

Chapter 11

Analysis of mortality by deprivation and cause of death

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Summary

- There was a clear gradient of increasing all-cause mortality with increasing deprivation for all countries of the United Kingdom and regions of England.
- Deaths from ischaemic heart disease, stroke, cancer and lung cancer also followed this general pattern, however, the relationship was not so clear for deaths from suicide and accidents.
- The largest difference between mortality for the most and least deprived areas was seen for ischaemic heart disease and lung cancer.
- For all-cause mortality, for those living in areas of equal deprivation as measured by the Carstairs and Morris index of deprivation, regions in the north had higher mortality than regions in the south. This was also true for ischaemic heart disease, stroke and lung cancer.
- Deprivation was found to be more strongly correlated with mortality than country or region for all causes of death examined.

stronger correlation between mortality and deprivation in the northern regions - often because these areas experience a wider range of deprivation. However, in some areas - with a very narrow range of deprivation - a steeper gradient was observed.³ In addition, some studies have examined the relationship between deprivation and mortality for specific causes of death separately and have found that the relationship is not constant for all causes.^{3, 4, 5}

This chapter examines the relationship between deprivation measured at the area level and mortality within countries of Great Britain and the regions of England, for males and females aged 15-64, between 1991 and 1993. It looks at all causes of death and the following specific causes:

- Ischaemic heart disease
- Stroke
- Cancer
- Lung cancer
- Accidents
- Suicide and undetermined injury

Chapter 10 provides the International Classification of Diseases (Ninth Revision) codes for these causes and a discussion of the likely coding differentials between countries of the United Kingdom.

11.1 Introduction

The geographic relationship between mortality and deprivation has been analysed in a number of studies. Drever and Whitehead examined the relationship between deprivation (using the Department of the Environment's 1991 Index of Local Conditions) and mortality in 350 local authorities in England from 1989 to 1993.¹ The report outlined that there is a very strong relationship between mortality and deprivation at the local authority level. Areas with high deprivation scores tended to have higher mortality than those with lower deprivation scores. This relationship was most marked for males, but it was still strong for females.

The relationship between deprivation at the electoral ward level and mortality has also been very well researched. A positive linear relationship has been confirmed; with increasing deprivation there is an increase in mortality.² In addition, studies have shown that there is no threshold level beyond which increasing deprivation is no longer associated with increasing mortality.³ However, the gradient in increasing mortality with deprivation has shown to be stronger for women than men in some studies, while in others the reverse is true.^{2, 3}

Some studies have looked at whether the relationship between mortality and deprivation varies throughout different parts of Great Britain. Eames and colleagues showed that there is a

11.2 Methods and data

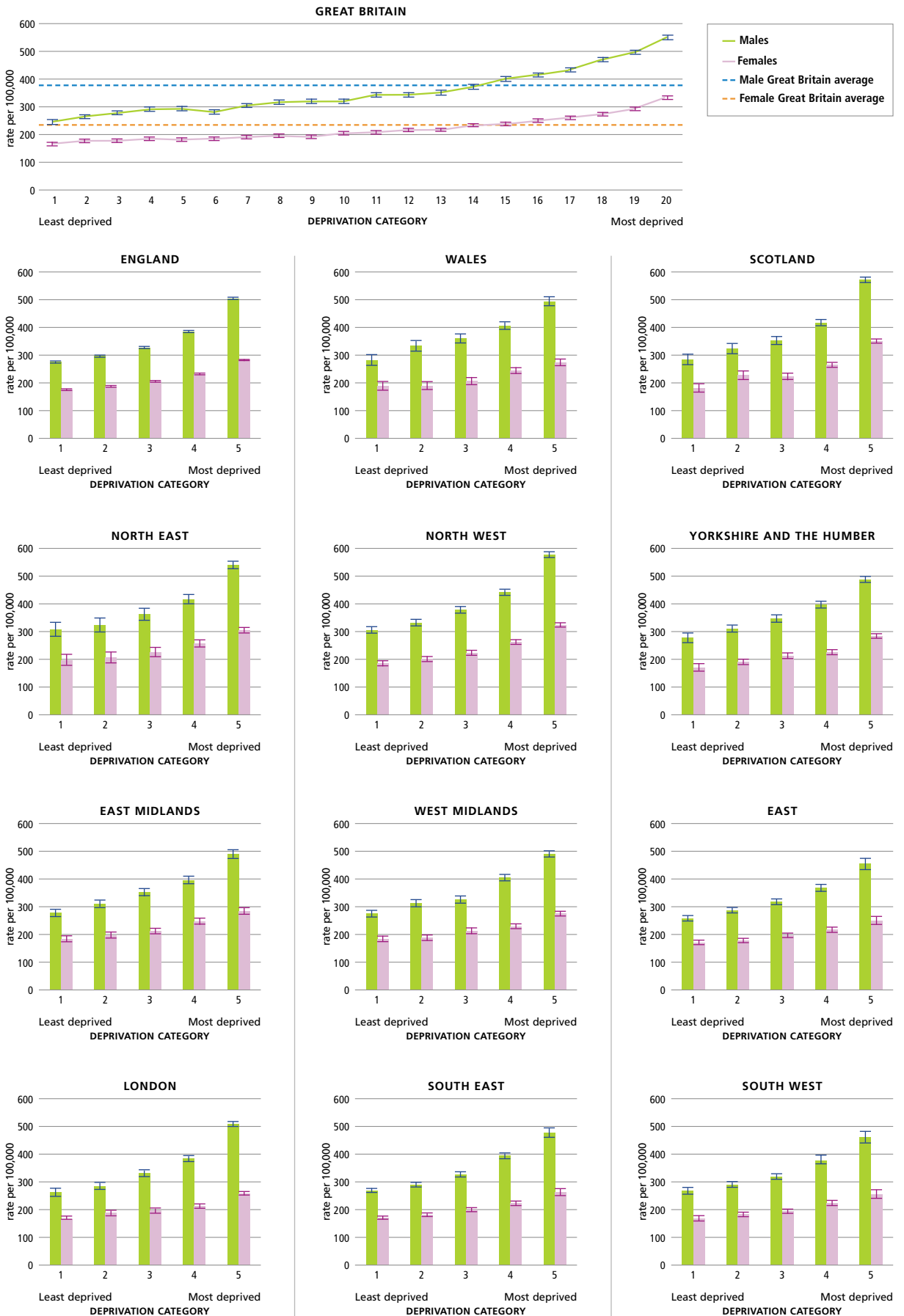
Death records of males and females aged 15-64 in Great Britain were extracted at electoral ward level (postcode sector level in Scotland) for the three years 1991-1993. Analysis was focused around 1991 as population data is only available for this year. All deaths were allocated a Carstairs and Morris deprivation score⁶ for the electoral ward (postcode sector in Scotland) and areas were divided into quintiles and twentieths based on this score. The method of allocating wards and postcode sectors to quintiles and twentieths is explained in more detail in chapter 4. The data was analysed using directly age-standardised mortality rates, for all causes and specific causes of death. For more details see Appendix A.

