Chapter 13

Geographic variations in health: main findings and implications for the future

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Summary of findings

- Age-standardised mortality rates for Scotland, Wales and Northern Ireland were higher than for England for both sexes. Within England, rates in the north were greater than those in the south.
- With some significant exceptions, this pattern was reflected in each age group for the major causes of death.
- Variations between local authorities within regions were greater than variations between regions throughout the United Kingdom.
- There were clear gradients with increasing levels of area deprivation throughout Great Britain in mortality from ischaemic heart disease, lung cancer and stroke and in infant mortality and stillbirth rates. For areas with similar levels of deprivation, mortality rates were higher in the north of England than in the south.
- Those living in more deprived areas had a higher incidence of lung cancer than those in less deprived areas. In contrast, the incidence of breast and prostate cancer shows an inverse association with deprivation; those living in less deprived areas were more likely to develop these cancers.
- Teenage fertility was seven times higher in the more deprived areas of Great Britain than in the least deprived areas. In contrast, higher fertility among older women was generally associated with areas in London, its surroundings and the more prosperous parts of Great Britain.
- Among men, there was a gradient of increasing mortality from ischaemic heart disease, lung cancer and stroke between Social Classes I and V in all countries and regions. The relative difference between these two classes was greatest in Wales, Scotland, Northern Ireland and the northern regions of England and least in the southern regions of England.
- Geographic variation in male mortality across the United Kingdom was minimal among those in Social Class I and increased across the Social Classes. Geographic variations among men in Social Class V were significantly greater than those in any other Social Class.
- Social Class made a larger contribution to male mortality variation than country or region of residence.
- Regional differences in stillbirth and infant mortality rates were reduced when factors such as Social Class were taken into account.
- Regional variations in notifications of congenital anomalies were affected by notification procedures. However, for those anomalies where the risk varies with mother's age, the geographic distribution was closely linked to variations in the mean age of mothers at the birth of their child.

13.1 Introduction

This chapter presents an overview of the main findings in this volume. It points to areas of concern where geographic inequalities have been increasing and comments on those areas where geographic inequalities are reducing. We draw together explanations for the patterns in health presented in the volume and highlight implications for future research.

13.2 Geographic differences in health described in this volume

From the analysis presented in this volume a number of patterns emerge. At country level, Scotland had the highest rates of lung cancer incidence and mortality; ischaemic heart disease (IHD), stroke and accident mortality; suicide; alcohol-related mortality and drug-related poisonings. Wales had the highest incidence of breast, prostate and colorectal cancer. Northern Ireland had the highest mortality from respiratory diseases. There was little variation between countries in stillbirths and infant mortality, although Scotland had a higher stillbirth rate than the other countries. England fared much better than the other countries, having the lowest rates for most of the outcomes discussed above.

However, at regional level within England, a north-south divide in health was evident for many outcomes discussed in this volume. Regions in the north had higher mortality from IHD, stroke, lung cancer and accidents, higher stillbirth and infant mortality rates and higher lung cancer incidence rates. Regions in the north also had higher pregnancy and birth rates for under 18s than those in the south.

A north-south divide in England was not evident in some of the other outcomes presented in this volume. London stood out as having the highest rates of mortality from infectious diseases and respiratory diseases. Suicide, drug-related poisonings and alcohol-related mortality did not show the north-south gradient that was evident for all-cause mortality. There was little geographic variation in breast, prostate and colorectal cancer mortality. There was, similarly, little variation in the incidence of colorectal cancer, while for breast and prostate cancer incidence rates in the south were higher than in the

north. The geographic pattern in mean age at live birth showed that mothers in the south were more likely to be older at the birth of their child than those in the north. Abortion rates were highest in London for women in all age groups. There was not a clear north-south divide in congenital anomaly rates, but for those conditions known to be related to the age of the mother[1,2,3] rates were related to the average age at childbirth in the area.

