

Chapter 7

**Analysis of infant mortality rates by risk factors and by cause of death in England and Wales**

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## Chapter 7

# Analysis of infant mortality rates by risk factors and by cause of death in England and Wales

### Summary

- After accounting for very low birthweight (<1,500 grams), the West Midlands still had a high infant mortality rate; with London and the South East having low rates.
- The North West and Yorkshire and the Humber both had high infant mortality rates for babies weighing 2,500 grams or more, the East of England and South East had low rates.
- Geographic differences in infant mortality persisted for mothers aged 20-29 and 30-39, with Yorkshire and the Humber and the West Midlands having higher rates and regions of the south having lower rates.
- Geographic differences in infant mortality still existed for babies born inside marriage. However, for babies born outside marriage and registered by both parents, only the East Midlands had a high infant mortality rate.
- London had a higher infant mortality rate for babies born outside marriage and registered by the mother alone. Equivalent analysis of ONS classification Groups found that *East Inner London* and *West Inner London* both had higher rates.
- When Social Class was accounted for, excess infant mortality for regions was removed from Social Class I, II and V. The geographic differences persisted in Social Classes IIIN, IIIM and IV, with higher rates in the West Midlands and lower rates in the South East. Wales had a significantly lower infant mortality rate for Social Class IIIM.
- Regional differences remained in the infant mortality rates after accounting for mothers born outside England and Wales, with higher rates in Yorkshire and the Humber and the West Midlands and a lower rate in the East of England.
- Babies of mothers born in Scotland and resident in the North East had a higher infant mortality rate. The East Midlands had a higher infant mortality rate for babies born to resident mothers from an 'Other European Union' country. Babies of mothers born in Pakistan and resident in London had a lower infant mortality rate.
- Regional differences persisted for infant deaths from congenital anomalies and immaturity-related conditions, with a higher rate for Yorkshire and the Humber and the West Midlands, and lower rates in the East of England and the South East.
- The North East and North West had higher infant mortality rates from sudden infant death, and the East of England and South East had lower rates.

### 7.1 Introduction

This chapter looks at geographic variations in overall infant mortality rates by known risk factors<sup>1</sup> for the period 1993-1997 within England and Wales only. The risk factors that were available for analysis were birthweight, mother's age, marital status, Social Class and mother's country of birth. Chapter 6 has already shown that Wales had lower infant mortality than England between 1991 and 1997, and that there was a north-south divide in infant mortality rates within England. In particular, Yorkshire and the Humber and the West Midlands had the highest infant mortality and the East of England, South East and the South West the lowest infant mortality. This section aims to determine whether regional differences in infant mortality persist after controlling for available risk factors. The chapter also analyses infant mortality by cause of death.

### 7.2 Methods and data

Apart from details about the child's sex, area of residence and occupation of his or her parents, death records do not include the fuller range of information recorded at birth registration. Information on birthweight, mother's age, marital status and mother's country of birth are all collected at birth registration only. For this reason, ONS has linked the death records of infants registered in England and Wales to their corresponding birth records since 1975. In Scotland, there is no routine linkage of birth and infant death registration data, even though extensive facilities for record linkage have been developed.<sup>2</sup> There is no routine linkage of data from birth and infant death registration in Northern Ireland. This chapter, therefore, analyses data for England and Wales only. It also presents data for regions within England and by ONS classification Group.

All babies born between 1st January 1993 and 31st December 1997 (where the mother's residence is known) are included in this analysis. Details of all deaths to babies born in this time period have been obtained and linked to their corresponding birth record. For the individual years 1993-1997, between 1 and 2.3 per cent of infant deaths were not linked to their respective birth records and are therefore excluded from this analysis.

Deaths in the first year of life are becoming increasingly rare. Therefore, to analyse data for Government Office Regions, it was necessary to aggregate data over several years. To examine the geographic variations in infant mortality by known risk factors, data for the years 1993-1997 have been combined.