11.3 All cause mortality

Figure 11.1 shows age-standardised mortality rates by deprivation twentieth within Great Britain for males and females separately. The chart shows clearly that mortality rates increase with increasing deprivation for both males and females. Not only was there a difference between the mortality experience of areas in the most and least deprived twentieths,

Figure 11.1

Age-standardised mortality rates for all causes of death by deprivation, country and region, ages 15-64
Great Britain 1991-1993



but also there was a gradual gradient of increasing mortality with increasing deprivation. This relationship was evident for both males and females where the ratio of mortality rates between the highest and lowest deprivation twentieths was 2.2 and 2.0 respectively, indicating that those living in the most deprived areas had double the mortality rates of those living in the least deprived areas.

Figure 11.1 also shows age-standardised mortality rates by deprivation quintiles for countries of Great Britain and regions of England. For every country and region there was an increase in mortality rates with increasing deprivation for both males and females. The relative difference in mortality between the most and the least deprived areas was higher for males than females in all countries and regions of Great Britain.

At country level, Scotland had the largest relative differences in the mortality experiences of the most and the least deprived (a ratio of 2.0 for males and 1.9 for females). The country with the smallest differences was Wales.

Within England, there was a difference in mortality both within and between deprivation quintiles for the different regions. The greatest relative difference in mortality between the most and least deprived was within London for males and the North West for females (a ratio of 1.9 and 1.7 respectively). Generally the southern regions, except London, had smaller differences between the most and least deprived areas than the northern regions. For the most deprived (deprivation quintile 5), the regions with the highest mortality rates for males and females were the North East and the North West. The lowest rates were found in the East of England, the South East and South West for both sexes. London also had low mortality rates for females in this deprivation quintile. For the least deprived (deprivation quintile 1) the areas with the lowest rates for both sexes were the South West, East of England, South East and London (and Yorkshire and the Humber for females) and those with the highest were the North East (and the North West for males). However within the North East and the North West mortality rates were consistently higher than England as a whole within all deprivation quintiles. In contrast mortality rates were consistently low in each deprivation quintile in the South West for both sexes. So generally there was a north-south divide in mortality rates within deprivation quintiles as regions in the north had higher mortality than regions in the south.

11.4 Ischaemic heart disease (IHD)

Figure 11.2 shows age-standardised mortality rates from IHD by deprivation twentieth within Great Britain. The gradient of increasing mortality with increasing deprivation was very clear for both males and females. The difference in mortality between the highest and lowest deprivation twentieths was 2.7 and 4.2 for males and females respectively, and was much greater than that seen for all-cause mortality presented in Figure 11.1. Although IHD mortality rates were higher for males, there was more variation in female mortality by deprivation twentieth.

The pattern of increasing mortality with increasing

deprivation by quintile within countries of Great Britain and regions of England closely resembles that for all causes of death. The countries with the greatest relative differences in IHD mortality between the deprivation quintile 1 and 5 were Wales and Scotland (difference of 2.2 and 3.1 for males and females respectively).

The geographic variation in female IHD mortality rates for areas of equal deprivation was greater than the variation for males. For example, the difference between the areas with highest and lowest mortality rates within deprivation quintile 5 was 1.4 for males and 1.7 for females, whereas for all causes of death these differences were similar for the two sexes. In addition, there appears to be a north-south divide within England when examining deprivation-specific IHD mortality rates. Areas in the north had higher IHD mortality than areas with equivalent deprivation in the south for both males and females.

11.5 Stroke

Figure 11.3 shows age-standardised mortality rates for stroke within Great Britain by deprivation twentieth. The gradient of increasing mortality with increasing deprivation is less clear than that presented for all causes of death. For example, for females, those that were least deprived had higher mortality rates than those with higher deprivation (twentieths 2 and 3).