Geographic patterns in mortality also differed by age as well as cause. At younger ages all-cause mortality rates in London were higher than average, whereas London had lower than average all-age rates. For IHD mortality, rates at ages 45-64 in London were lower than average, whereas stroke mortality rates at these ages in London were very high. No clear north-south divide in all-cause mortality was evident for those aged 15-44.

Differences in infant mortality rates by region were much reduced by accounting for factors such as birthweight, mother's age, Social Class, registration type and mother's country of birth. However, part of the differences between areas remained, indicating that these factors contribute to, but do not wholly account for, geographic differences in infant mortality. Regional differences were also seen in specific causes of infant death, particularly congenital anomalies and immaturity-related conditions.

A central finding in this volume is that differences between countries and regions masked wide differences within the regions themselves. In most cases 'within region' differences were much greater than 'between region' differences. We have used the ONS classification of local authorities[4] and the Carstairs and Morris index of deprivation[5] to describe these differences. Both of these measures group areas together on the basis of the characteristics of the individuals living there.

Urban and industrial areas, described using ONS classification Groups, had the highest stillbirth and infant mortality rates; all-cause mortality rates; mortality rates from major causes of death such as IHD, lung cancer and stroke; and teenage pregnancy rates. The characteristics of these areas include high unemployment, a high proportion of the population in Social Classes IV or V and a high proportion of terraced and social housing. In addition, using the Carstairs and Morris index of deprivation suggested that more deprived areas had higher rates of the outcomes described above than less deprived areas.

However, the pattern of cancer incidence by ONS classification Group varied by the site of the cancer. Urban and industrial areas and deprived areas had the highest rates of lung cancer incidence in both males and females. For colorectal cancer the pattern was unclear, while for prostate cancer and breast cancer the least deprived areas had the highest rates. In addition, fertility patterns by ONS classification Group varied with age; older mean ages at childbirth were found in prosperous areas, in areas immediately surrounding London and in London itself, whereas younger mean ages were found in the more urban and industrial areas, with high teenage pregnancy rates as described above.

From this discussion we can see that some of the differences highlighted between countries and regions can be explained by differences in the characteristics of the individual areas within these countries and regions. Countries and regions with a high percentage of the population living in authorities classified as urban and industrial or deprived had poorer health than those with low percentages living in these areas, although any potential health problems associated with older motherhood will be more prevalent in those areas classified as prosperous and least deprived.

13.3 Changes in geographic variation over time

It has been reported elsewhere that over recent decades, areas already experiencing the worst health have seen the smallest declines in mortality.[6,7] Generally in this volume, we have found that although mortality may be declining, differences between countries and regions have remained similar, or even widened - for example in the case of drug-related poisonings, the rate for London diverged from the rates in other regions during the 1990s.

Trends in fertility showed a slightly different pattern. Although rates have changed over the 1990s, the differences between countries and regions have remained relatively constant. For example, the effect of the 1995 pill scare appears to have been similar for all areas in Great Britain. One exception to this is the Total Fertility Rate, where the rate in Northern Ireland appeared to be converging with the rate in the other countries of the United Kingdom.

Although we have not analysed trends in health at the local level, it is possible at a broad level to compare patterns over time from earlier decennial supplements. It appears that although the names and precise boundaries of the authorities with highest and lowest mortality may have changed over time, they often cover similar geographic areas. For example, mortality in infants was noted by Farr in 1864[8] to be high in urban districts such as East London, Coventry, Whitechapel, Leeds, Wolverhampton, Manchester and Liverpool. Life expectancy at birth was also noted to be low in Manchester and Liverpool in 1911-1912,[9] and has recently been shown to be amongst the lowest in the United Kingdom in 1995-1997.[10] Reference to a north-south divide in mortality was made in 1921,[11] showing that standardised male mortality was highest in the north and lowest in the Midlands if London was included with the south. However, if London was excluded, the south had the lowest mortality. For females, mortality was lowest in the south whether London was included or not. These patterns have persisted into more recent times and were described in detail in the area mortality decennial supplements covering the 1970s[12] and 1980s,[13] as well as in this volume.

