in British society. Moreover, using a set of consistent geographical boundaries this pattern of polarisation is not a statistical artefact, and because the areas are smaller than regions and counties the polarisation found is more extreme.

Why construct consistent boundaries? If we make efforts to ensure 'good data', we not only minimise the possibility of artefactual explanations, but we are then in a position to move on to discuss possible explanatory factors, in this case, to what extent geographical patterns in mortality are due to the characteristics of people, places or migration. Further studies are needed to assess the relative contribution of these various factors. Such studies should address the extent to which this observed polarisation in mortality is due to changes in the socioeconomic circumstances of individuals, to contextual factors which have altered places, or to differential migration. There is also the important question as to why these changes have occurred.

Geographical inequalities in health are not simply a passive reflection of social inequalities, although social inequalities lie behind a large part of the map of health in Britain. For instance, particular health damaging effects, such as traffic accidents, have a very marked geography (being more prevalent among rural populations). Most important, recent *changes* to the geography of health in Britain – falling mortality rates in remote rural areas and rising mortality rates in London boroughs, for instance (Dorling 1997) – do not mirror changes in the social class composition of these areas as it is conventionally measured. Social classes have actually become slightly more evenly mixed over space in 1990s Britain (Dorling and Woodward 1996). There are many reasons why this mismatch of geographical and social changes might be so, which the authors of this paper are currently investigating.

The evidence we have presented of increasing polarisation shows that, at least until 1992, the government was not on target to reach its commitment to reduce geographical inequalities in health by the year 2000 (Target 1 of the WHO targets for countries in the European Region). Yet as Davey Smith (1993) points out, the fact that mortality rates vary temporally and geographically means that reduction *is* possible. Knowing that something needs to be done and that something can be done about geographical inequalities in health provides us with a solid basis for considering the best ways of reducing such inequalities. Although many interventions are possible the most direct approach is to improve the health service. An increase of NHS funds to areas with high mortality, although preferably not at the expense of other areas, may well be one effective policy. However, this is only likely to be part of the solution. Increases in resources and services do not necessarily result in an increase in use of those services. Differences in health by tenure also suggest the need for the specific targeting of resources and community-based health services, and also indicate the need for other measures such as an improvement in housing and in neighbourhood facilities and services. These are only some of the measures that might be considered. There are likely to be others, in particular interventions based on the finding that deprivation is strongly linked to early mortality. As we move from analysis of data and consideration of validity issues to an exploration

of the reasons for the patterns found, we can increasingly suggest ways of reducing those inequalities as well as describing them.

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Acknowledgements

This research was conducted under ESRC grant number L128251009.

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