The pattern by deprivation quintile presented in Figure 11.3 shows that as a rule the general pattern of increasing mortality with increasing deprivation existed for most countries of Great Britain and regions of England. However, there were some exceptions. For example, in the North East those considered the least deprived (quintile 1) had higher mortality than those that were more deprived (quintile 2 and 3) for both males and females. The gradient of increased mortality with increased deprivation was clearest in the North West and the East of England for males and the West Midlands for females. The greatest differences between the most and least deprived quintiles was in the West Midlands and the South West for females (a difference of 2.5) and Yorkshire and the Humber for males (2.5). As for IHD mortality, there was some evidence that, for areas of equal deprivation, areas in the north of England had higher mortality from stroke than areas in the south of England outside London.

11.6 All cancers

There was a clear gradient of increasing mortality with increasing deprivation, by deprivation twentieth in Great Britain for cancer (Figure 11.4). However, this gradient was less steep than for all cause mortality. For males, mortality rates in the most deprived were 1.9 times those in the least deprived and for females this was reduced to 1.4. This compares to 2.2 and 2.0 for males and females respectively for all causes. Thus, the differences between mortality rates for each deprivation twentieth were greater for males than for females. However, this is likely to be due to differences in the types of cancer dominating these all cancer

Figure 11.2

Age-standardised mortality rates for ischaemic heart disease by deprivation, country and region, ages 15-64
Great Britain 1991-1993

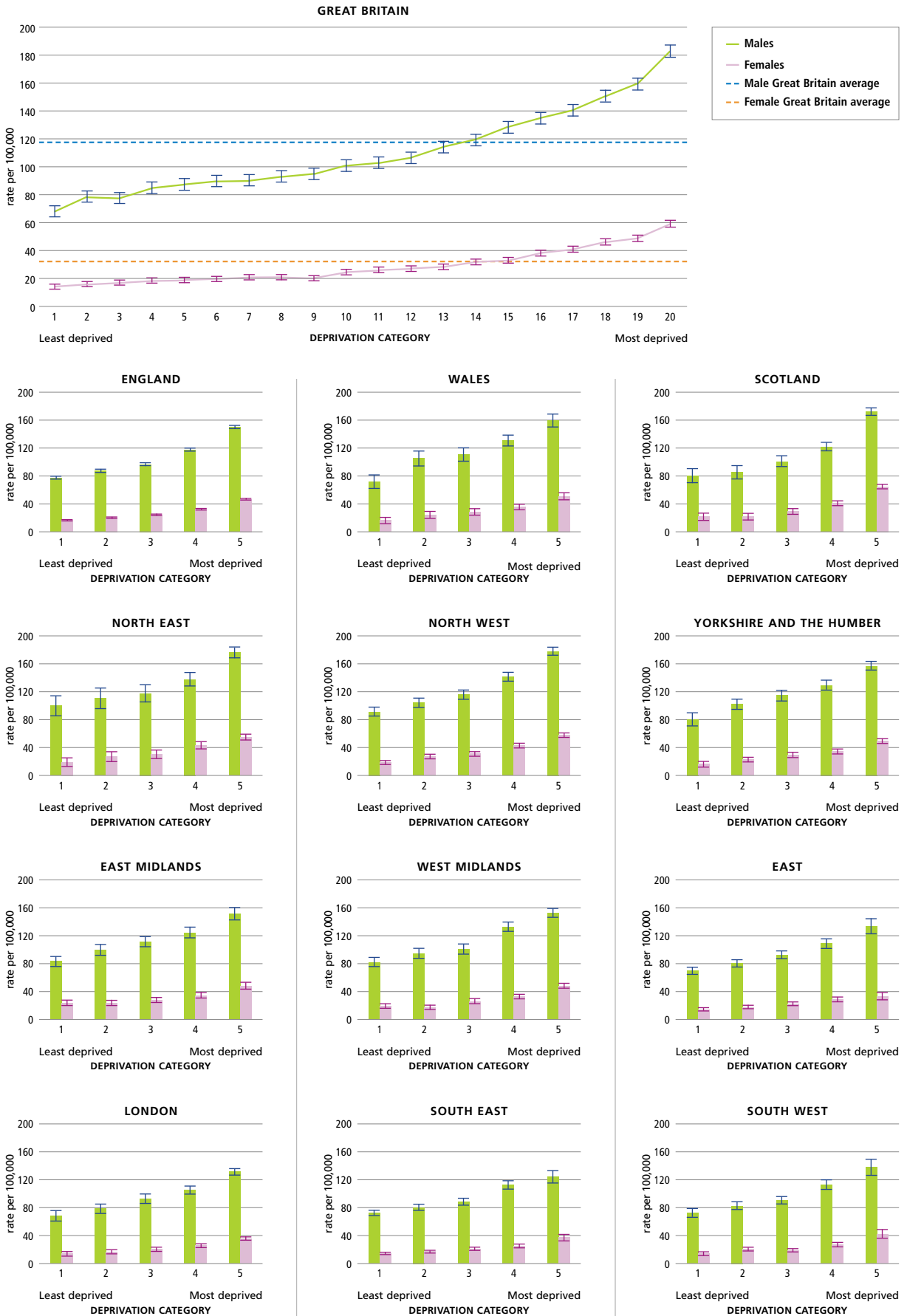


Figure 11.3

Age-standardised mortality rates for stroke by deprivation, country and region, ages 15-64
Great Britain 1991-1993