13.4 Interpretation of the results presented in this volume

In previous chapters we touched briefly on the interpretation of geographic inequalities in health and possible explanations for the findings in this volume. In this section we consider the following general issues in greater detail:

- Are the differences merely an artefact of the data presented here?
- Do migration patterns contribute to geographic variations in health across the United Kingdom?
- Are there geographic reasons for the differences presented, or are geographic inequalities merely a result of differences in the socio-economic structure of the areas?
- What contributions do health-related behaviour and the environment make to these differences?

Data issues

It is possible that issues such as differential completeness of data or levels of reporting, numerator-denominator biases and data quality may have contributed to some of the geographic differences reported in this volume.

The births and deaths data used in this volume are considered to be complete, as they are obtained from national registration data. However, data on congenital anomalies are not complete[14] and the level of completeness is known to vary by registry, as described in chapter 8 of this volume. Care must also be taken in interpreting variations in cancer incidence, as there are a number of factors that may affect variations between areas including geographic coverage of the cancer registries, methods of data collection and completeness of registration. These and other factors are described in more detail in the recent volume *Cancer Trends in England and Wales 1950-1999*.[15] There are potential biases in data on abortions by area, in particular abortion and conception rates calculated for local authorities may be inflated in areas where non-residents attend for abortion giving a temporary address as their address of usual residence.[16] Differences in the recording of abortions in Scotland compared to England and Wales were also described in detail in chapter 5.

Another issue to be considered is the stability of the geographic areas used in the analysis. The boundaries of areas change, due both to substantive administrative reorganisations and to a continual process of adjustment at small area level. Populations and events associated with individuals in that population may be assigned to one area one year and another the next. These boundary changes therefore pose problems of comparability when analysing data for geographic areas over time, as population exposure to risk is not held constant. One way to get round this problem is to allocate postcodes to boundaries at a fixed point in time and to match the data in other years with this geographic definition. This is the approach adopted in this volume for data for England, Wales and Scotland, using boundaries currently in use as the fixed spatial reference.

However, use of the postcode to allocate events such as births and deaths to geographic areas also poses problems. The post office administers postcodes, and can terminate and re-use them in a different area from the original postcode. This creates two problems for data analysis. First, it is difficult to allocate terminated postcodes to a current area. Second, it is difficult to avoid allocating an event to the wrong area if the postcode has been re-used elsewhere. While these problems can be overcome to some extent, this is far from straightforward. In addition, each postcode covers around 15 addresses. This may cross an area boundary, requiring arbitrary decisions to be taken as to which area to allocate an event with a postcode of this sort. Some events will necessarily be wrongly allocated.

Grid referencing of data - linking addresses to a fixed point on a map - reduces many of the above problems. Data can easily be recast using different boundaries to provide statistics for different areas, independently of the time period during which the boundaries were in use. By choosing a grid referencing system with a suitable degree of spatial definition, the chances of misallocating an address across a boundary are substantially reduced. ONS strategy is to progressively adopt grid referencing. This will enable the Office to respond more easily to boundary change and be more flexible in the outputs it produces.

Artefact explanations

The main problem in inferring causality from geographic patterns is the so-called 'ecological fallacy.' Statistics for areas show the average health experience for people living in that area during a particular time period, as well as the average values for possible causal factors. However, the fact that there is a statistical relationship between health outcomes and other factors at an area level does not imply causality. Robinson was among the first to point out that the behaviour of individuals cannot be inferred from analysis based on aggregate units.[17] Within an area, the individuals with the worst health may not be those with the highest levels of the suspected causal factor. Indeed, those currently experiencing adverse health outcomes in an area may not have been exposed to the risk at all, for sufficient duration or at a point in time that would make the relationship plausible.

A significant issue in looking at area correlations in general, and deprivation in particular, is the effect of collinearity, i.e. that risk factors cluster together. In geographic analyses, this means that if clustering occurs at the area level being analysed, it may be impossible to tell which of the factors is having a causal effect on outcomes. Any inferences may therefore be subject to the ecological fallacy.