Table 7.1

Live births and infant mortality rates\* by birthweight, country and region  
England and Wales 1993-1997

	Percentage of live births with birthweight stated	Percentage of live births**			Number of infant deaths				Infant mortality rate*			
		<1,500	<2,500	2,500+	with birthweight stated	<1,500	<2,500	2,500+	with birthweight stated	<1,500	<2,500	2,500+
England and Wales	98.7	1.2	7.2	92.8	19,304	8,494	11,509	7,795	6.0	227.9	49.7	2.6
England	98.7	1.2	7.2	92.8	18,311	8,075	10,933	7,378	6.0	228.0	49.7	2.6
Wales	98.7	1.1	6.7	93.3	993	419	576	417	5.7	226.4	49.2	2.6
North East	99.5	1.1	7.3	92.7	973	396	562	411	6.3	231.0	49.8	2.9
North West	98.3	1.1	7.4	92.6	2,679	1,107	1,541	1,138	* 6.3	229.4	49.4	* 2.9
Yorkshire and the Humber	99.2	1.2	7.5	92.5	2,167	924	1,243	924	* 7.0	246.9	52.8	* 3.2
East Midlands	98.9	1.2	7.2	92.8	1,496	667	913	583	6.0	234.2	50.9	2.5
West Midlands	99.1	1.3	7.9	92.1	2,327	1,077	1,462	865	* 6.9	* 251.9	* 55.1	2.8
East	99.2	1.0	6.5	93.5	1,724	772	1,040	684	~ 5.3	229.9	49.3	~ 2.2
London	97.0	1.3	7.8	92.2	3,056	1,445	1,907	1,149	6.0	~ 211.5	48.4	2.5
South East	98.9	1.0	6.5	93.5	2,347	997	1,349	998	~ 4.9	~ 209.1	~ 43.8	~ 2.2
South West	99.3	1.1	6.6	93.4	1,542	690	916	626	5.6	225.5	50.4	2.4

\* rate per 1,000 live births

\*\* number of live births of stated birthweight (eg <1,500 grams) as a percentage of all live births for which birthweight is known.

\* significantly higher than the England and Wales rate

~ significantly lower than the England and Wales rate

### 7.3 Birthweight

A number of studies have found birthweight to be the single most important risk factor for infant mortality.<sup>3,4</sup> The birthweight of a baby may be influenced by social and economic factors prior to the birth. These factors can result in preterm delivery or poor fetal growth with low birthweight. Preterm delivery is also an important risk factor for infant death, but gestation length is not recorded at birth registration in England and Wales.

Previous analysis of singleton live births by birthweight between 1982-1996, shows that the proportion of babies at the upper end of the distribution rose over the period. This suggests that overall, the average birthweight of a singleton has increased.<sup>5,6</sup> In addition, the percentage of low birthweight babies continued to rise in the late 1980s and 1990s.<sup>7</sup> This can be attributed to a rise in the registration of babies weighing under 1,000 grams and to a rise in multiple births. This is thought to be largely due to the increasing survival rate of very preterm babies as a result of improvements in the intensive care received.

The World Health Organisation definitions of birthweight are shown in Box 7.1.

Between 1989 and 1993 ONS's predecessor stopped investigating cases where the birth information was not recorded at birth registration. Subsequently, the number of live birth records with birthweight missing was 3.3 per cent in 1993. During 1994, these investigations were re-introduced, so that by 1997 birthweight was not stated for only 0.17 per cent of all live births.<sup>9</sup> Therefore, any mention of the percentage of live births by birthweight refers to the percentage of stated birthweight, where the birthweight was stated at birth registration.

#### Box 7.1

##### WHO definitions of birthweight

**Birthweight:** The first weight of the fetus or newborn obtained after birth.

**Extremely low birthweight:** Less than 1,000g (up to and including 999g).

**Very low birthweight:** Less than 1,500g (up to and including 1,499g).

**Low birthweight:** Less than 2,500g (up to and including 2,499g).

Source: *International statistical classification of diseases and related health problems, tenth revision* (1992).<sup>8</sup>

Table 7.2

Live births and infant mortality rates\* by birthweight and ONS classification Group  
England and Wales 1993-1997