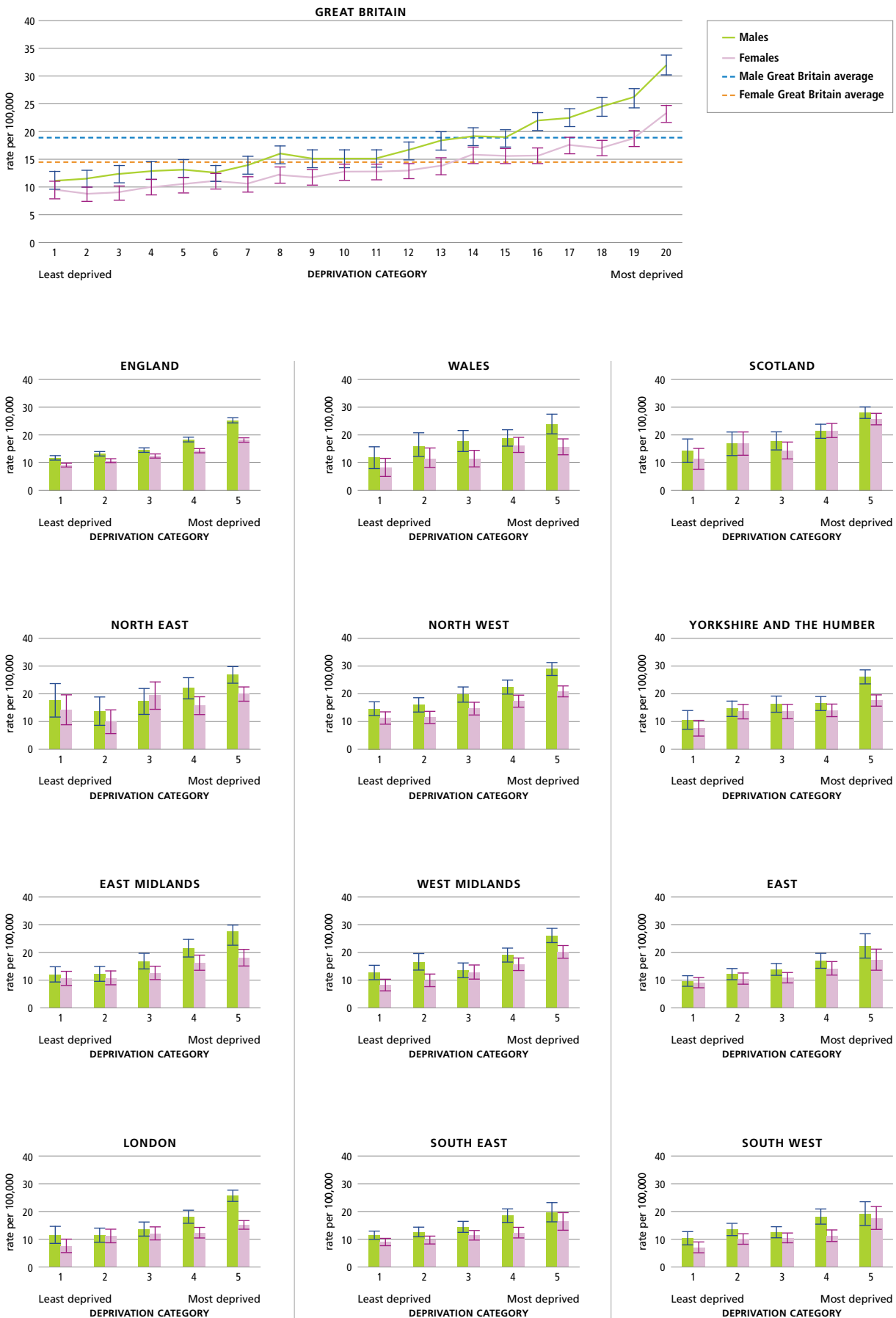
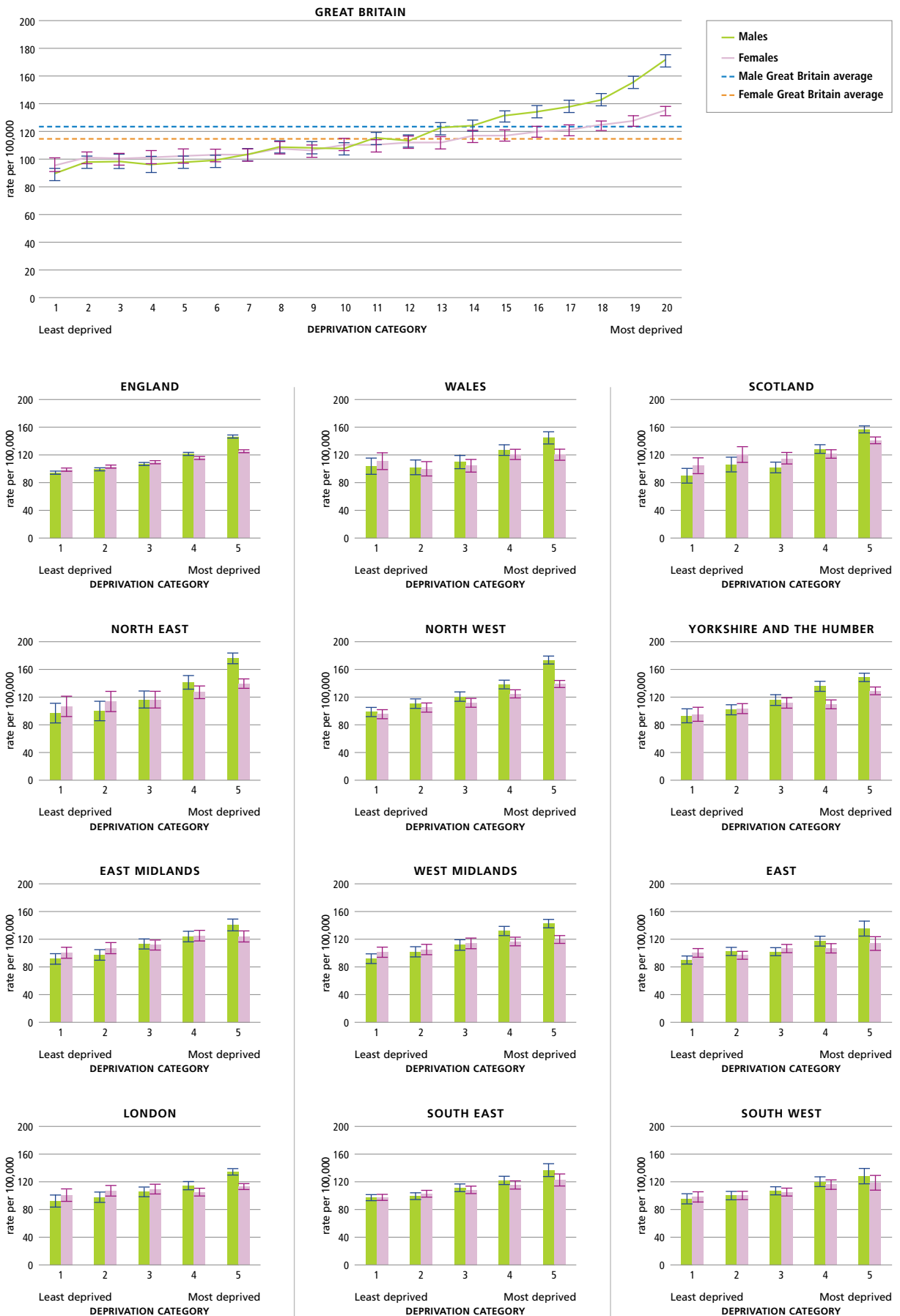