Selective migration

The effect of migration on geographic variations in health is always of concern when looking at differences at one point in time. Welton[18] noted this problem in looking at migration into and out of London between 1851 and 1860. He hypothesised a dual effect. Migrants were generally stronger than those who remained, resulting in a relatively unhealthy rural population at ages affected by migration to towns. Also, migrants who then lost their health in the towns returned home to die, or long-standing town-dwellers may have moved to the countryside

after becoming ill. Stevenson,[19] in 1913, also noted the problem of town-dwellers returning to the countryside to die and pointed out that this was difficult to resolve as previous residence in a town would not have been noted anywhere in the death registration. Hill,[20] in 1925, reported on a study carried out to look in more detail at this effect. He concluded that migration of healthy people to the towns was very important, but that the returning home of migrants to die seemed to be less important in affecting death rates. Fox and Goldblatt[21] reviewed this hypothesis using data from the ONS Longitudinal Study and put forward the view that migration selects out two principal groups - those with existing serious health problems, who are more likely to move locally and have high mortality in the short term, and those with very good health over the long term - who tend to predominate among those moving greater distances.

Analysis by Davey Smith and colleagues showed that those areas experiencing the greatest population decline in the 1980s also experienced increases in their mortality rates throughout this period.[22] They suggest that the 'healthy migrant effect' described by Hill was probably responsible for this. Analysis in the previous Decennial Supplement on geography found that movers into more affluent areas tended to have similar or lower mortality than the area they moved into and that the pattern of mortality for migrants across England and the net effect of migration on mortality rates in the area of origin and destination were variable.[23] Another study by Strachan *et al* examined migration into London and showed that movers into London acquired the low mortality rates from IHD seen in London as a whole.[24]

Brimblecombe *et al*, using the mortality data so far available from the British Household Panel Survey, found that migration appeared to make little difference to regional mortality rates,[25] but that it could account for most of the difference in male mortality rates between districts[26] and between deprived and non-deprived areas.[27] However, selective attrition, the method used in collecting the mortality data and small numbers of events may have had an impact on these findings.

Analysis by Reid and Harding[28] attempted to overcome some of the effects of migration on mortality patterns by looking at the mortality of those who remained within the same region between 1981 and 1991, by disadvantage in 1981 and 1991. They found that both region of residence and long-term disadvantage appeared to have independent effects on mortality.

Migration may also have an impact on the fertility patterns seen in chapter 5 as migration occurs more in the childbearing years.[29] Migration appears to be associated with childbearing itself, with the desire to move to more spacious accommodation around the birth of a child. The ability to move depends on housing tenure, income and resources, with those living in shared accommodation before the birth of a child being more likely to move. Fertility rates in under 18s and 18-19s may also be altered by the movements of students to university towns and cities. However, it is difficult to quantify what effect this has on rates.

Differences in the socio-economic structure of the population within areas

One explanation put forward for geographic differences in health is that they simply reflect a concentration of people of lower socio-economic status, with their concordant health problems. This can only be a partial explanation, as the results in this volume demonstrate. Other factors also appear to influence geographic patterns of health in the United Kingdom.

Within the countries of the United Kingdom and the regions of England there are differences in the health of the population by socio-economic status. Within all regions of England babies born to fathers in Social Class V had higher infant mortality rates than those born to fathers in Social Class I, although regional differences persisted across all Social Classes. Both area and individual effects were important in determining geographic differences in adult mortality, with individual Social Class and local area deprivation making a larger contribution to male mortality than country or region of residence. Men aged 20-64 in Social Class V had higher mortality than those in Social Class I living in the same region. Men in Social Class V living in the northern regions of England had higher mortality than men aged 20-64 in Social Class V living in the southern regions of England, while there was little geographic variation within Social Class I.