	Percentage of live births with birthweight stated	Percentage of live births**			Number of infant deaths				Infant mortality rate*			
		<1,500	<2,500	2,500+	with birthweight stated	<1,500	<2,500	2,500+	with birthweight stated	<1,500	<2,500	2,500+
England and Wales	98.7	1.2	7.2	92.8	19,304	8,494	11,509	7,795	6.0	227.9	49.7	2.6
Rural Amenity	99.3	1.0	6.1	93.9	757	341	458	299	~ 4.8	218.2	48.3	~ 2.0
Remoter Rural	99.1	1.0	6.3	93.7	663	265	372	291	5.8	228.1	52.3	2.7
Established Manufacturing Fringe	98.7	1.1	6.9	93.1	1,001	435	604	397	5.9	231.5	51.7	2.5
New and Developing Areas	99.0	1.2	7.2	92.8	1,523	681	890	633	6.1	228.8	49.3	2.7
Mixed Urban	99.0	1.0	6.5	93.5	1,375	650	857	518	~ 5.3	240.1	50.9	~ 2.1
Coast and Country Resorts	98.8	1.1	6.6	93.4	1,215	519	695	520	5.7	224.8	49.4	2.6
Established Service Centres	99.2	1.2	7.4	92.6	1,207	508	706	501	6.1	215.8	48.2	2.7
Growth Areas	99.0	1.0	6.2	93.8	1,903	854	1,137	766	~ 4.8	219.3	46.2	~ 2.1
Most Prosperous	99.2	0.9	6.0	94.0	543	236	325	218	~ 4.5	216.7	44.8	~ 1.9
Coalfields	99.3	1.2	7.2	92.8	2,130	952	1,263	867	6.4	245.4	52.4	2.8
Manufacturing Centres	99.3	1.3	8.7	91.3	2,812	1,176	1,647	1,165	* 7.7	* 247.5	51.5	* 3.5
Ports and Industry	98.0	1.3	8.1	91.9	1,395	584	834	561	* 7.0	229.6	51.3	* 3.0
Education Centres and Outer London	97.7	1.3	7.7	92.3	1,619	732	992	627	5.8	~ 201.7	46.7	2.4
West Inner London	94.7	1.3	7.4	92.6	360	172	218	142	5.7	206.2	47.0	2.4
East Inner London	95.2	1.6	8.9	91.1	801	389	511	290	* 7.4	228.7	53.0	2.9

\* rate per 1,000 live births

\*\* number of live births of stated birthweight (eg <1,500 grams) as a percentage of all live births for which birthweight is known.

\* significantly higher than the England and Wales rate

~ significantly lower than the England and Wales rate

### England, Wales and Government Office Regions

Table 7.1 confirms findings from chapter 6 and shows that Wales had lower infant mortality than England between 1993 and 1997 and that within England, Yorkshire and the Humber and the West Midlands had the highest rates and the East of England, the South East and the South West the lowest.

Birthweight-specific infant mortality rates show that infant mortality decreases dramatically with increasing birthweight. In England, 1.2 per cent of all live births weigh less than 1,500 grams. In Wales this figure was 1.1 per cent. The infant mortality rate for England for babies born weighing less than 1,500 grams, was 228 per 1,000 live births; whilst the rate for Wales was 226. This was 38 times the overall infant mortality rate in England and 40 times the rate in Wales. This means that 1 in 5 of the around 1 per cent of live births weighing less than 1,500 grams, will die before completing one year of life.

Therefore, it is likely that areas with a large percentage of very low birthweight babies had higher infant mortality rates. However, within England, the West Midlands and London had the highest percentage of live births weighing less than 1,500 grams (1.3 per cent). Table 7.1 does show that the West

Midlands had the highest infant mortality rate of all regions of England for babies weighing less than 1,500 grams, but London had significantly lower infant mortality rates compared to England and Wales within this birthweight category. The rate ratio between the regions in England with the highest and lowest infant mortality rates, for babies weighing less than 1,500 grams was 1.2. This was less than the differential presented for the overall infant mortality rates in this table and in chapter 6 (Table 6.1).