Figure 11.4

Age-standardised mortality rates for all cancers by deprivation, country and region, ages 15-64
Great Britain 1991-1993



rates for males and females. Previous analysis has shown that mortality from lung cancer, the most common cancer in males, more closely follows the traditional relationship with deprivation than breast cancer, the most common cancer in females.⁷ Lung cancer mortality makes up a greater proportion of all cancer mortality in males than females; approximately 29 per cent for males compared to 16 per cent for females. Chapter 10 of this volume, looking at the relationship between breast cancer mortality and ONS classification Group, showed that there was little variation between Groups.

Analysis of cancer mortality by deprivation quintile within countries of Great Britain and regions of England also shows a flatter gradient than was seen for all causes of death. Similarly this may be explained because mortality from certain cancers such as breast and prostate cancer have an inverse relationship with deprivation.⁷ The results indicate that, for females, in some countries and regions the mortality level for those in quintile 2 was equivalent to, or in some cases was less than, mortality levels in deprivation quintile 1 (for example, Wales and the East of England). The greatest relative differences in mortality rates between deprivation quintiles were found in the North East, the North West and Scotland for males, and the North West, Yorkshire and the Humber and Scotland for females.

There was little difference between the mortality experiences of those in the least deprived quintile across Great Britain. However, there were considerable regional differences in cancer mortality for those in the most deprived quintile. The ratio of the male mortality rates in the North East and the South West, the regions with the highest and lowest mortality within this most deprived group, was 1.4.

11.7 Lung cancer

Mortality from lung cancer shows a much clearer gradient of an increase in mortality with increasing deprivation than that seen for all cancers (Figure 11.5). In addition, the distribution of mortality by deprivation twentieth reveals that the mortality rates of those in the highest deprivation category (twentieth 20) were significantly higher than for the next lower deprivation score (twentieth 19). For example those in twentieth 20 had 3.7 and 3.4 times higher mortality than those in twentieth 1 for males and females respectively and 1.2 times higher mortality than those in deprivation twentieth 19 for both males and females.

Examination of mortality by deprivation quintile for males indicates that this general pattern was evident within the different countries and regions of Great Britain. However, for females, in many countries and regions, the first three deprivation quintiles often had quite similar mortality levels. Those in the most deprived category experienced significantly higher lung cancer mortality than those in deprivation quintile 4 for the majority of areas for both sexes. The greatest relative differences between the highest and lowest deprivation quintiles for males were found in Scotland and the North East with smaller differences in the southern regions. This north-south distinction was not so clear for females.

Within deprivation categories the geographic variation was greatest for females. For example within the least deprived (quintile 1), the female mortality rates differed by two fold between the North East, the area with the highest mortality, and the West Midlands. In contrast the ratio was only 1.4 between the North West, the area with the highest mortality, and Scotland for males. However, the analysis of the geographic variation for the most deprived (quintile 5) reveals that the regional distribution of mortality was more pronounced. The difference between areas with high and low mortality in this deprivation group was 1.8 and 2.0 for males and females respectively. Mortality among the most deprived tended to be higher in the north of England compared to the south of England.

11.8 Accidents

The relationship between deprivation and accident mortality differed between the two sexes. For males there was a gradual increase in mortality as deprivation increased (Figure 11.6). The difference between the highest and lowest deprivation twentieths for males was 2.1. However for females there was no relationship between accident mortality and deprivation.

For male accident mortality, the difference between the most deprived and the least deprived was generally smaller than for other causes of death. For example, the region of England with the largest difference was London, where the most deprived had 1.4 times the mortality of the least deprived. In Scotland the differences in mortality by deprivation were high, but the least deprived had higher mortality than those that were more deprived (in deprivation quintile 2). In addition, for males in the North West, Yorkshire and the Humber and London mortality in deprivation quintile 1 was higher than for quintile 2.