The extent and causes of socio-economic differences in health, such as these, have been analysed in this country for over 150 years, based on both geographic and occupational differences in mortality. In the mid-1970s, concern at *"Britain's failure to match the improvement in health in some other countries"*[30] focused attention on the contribution made by persistent inequalities in health. The Black report[30] brought together evidence available at that time on inequalities in mortality, longstanding illnesses and utilisation of health services (particularly preventative services). It concluded that, while genetic and cultural or behavioural explanations played their part at different stages of the life course - including smoking patterns and access to and uptake of health care (in particular preventative services such as antenatal care) - the predominant or governing explanation for inequalities in health lay in material deprivation and specific features of the socio-economic environment such as working and housing conditions. Since that report, several generic models, described in more detail in chapter 12, have been suggested which may help in explaining geographic and social patterns of health.

From their examination of the evidence on geographic differences, Shaw and colleagues[7] argue that social circumstances across the entire life course influence health, as do characteristics of the areas in which people live. Thus health inequalities are produced by clusters of disadvantage, and health-related behaviours are strongly related to people's social environment. Brunner and Marmot[31] hypothesise that the social determinants of health may be psychosocial, based on chronic stress associated with organisation of work, degree of social isolation and sense of control over life. They argue that position

in the hierarchy is important, suggesting some concept of relative rather than absolute deprivation.

Wilkinson[32] has hypothesised that greater income inequality is one of the major influences on the proportion of the population who find themselves relatively deprived. In contrast to views emphasising the influence of area on individual health, in looking at the contribution of small areas and personal disadvantage in the ONS Longitudinal Study, Sloggett and Joshi[33] concluded that higher death rates in deprived areas occur because a disproportionate number of socially disadvantaged people live there.

Dahlgren and Whitehead[34] proposed a generic model of health that represents the various determinants of health as layers of influence, one over another. This emphasises that individuals are endowed with fixed characteristics such as age and sex, which influence their health potential. Surrounding the individuals are layers of influence that, in theory, could be modified. These range from personal behaviour, to social and community influences, to wider influences on a person's ability to maintain health and finally to the overall economic, cultural and environmental conditions prevailing in a society.

Health-related behaviour

Geographic variation in behaviours affecting health may have a role in determining the geographic patterns of some of the outcomes described in this volume, most obviously mortality and the incidence of cancer.

Levels of smoking vary quite markedly across the United Kingdom. It is also clear from the analysis in chapters 9 and 10 that the regional pattern of lung cancer incidence and mortality closely follows the regional pattern of smoking described in chapter 3. The effect of deprivation on both lung cancer incidence and mortality also follows the pattern of smoking by deprivation. It is well known that those of lower social status are more likely to be heavy smokers than those of higher status[35] and it is this fact that drives the pattern of lung cancer by deprivation.

Studies have suggested that diet has little influence on regional differences in mortality and alcohol some influence, whereas smoking has a substantial degree of influence.[36] Data presented in chapter 3 of this volume show that alcohol consumption and diet seem to vary only a little between regions and are therefore likely to have limited influence on the regional geographic patterns of health described.

The effect of behaviours where the influence on health is not as clear-cut is difficult to interpret. It is likely that differences in attitude to health and disease across regions and across Social Classes also have an impact on the geographic variation described in this volume but it is far from straightforward to quantify the effects. For example, while physical activity varies across groups with differing social status and shows a north-south divide within England,[37] the contribution this makes to the patterns of health described is unclear.

Genetics

Genetic factors and their differential distribution within the United Kingdom may also have a role to play. Some of the outcomes we have examined in this volume are known to have a genetic cause, for example Down syndrome. Genetics may also influence health and disease in a less direct way. It is possible that the distribution of ancestral populations based on different origins and modes of settlement still influences spatial patterns of health and disease today, despite blurring by centuries of migration and intermarriage. Migration of modern immigrant groups may also play a part in localised clustering of conditions such as sickle-cell anaemia, thalassaemia and polydactyly. Immigrant groups may also carry with them diseases that are more prevalent in their countries of origin. This may, for example, partly explain the higher rates of infectious disease mortality in London, although the role of HIV should not be underestimated.[38]

There is strong evidence of a relationship between blood group and disease.[39] The distribution of blood groups differs across the country and does seem to show a very broad relationship with regional mortality, with those areas having a higher percentage of blood group A genes being lower mortality areas, and those with a higher percentage of O genes being higher mortality areas.[40]

There is also evidence of a relationship between genetics and some diseases. For example, some forms of breast cancer have been shown to be genetically determined.[41,42] Some patients with severe heart problems have a gene that prevents cholesterol being removed from the blood.[43] In addition, the inherited form of Alzheimer's is probably the commonest severe mental illness with an unequivocally genetic basis.[43] However, the effect of these relationships on regional and local mortality variations is difficult to assess.