In England, 7.2 per cent of live births had a birthweight less than 2,500 grams, compared to 6.7 per cent in Wales. Babies born weighing less than 2,500 grams in England had an infant mortality rate of 49.7 per 1,000 live births; in comparison, Wales had a rate of 49.2. West Midlands had the highest percentage (7.9 per cent) of babies born weighing less than 2,500 grams and the East of England and the South East the lowest (6.5 per cent). The West Midlands had a significantly higher infant mortality rate for babies born weighing less than 2,500 grams and the South East had a significantly lower rate.

The infant mortality rate for babies weighing 2,500 grams or more in both England and Wales, was 2.6 per 1,000 live births.

Table 7.3

Live births and infant mortality rates\* by mother's age, country and region  
England and Wales 1993-1997

	Percentage of live births				Number of infant deaths				Infant mortality rate*			
	<20	20-29	30-39	40+	<20	20-29	30-39	40+	<20	20-29	30-39	40+
England and Wales	6.7	53.8	37.7	1.8	2,135	10,828	6,939	462	9.7	6.2	5.6	8.0
England	6.6	53.6	38.0	1.8	2,019	10,236	6,616	443	9.9	6.2	5.6	8.1
Wales	8.8	57.1	32.7	1.5	116	592	323	19	~ 7.5	5.9	5.6	7.4
North East	10.0	56.4	32.5	1.2	155	548	278	13	10.1	6.3	5.6	7.0
North West	8.4	55.7	34.4	1.5	354	1,538	884	56	9.9	6.4	6.0	8.8
Yorkshire and the Humber	8.4	57.7	32.5	1.4	278	1,293	635	41	10.5	* 7.1	* 6.2	9.4
East Midlands	7.2	56.3	35.1	1.4	172	935	442	37	9.6	6.6	5.0	10.3
West Midlands	7.7	56.8	33.8	1.6	264	1,332	784	64	10.1	* 6.9	* 6.8	* 11.9
East	5.2	53.4	39.7	1.7	160	964	637	28	9.4	~ 5.5	~ 4.9	~ 5.0
London	4.9	48.5	44.2	2.5	266	1,585	1,396	96	10.4	6.2	6.0	7.3
South East	5.0	50.1	42.9	2.0	214	1,253	971	67	8.9	~ 5.2	~ 4.7	7.0
South West	5.7	53.7	38.8	1.8	156	788	589	41	9.9	~ 5.3	5.5	8.2

\* rate per 1,000 live births

\* significantly higher than the England and Wales rate

~ significantly lower than the England and Wales rate

The East of England and the South East had the highest percentage (93.5 per cent) of babies born weighing 2,500 grams or more and West Midlands the lowest (92.1 per cent). The North West and Yorkshire and the Humber both had significantly higher infant mortality rates for babies born weighing 2,500 grams or more compared to England and Wales. The East of England and the South East had significantly lower infant mortality rates for babies weighing 2,500 grams or more compared to England and Wales as a whole, a rate of 2.2 per 1,000 live births. The rate ratio for the regions with the highest and lowest infant mortality rate was 1.4, for babies weighing 2,500 grams or more. Therefore, even within this birthweight category large geographic variations in infant mortality exist.

#### ONS classification Groups

Table 7.2 shows that *East Inner London* had the highest percentage (1.6 per cent) of live births weighing less than 1,500 grams and *Most Prosperous* the lowest. Chapter 6 has already demonstrated that *East Inner London* and *Manufacturing Centres* had the highest infant mortality rate between 1991 and 1997 and *Growth Areas* and *Most Prosperous* the lowest. Table 7.2 confirms these findings. However, when birthweight was controlled for we can see that the excess infant mortality was much reduced. For babies with birthweight less than 1,500 grams, only *Manufacturing Centres* had a significantly higher infant mortality rate than England and Wales as a whole.

The percentage of babies weighing less than 2,500 grams ranged from 6 per cent in *Most Prosperous* areas to 8.9 (over 47 per cent higher) in *East Inner London*. No ONS classification Group had significantly higher or lower infant mortality than England and Wales for babies born weighing less than 2,500 grams.

Babies weighing 2,500 grams or more accounted for between 91.1 per cent (*East Inner London*) to 94 per cent (*Most Prosperous*) of all live births. *Manufacturing Centres* and *Ports and Industry* both had significantly higher infant mortality rates than England and Wales for babies weighing 2,500 grams or more. *Rural Amenity*, *Mixed Urban*, *Growth Areas* and *Most Prosperous* were the areas with significantly lower rates for babies weighing 2,500 grams or more at birth compared to England and Wales.