11.9 Suicide and undetermined injury

The association between suicide mortality and deprivation in Great Britain also differed between the two sexes. The analysis of the relationship between mortality and deprivation twentieth revealed that for males a gradient between the two variables existed (Figure 11.7). Those considered the most deprived (deprivation twentieth 20) had significantly higher mortality from suicide than any other deprivation group. The male gradient was, however, relatively flat between deprivation twentieths one and fourteen, and then increased as deprivation increased in the most deprived twentieths. However for females there was no specific relationship between the two variables.

A similar unclear pattern is evident by deprivation quintile for the countries of Great Britain and regions of England. For male mortality, the country within Great Britain with the greatest difference between the least deprived and most deprived was Scotland. However, in Wales there was little difference in mortality by deprivation quintile. For the regions of England, the pattern of suicide mortality by deprivation was variable.

Figure 11.5

Age-standardised mortality rates for lung cancer by deprivation, country and region, ages 15-64
Great Britain 1991-1993

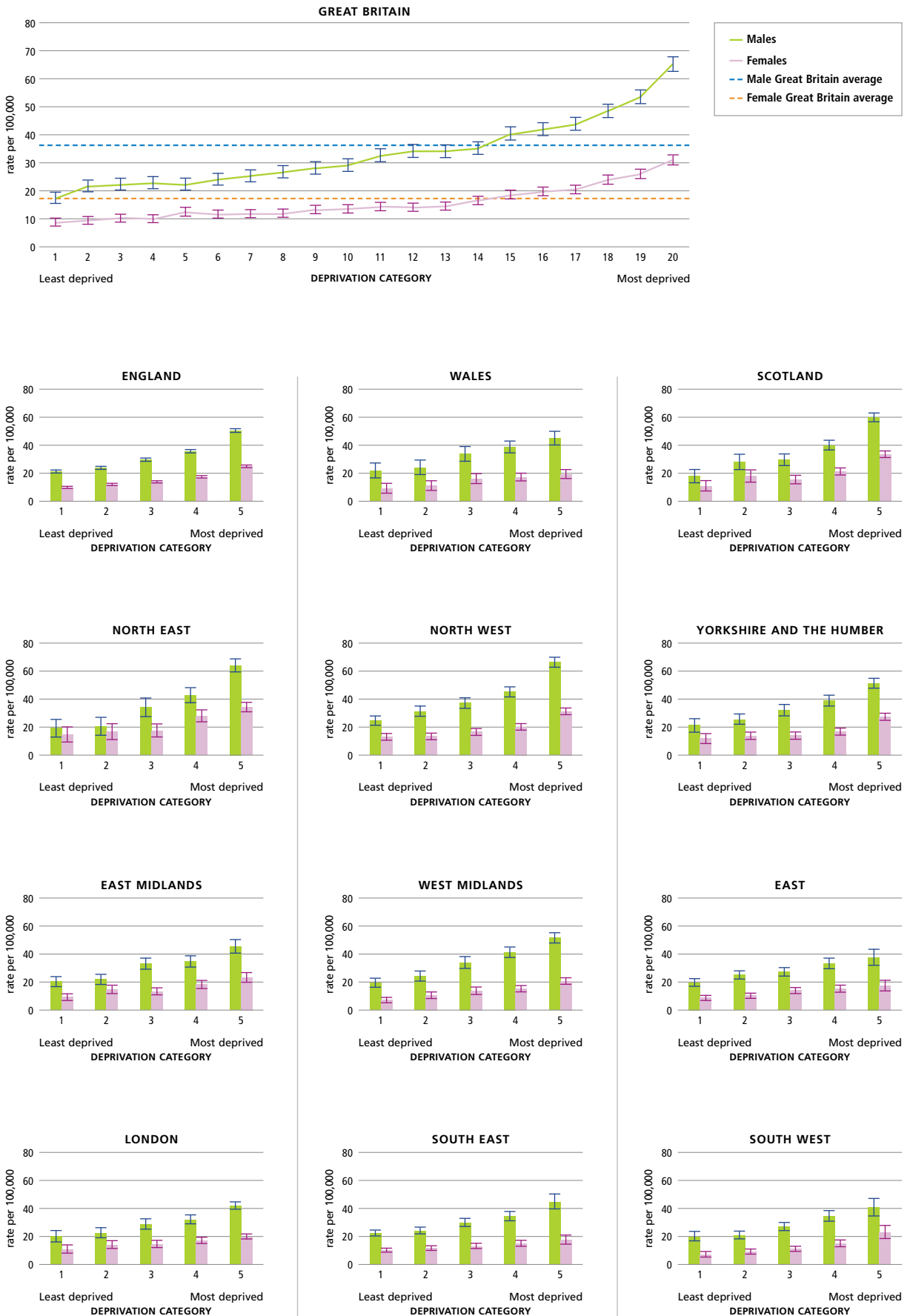


Figure 11.6

Age-standardised mortality rates for accidents by deprivation, country and region, ages 15-64
Great Britain 1991-1993