The environment

Much work has been carried out into the associations between environment and health. In this section we examine some of the aspects briefly and speculate as to whether these associations could have an effect on the geographic patterns of health described in earlier chapters. For example, the environment might have a much stronger role in congenital anomalies than other health measures studied in this volume.[44] The relationship between weather and various aspects of health has been much studied, for example relationships have been found between temperature and IHD,[45] stillbirths and infant mortality,[46] stroke and pneumonia, but not cancer.[47] IHD mortality has also been found to be correlated with rainfall, and it is possible that this has an impact on regional differences in IHD mortality.[45] However, it is thought that the association between IHD and temperature is likely to explain relatively little inter-regional variation, explaining more seasonal variation.[48] Analysis of infant mortality and stillbirths also suggests that it is seasonal variation in temperature that has an effect.[49] Seasonality in mortality has declined since the 1960s, possibly due to increased usage of central heating, but also a decline in air pollution.[50]

The impact of background radiation may be a factor in some diseases. The sedimentary rocks of the south and east (lowland) have a lower content of radioactive elements, and therefore gamma radiation, than the north and west (highland).[40] In addition, doses of radiation that are not permitted in the nuclear industry are not uncommon from natural sources in the high radon areas of Devon and Cornwall.[51] This raises concern as studies of miners occupationally exposed to radon have consistently shown them to be at increased risk of lung cancer.[52] Evidence suggests that residential radon exposure increases the risk of lung cancer by about the same level as this occupational exposure, implying that residential radon may be responsible for about one in 20 lung cancers in the United Kingdom.[53]

Issues of water quality, particularly water hardness, have been much reviewed. Hard water is found in the south and east, soft water in the north and west. A consistent relationship has also been shown between soft water and high levels of heart disease. The most detailed study is the British Regional Heart Study, which studied 253 towns. Water hardness was found to be one of several factors involved in geographic variations in heart disease. Other independent variables were temperature, rainfall, manual employment and car ownership.[54]

Both deficiencies and excesses of certain trace elements, in water and elsewhere, are known to be harmful to health.[55,56] Excesses of nickel, cadmium, mercury and lead are considered hazardous. However, the effect that high levels of cadmium from a disused zinc mine near the village of Shipham has had on the mortality of residents of the village is unclear. The latest study of this village shows all-cause mortality lower than expected, but with a significant excess of cancer incidence and a borderline significant excess of stroke mortality.[57] The potential hazards of lead poisoning from drinking soft water after exposure to lead pipes has also been highlighted,[58] although this is less of a problem today. High concentrations of aluminium in water have been put forward as an explanation of geographic variation in the distribution of Alzheimer's disease,[59] although the strength of the association has since been debated.[60]

Atmospheric pollution is certainly associated with excess mortality from respiratory diseases, a classic example being the great smog of 1952 in London,[61] which caused 4,000 deaths in the period between the 6th and 10th December, and air pollution may be partly responsible for the raised levels of respiratory disease mortality in London. In addition, problems with pollution from petrochemical and chemical complexes may be associated with mortality. This has been demonstrated for cancer in the city of Houston in the United States.[62] A heavy concentration of lung cancer in industrial areas may be indicative of a link with pollution as hypothesised by Haynes,[63] although this is confounded by differential levels of smoking. Doll and Peto have hypothesised that smoking is more responsible for urban excesses of lung cancer than is atmospheric pollution.[64] Particular local problems also exist, for example lead poisoning near roads, and associations with particular industries, for example asbestos, coal, slate, tin and china clay.[65]