#### 7.4 Mother's age

Previous analysis of infant mortality rates by mother's age shows that infant mortality is high for mothers aged under 20, is relatively low for mothers in their twenties and thirties; and then rises with age for mothers aged 35 and over. The age at which women have children is influenced by their socio-economic status, including job opportunities, access to further and higher education and training in their employment. In addition, women with high levels of education and training in their employment are more likely to have partners in professional jobs. Thus, relatively few women with partners in

Table 7.4

Live births and infant mortality rates\* by mother's age and ONS classification Group  
England and Wales 1993-1997

	Percentage of live births				Number of infant deaths				Infant mortality rate*			
	<20	20-29	30-39	40+	<20	20-29	30-39	40+	<20	20-29	30-39	40+
England and Wales	6.7	53.8	37.7	1.8	2,135	10,828	6,939	462	9.7	6.2	5.6	8.0
Rural Amenity	4.5	50.2	43.2	2.1	77	365	313	24	10.9	~ 4.6	~ 4.6	7.4
Remoter Rural	5.9	55.9	36.4	1.8	61	371	233	16	9.0	5.8	5.6	7.8
Established Manufacturing Fringe	7.3	57.0	34.3	1.4	107	593	333	18	8.5	6.0	5.6	7.3
New and Developing Areas	6.6	57.0	35.0	1.4	185	900	491	17	11.0	6.2	5.5	4.9
Mixed Urban	5.2	51.5	41.6	1.7	128	746	542	32	9.5	~ 5.5	~ 5.0	7.1
Coast and Country Resorts	7.2	55.3	35.7	1.8	127	701	437	32	8.1	5.8	5.6	8.4
Established Service Centres	8.2	55.5	34.7	1.5	153	665	402	28	9.3	6.0	5.8	9.2
Growth Areas	4.1	50.1	43.9	1.9	140	980	820	61	8.5	~ 4.9	~ 4.7	8.2
Most Prosperous	3.2	40.9	53.2	2.7	35	240	265	25	9.2	~ 4.8	~ 4.1	7.6
Coalfields	10.1	59.7	29.1	1.1	304	1,254	620	45	8.9	6.2	* 6.3	* 12.2
Manufacturing Centres	9.0	59.6	30.0	1.4	363	1,735	789	51	10.9	* 7.9	* 7.1	9.9
Ports and Industry	9.9	56.2	32.5	1.4	205	838	422	22	10.1	* 7.3	* 6.3	7.6
Education Centres and Outer London	4.5	47.9	45.1	2.5	134	846	730	47	10.4	6.2	5.7	6.7
West Inner London	4.0	41.7	50.8	3.5	24	167	195	18	9.1	6.0	5.8	7.7
East Inner London	6.6	51.7	39.1	2.6	92	427	347	26	12.2	* 7.3	* 7.8	8.8

\* rate per 1,000 live births

\* significantly higher than the England and Wales rate

~ significantly lower than the England and Wales rate

Social Classes I or II have babies before they reach the age of 20. Concern about teenage pregnancy has increased the extent to which data on this subject are compiled and published. Analysis on a wide range of data on teenage pregnancy shows that, compared with all births, babies born to teenagers have high rates of infant mortality and a high percentage of babies are born with a low birthweight.<sup>10</sup> In comparison there are a number of factors affecting a woman's decision to have a child in her late thirties. Some may have long histories of miscarriage or perinatal deaths, others may have remarried or started a new partnership, while others may have only recently decided to start a family. Some births to older women may be to women with a large number of children already, whereas others will be to women who have decided to delay childbearing for some reason. As parity (the number of previous live and stillborn children) is only collected for births inside marriage it is not possible to take these factors into consideration in this chapter.

This section looks at variations in infant mortality rates by mother's age at the time of the child's birth, grouped in four categories (under 20, 20-29, 30-39 and 40 and over).