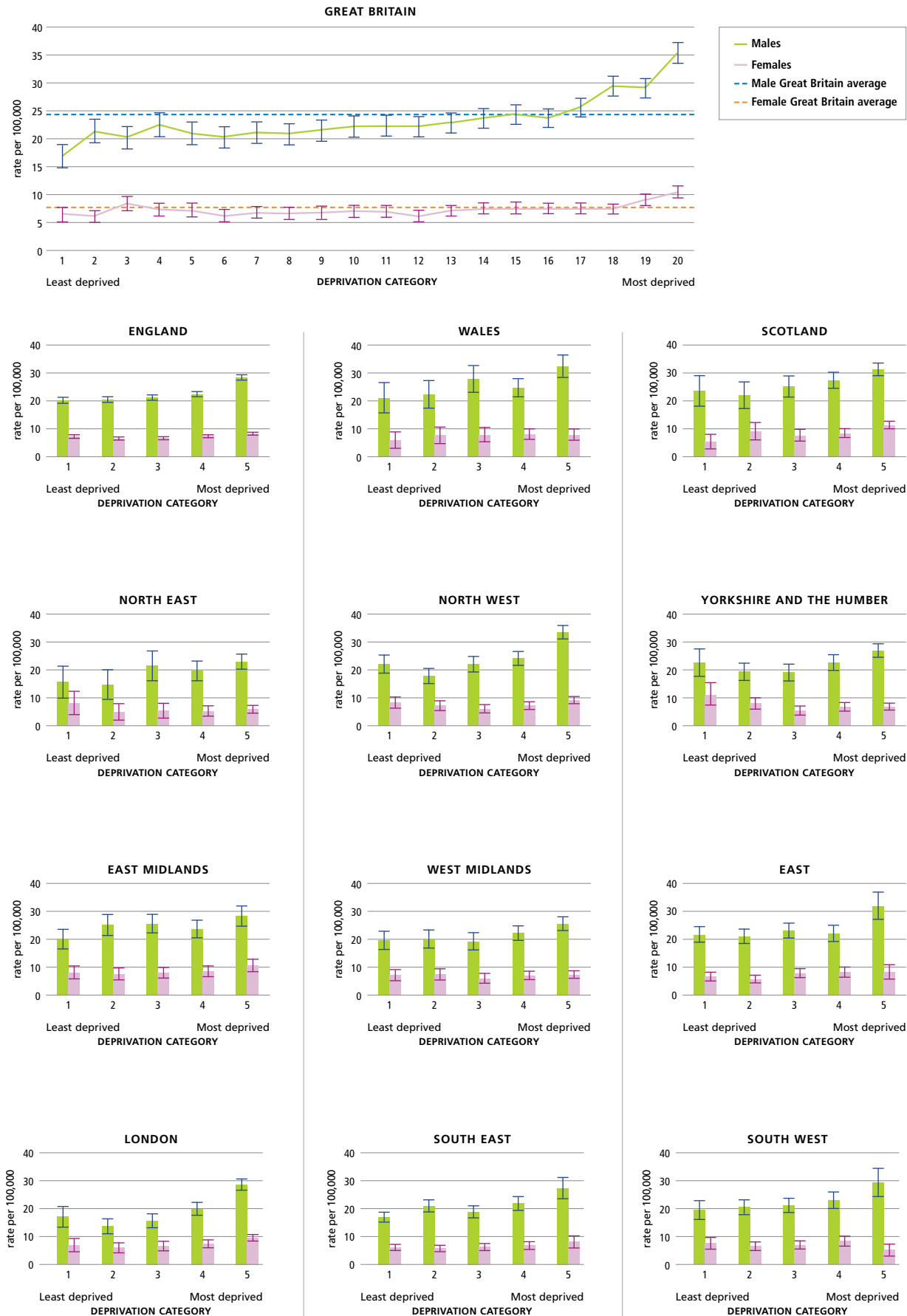
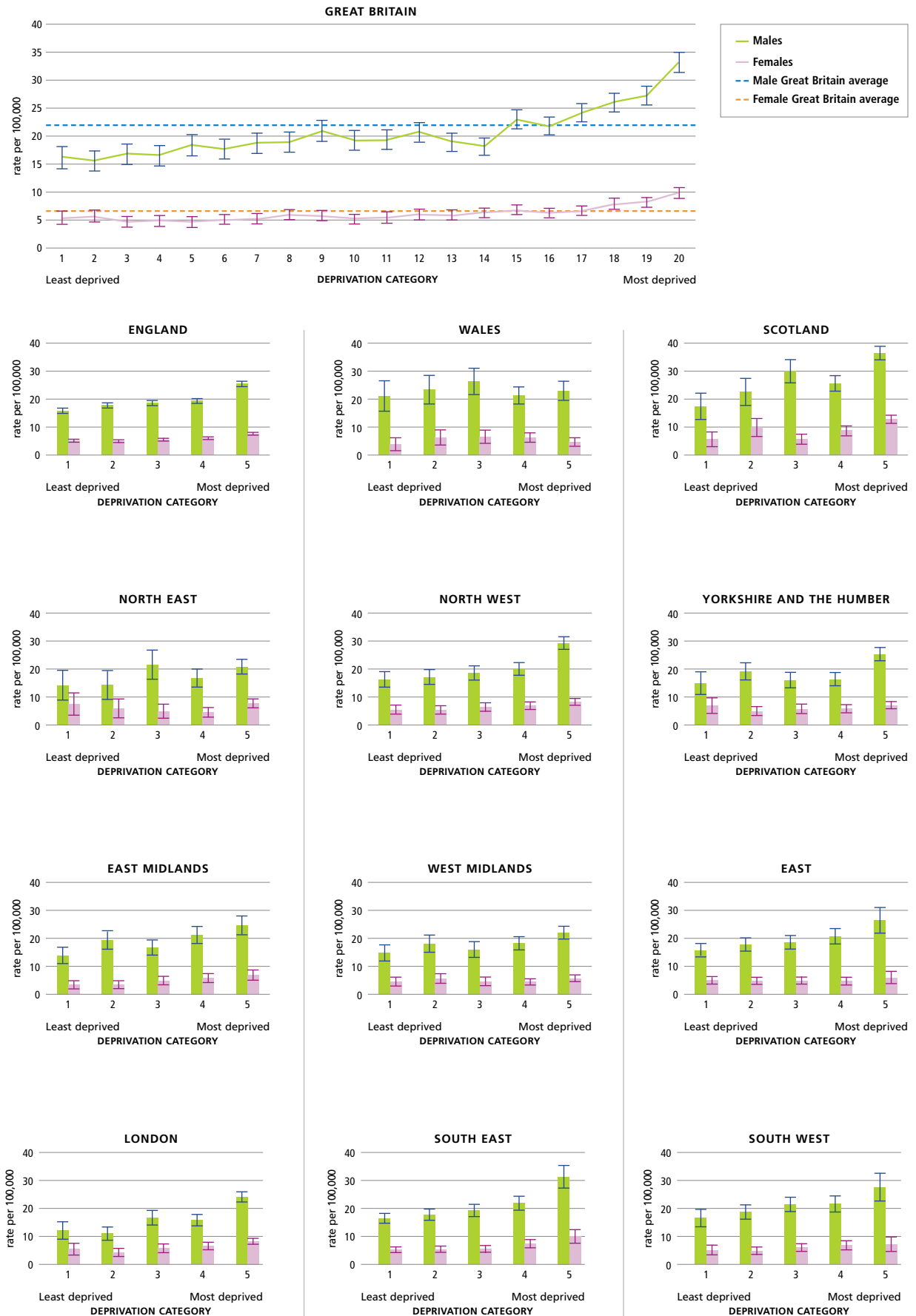