Access to services

Before the establishment of the NHS in 1946, the regional distribution of healthcare facilities favoured the south and east of the country, because of the attraction of services to client wealth. These regional differences in England and Wales continued well into the 1970s, because of the maintenance of inherited stock.[40] In 1971, Tudor Hart hypothesised the 'inverse care law', whereby those most in need of health services and health care were the least likely to receive the services and care they required.[66] Since 1976 regional resources have been allocated based on formulae intended to meet health needs, rather than reflecting demand, existing utilisation or supply.[67,68] However, expansion of private services has been concentrated in the south[69] and it is acknowledged that the inverse care law continues to operate in many parts of the NHS.[70] Poverty itself may pose problems in accessing health care services,[71] and an inequitable system may reinforce poverty.[72]

13.5 Discussion

This volume set out to provide a broader view of geographic variations in health than its predecessors. In terms of topics covered, this was achieved by examining mortality (including infant mortality and stillbirths), fertility-related topics (including conceptions, abortions, live births and congenital anomalies) and cancer incidence. In geographic terms, the analyses were extended to cover the whole of the United Kingdom wherever possible. The previous decennial supplement, *Health Inequalities*,[73] had confirmed a widening of socio-economic differences in health. There is also growing concern that the quality of life in many poor neighbourhoods has become increasingly detached from the rest of society.[74] This prompted us to place particular attention on the characteristics of areas and the interplay between place and person in the analyses presented.

This report has confirmed that in the 1990s, mortality from the major causes was higher in Scotland, Wales and Northern Ireland than in England for both sexes and that, within England, the north-south divide persisted. However, variations between local areas within each region were greater than the variations between regions and there were clear gradients with increasing levels of area deprivation across the United Kingdom in mortality from ischaemic heart disease, lung cancer and stroke, and in infant mortality and stillbirth rates. For areas with similar levels of deprivation, mortality rates were higher in the north of England than in the south.

At an individual level, Social Class made a larger contribution to adult male mortality variation than country or region of residence and regional differences in stillbirth and infant mortality rates were partially explained by factors such as Social Class. Among men there was a gradient of increasing mortality from ischaemic heart disease, lung cancer and stroke between Social Classes I and V in all countries and regions. The relative difference between these two classes was greatest in Wales, Scotland, Northern Ireland and the northern regions of England and least in the southern regions of England. There

was little geographic difference in mortality among those in Social Class I. Regional and country differences increased substantially across the Social Classes and were significantly greater in Social Class V than in any other Social Class.

Patterns of cancer incidence varied by site. Those living in more deprived areas had a higher incidence of lung cancer than those in less deprived areas, while the reverse was true for breast and prostate cancers. Teenage fertility was seven times higher in the more deprived areas of the United Kingdom than in the least deprived areas. In contrast, higher fertility among older women was generally associated with areas in London, its surroundings and the more prosperous parts of the United Kingdom. Although regional variations in notifications of congenital anomalies were affected by notification procedures, for those anomalies where the risk varies with mother's age, the geographic distribution was closely linked to variations in the mean age of mothers at the birth of their child.

Each of the administrations in the United Kingdom has developed strategies for health in which the reduction of inequalities is an integral part. The *NHS Plan*[75] for England aims to bring improvements in health across the board and to reduce health inequalities. The White Paper *Towards a Healthier Scotland*[76] calls for a "*coherent attack on health inequalities with a special focus on improving the health of children and young people.*" The recent consultation paper produced by the Department of Health, Social Security and Public Safety in Northern Ireland *Investing for Health*[77] and the Health Strategy for Wales *Better Health Better Wales*[78] both have a commitment to targeting health inequalities.

The information provided in this volume on health status in different areas, its spatial patterning and its relationship to disadvantage will provide the background against which decisions can be made to target action and ensure that appropriate baselines are set to monitor the impact of policies and initiatives on outcomes. In the future, the opportunities provided by the ONS geographic referencing strategy and the greater availability of data on health at local level will improve the quality of local area monitoring and hence bring greater accuracy in assessing the role of neighbourhood characteristics on individuals' health.

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