#### England, Wales and Government Office Regions

Table 7.3 shows that babies born to mothers aged under 20 had the highest infant mortality rates, a rate of 9.9 per 1,000 live births for England. Wales had a significantly lower infant mortality rate for babies born to mothers aged under 20

compared to England and Wales as a whole, a rate of 7.5 per 1,000 live births. This agrees with other findings that babies born to teenage mothers have around a 60 per cent higher than average infant mortality rate.<sup>11</sup> Seven per cent of all live births in England and 9 per cent of all live births in Wales were to mothers aged under 20. In the North East, mothers aged under 20 accounted for 10 per cent of all live births. In comparison, less than 5 per cent of all live births in London were to mothers aged under 20. Both these regions along with Yorkshire and the Humber and the West Midlands, had infant mortality rates above 10 per 1,000 live births for babies born to mothers aged under 20, although these differences were not significant.

More than half of all live births (54 per cent) in England and (57 per cent) in Wales were to mothers aged 20-29. The infant mortality rate for babies born to mothers aged 20-29 was 6.2 per 1,000 live births in England, and 5.9 in Wales. Yorkshire and the Humber and the West Midlands had significantly higher rates for babies born to mothers aged 20-29 compared to England and Wales. The East of England, South East and South West all had significantly lower infant mortality rates than England and Wales for babies born to mothers aged 20-29. Therefore, large geographic differences in infant mortality can be seen even within specific mother's age groupings. The same regions with high and low overall infant mortality rates had high or low rates for those mothers aged 20-29. A similar pattern was seen for women aged 30-39.

Table 7.5

Live births and infant mortality rates\* by marital status, country and region  
England and Wales 1993-1997

	Percentage of live births			Number of infant deaths			Infant mortality rate*		
	Inside marriage	Outside marriage joint registration	Outside marriage sole registration	Inside marriage	Outside marriage joint registration	Outside marriage sole registration	Inside marriage	Outside marriage joint registration	Outside marriage sole registration
England and Wales	65.7	26.7	7.6	11,832	6,477	2,055	5.5	7.4	8.3
England	66.0	26.5	7.5	11,278	6,093	1,943	5.5	7.4	8.3
Wales	61.4	29.8	8.8	554	384	112	5.1	7.3	7.3
North East	57.9	32.2	9.9	486	387	121	5.4	7.8	8.0
North West	60.0	29.7	10.3	1,515	979	338	5.9	7.7	7.6
Yorkshire and the Humber	63.5	28.5	8.0	1,308	706	233	* 6.6	7.9	9.3
East Midlands	65.5	27.3	7.2	887	564	135	5.4	* 8.3	7.4
West Midlands	65.0	26.9	8.0	1,471	735	238	* 6.7	8.0	8.7
East	70.8	23.9	5.2	1,137	522	130	~ 4.9	~ 6.6	7.5
London	66.4	25.2	8.4	1,921	976	446	5.5	7.4	* 10.1
South East	71.3	23.5	5.2	1,576	760	169	~ 4.6	~ 6.7	~ 6.7
South West	68.5	25.4	6.1	977	464	133	5.2	6.6	7.9

\* rate per 1,000 live births

\*significantly higher than the England and Wales rate

~ significantly lower than the England and Wales rate

England had an infant mortality rate of 8.1 per 1,000 live births, for babies born to mothers aged 40 and over. The equivalent rate for Wales was 7.4 per 1,000 live births. In England and Wales, only 1.8 and 1.5 per cent respectively of all live births were born to mothers aged 40 and over. The West Midlands had a significantly higher infant mortality rate for babies born to mothers aged 40 and over than England and Wales and the East of England had a significantly lower rate.

### ONS classification Groups

Table 7.4 shows that no ONS classification Group had significantly higher or lower infant mortality rates than England and Wales as a whole for mothers aged under 20.

*Manufacturing Centres, Ports and Industry* and *East Inner London* all had significantly higher infant mortality rates for women aged 20-29 and 30-39 compared to England and Wales. In comparison, *Rural Amenity, Mixed Urban, Growth Areas* and *Most Prosperous* all had significantly lower infant mortality rates for women aged 20-29 and 30-39 compared to England and Wales. This was a similar pattern to that presented for overall infant mortality. Authorities classified as *Coalfields* had significantly higher infant mortality rates for mothers aged 30-39 and 40 and over; it was the only Group which had a significantly higher rate for women aged 40 and over.