Figure 11.7

Age-standardised mortality rates for suicide and undetermined injury by deprivation, country and region, ages 15-64 Great Britain 1991-1993



However, rates in the North West, Yorkshire and Humber, London and the South East were significantly higher for the most deprived (quintile 5) than elsewhere.

11.10 Discussion

This chapter demonstrates a clear gradient of increasing all-cause mortality with increasing deprivation for all countries of the United Kingdom and regions of England. However, the gradient and the ratio of mortality rates between the most and the least deprived was not consistent for all causes of death. Mortality from IHD and lung cancer showed large differences between the most and the least deprived. In contrast mortality from stroke, all cancers, accidents and suicide showed a weaker relationship with deprivation.

It is also clear from the data presented in this chapter that geographic differences in mortality rates existed between those living in areas with an equal level of deprivation as measured by the Carstairs and Morris index. For all cause mortality, for those living in areas with an equivalent level of deprivation, regions in the north had higher mortality than regions in the south. This was also true for mortality from IHD, stroke and lung cancer. Other causes did not show such a difference.

An analysis of variance was conducted to examine how much of the variation in mortality rates presented in this chapter was accounted for by the country and region of location (country/region) and how much was accounted for by deprivation. The results indicate that both country/region and deprivation contributed to the variation in mortality. For IHD, stroke, cancer and lung cancer approximately 80-90 per cent of the variation in rates was explained by these two factors. A smaller percentage of the variation was explained for other causes of death. The analysis also showed that deprivation is more strongly correlated with mortality than country/region for all causes of death examined.

The major problem with measuring the association between mortality and deprivation at the area level is that the relationship is subject to the ecological fallacy.⁸ The existence of a positive relationship between area level deprivation and mortality does not mean that all individuals in the deprived areas are 'deprived' and, therefore, subject to this increased mortality risk. The extent of this effect is dependent on the proportion of people suffering material deprivation in the deprived area.² Regional differences in the proportion of 'deprived' people in areas classified as deprived may be effecting the results presented in this chapter. However, what is not yet fully understood about the relationship between deprivation and mortality at the area level is whether the differences observed are merely a result of the concentration of people of low socio-economic status within deprived areas, or whether there are other area effects in operation that have not been measured.

Chapter 12 of this volume demonstrates that the gradients in mortality observed when using individual social class

information from a death certificate or area level deprivation scores are very similar. What has not been demonstrated in this chapter, but has been concluded elsewhere, is that if social class is controlled for, a variation in mortality by area level deprivation still exists and vice versa.⁹ This would suggest that there is some other effect of area or geography on mortality, other than that being measured in the deprivation index. In some cases the area effect may be related to factors that are not measured in the study or by the deprivation index such as crime, pollution and environmental factors.¹⁰ For example, it has been reported that there is a decrease in coronary heart disease mortality with increasing water hardness.¹¹

However, another study has found that the relationship between deprivation and mortality at the area level is largely eliminated if the socio-economic characteristics of individuals are controlled for.⁷ Thus this would imply that non-deprived people living in deprived areas are not subject to an increased risk of death. In addition, deprived people living in non-deprived areas are not subject to a protective effect of living in these areas. Therefore it is individual factors that are most important in determining mortality risk. As discussed in chapter 10, analysis examining the association between suicide and area-based deprivation and social fragmentation showed that suicide mortality was more strongly associated with social fragmentation than deprivation, whereas deaths from other causes were more closely related to deprivation.¹² The relative importance of behavioural and material factors in determining inequalities in health has been debated extensively and is beyond the analysis of this volume.^{13,14}

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