### 7.5 Marital status

Infant mortality is known to be strongly associated with the parents' marital status.<sup>12</sup> In England and Wales, the proportion of births inside marriage has fallen from 91 per cent in 1976 to 62 per cent in 1998, whilst the proportion registered outside marriage has quadrupled over the period from 9 per cent to 38 per cent.<sup>13</sup>

For details of both parents to be recorded at birth registration for births outside marriage, both parents have to be present at the registration. However, if the father completes a statutory declaration form prior to the registration then his name can be recorded on the birth certificate and the birth is classed as a joint registration outside marriage. If the father does not attend the registration or does not complete a statutory declaration form, then the birth is registered as a sole registration. For sole registration, no details on the father are collected.

In interpreting births by marital status it also has to be borne in mind that marriage patterns vary from culture to culture. In 1997 in England and Wales, only 0.9 per cent of births to women born in Bangladesh were outside marriage, compared with 48.6 per cent of births to women born in the Caribbean Commonwealth.<sup>14</sup>

Table 7.6

Live births and infant mortality rates\* by marital status and ONS classification Group  
England and Wales 1993-1997

	Percentage of live births			Number of infant deaths			Infant mortality rate*		
	Inside marriage	Outside marriage joint registration	Outside marriage sole registration	Inside marriage	Outside marriage joint registration	Outside marriage sole registration	Inside marriage	Outside marriage joint registration	Outside marriage sole registration
England and Wales	65.7	26.7	7.6	11,832	6,477	2,055	5.5	7.4	8.3
Rural Amenity	73.9	21.5	4.6	502	225	52	~ 4.3	6.7	7.2
Remoter Rural	70.1	24.6	5.2	443	191	47	5.5	6.8	7.9
Established Manufacturing Fringe	66.0	27.4	6.6	632	338	81	5.5	7.1	7.1
New and Developing Areas	66.8	26.4	6.8	944	515	134	5.6	7.7	7.8
Mixed Urban	68.8	25.3	5.9	903	429	116	~ 5.0	~ 6.4	7.5
Coast and Country Resorts	62.9	29.3	7.8	708	453	136	5.2	7.1	8.0
Established Service Centres	60.4	30.0	9.6	640	462	146	5.3	7.7	7.6
Growth Areas	75.4	20.6	4.1	1,396	502	103	~ 4.7	~ 6.1	~ 6.4
Most Prosperous	78.3	18.2	3.5	404	136	25	~ 4.3	6.1	5.9
Coalfields	57.4	33.1	9.5	1,118	843	262	5.8	7.5	8.2
Manufacturing Centres	62.8	28.0	9.1	1,743	880	315	* 7.5	* 8.5	9.3
Ports and Industry	52.3	34.0	13.7	681	597	209	* 6.4	* 8.6	7.5
Education Centres and Outer London	67.9	24.5	7.6	1,035	521	201	5.4	7.5	9.3
West Inner London	68.7	23.0	8.2	231	111	62	5.1	7.3	* 11.4
East Inner London	59.2	28.6	12.2	452	274	166	* 6.7	8.4	* 12.0

\* rate per 1,000 live births

\*significantly higher than the England and Wales rate

~ significantly lower than the England and Wales rate

### England, Wales and Government Office Regions

Table 7.5 shows that the lowest infant mortality rates by marital status occurred inside marriage, a rate of 5.5 per 1,000 live births in England and a rate of 5.1 in Wales. Sixty-six per cent of all live births in England and 61 per cent in Wales occurred inside marriage. In comparison, 58 per cent of all infant deaths in England, and 53 per cent in Wales occur inside marriage. For all regions, the lowest infant mortality rates also occurred inside marriage. Both Yorkshire and the Humber and the West Midlands had significantly higher rates of infant death inside marriage than England and Wales as a whole. The East of England and the South East had significantly lower infant mortality rates inside marriage than England and Wales as a whole. This follows the geographic pattern already identified for overall infant mortality.

The infant mortality rate for births registered by both parents outside marriage was 7.4 per 1,000 live births for England and 7.3 per 1,000 for Wales. Within England, the East Midlands had the highest infant mortality rate for live births registered outside marriage by both parents, with a rate of 8.3 per 1,000 live births. The South East and East of England had a significantly lower infant mortality rate than England and Wales for this registration type.

For England, the highest infant mortality rates by marital status were to babies registered outside marriage by the mother alone, a rate of 8.3 per 1,000 live births. This rate was 51 per cent higher than the rate for babies born inside marriage. In Wales, this was not the case, as the rate of 7.3 per 1,000 live births was identical to the rate for babies born outside marriage registered by both parents. London had the highest infant mortality rate of 10.1 per 1,000 live births, for babies registered outside marriage by the mother alone; this was significantly higher than the rate for England and Wales. The South East had a significantly lower infant mortality rate for babies registered outside marriage as sole registration than England and Wales as a whole.

### ONS classification Groups

Table 7.6 shows that the geographic pattern of infant mortality for those babies born inside marriage was the same as overall infant mortality.

*Manufacturing Centres* and *Ports and Industry* both had significantly higher infant mortality rates both inside marriage and outside marriage registered by both parents than England and Wales. The *East Inner London* Group had significantly

higher infant mortality rates inside marriage than England and Wales. *East Inner London* and *West Inner London* had significantly higher infant mortality rates outside marriage registered by the mother alone compared to England and Wales. *Mixed Urban* and *Growth Areas* had significantly lower infant mortality rates inside marriage and outside marriage registered by both parents compared to England and Wales. *Growth Areas* also had significantly lower infant mortality rates than England and Wales outside marriage registered by the mother alone. *Rural Amenity* and *Most Prosperous* had significantly lower infant mortality rates inside marriage compared to England and Wales.

## 7.6 Social Class

The previous section showed that infant mortality rates differ quite markedly according to the marital status of the parents. To an extent this reflects differences in their Social Class distribution. The percentage of births outside marriage and jointly registered by both parents varies strongly by the Social Class of the baby's father.

Mothers occupation at birth has been collected since 1986, but only on a voluntary basis and therefore the information is poorly recorded. Questions have been raised regarding how a mother's occupation should be recorded and classified.<sup>15,16</sup> Therefore, analysis by Social Class in this section is based on father's occupation.

For this analysis, infant deaths were allocated to Social Classes on the basis of father's occupation at the death of the child, whereas births were allocated to Social Classes on the basis of father's occupation at the birth of the child. Infant deaths cannot be classified on the basis of father's occupation at birth as currently only 10 per cent of all births are coded by father's Social Class and very few of these babies die before completing the first year of life. Analysis in this section is restricted to Social Class variations in infant deaths within marriage, or if outside marriage, registered by both parents and having the father's occupation recorded.

Analysis of infant mortality for 1983-1985 by Social Class and by district health authority was published in the previous *Mortality and Geography* supplement.<sup>17</sup> This showed that districts with the highest proportion of fathers in partly skilled and unskilled manual occupations tended to have the highest percentage of low birthweight babies and the highest infant mortality rates.

### England, Wales and Government Office Regions

Of babies born in England between 1993 and 1997, those whose fathers were in Social Class V (unskilled occupations) had an infant mortality rate of 8.8 per 1,000 live births, nearly double the rate (4.5) for those in Social Class I (professional occupations). The Social Class gradients in infant mortality varied for England, Wales and the regions of England (Figure 7.1), with the largest difference between Social Class I and V occurring in Yorkshire and the Humber.

No region had a significantly higher or lower infant mortality rate for Social Class I than England and Wales. West Midlands had significantly higher infant mortality rates than England and Wales for Social Classes IIIN, IIIM and IV. Yorkshire and the Humber had a significantly higher infant mortality rate for Social Class IIIM compared with the rate for England and Wales. The East of England had significantly lower infant mortality rates for Social Classes IIIN and V compared to the rates for England and Wales. The South East had significantly lower infant mortality rates for Social Classes IIIN and IIIM compared with the rate for England and Wales. Wales had a significantly lower infant mortality rate for Social Class IIIM than England and Wales as a whole.

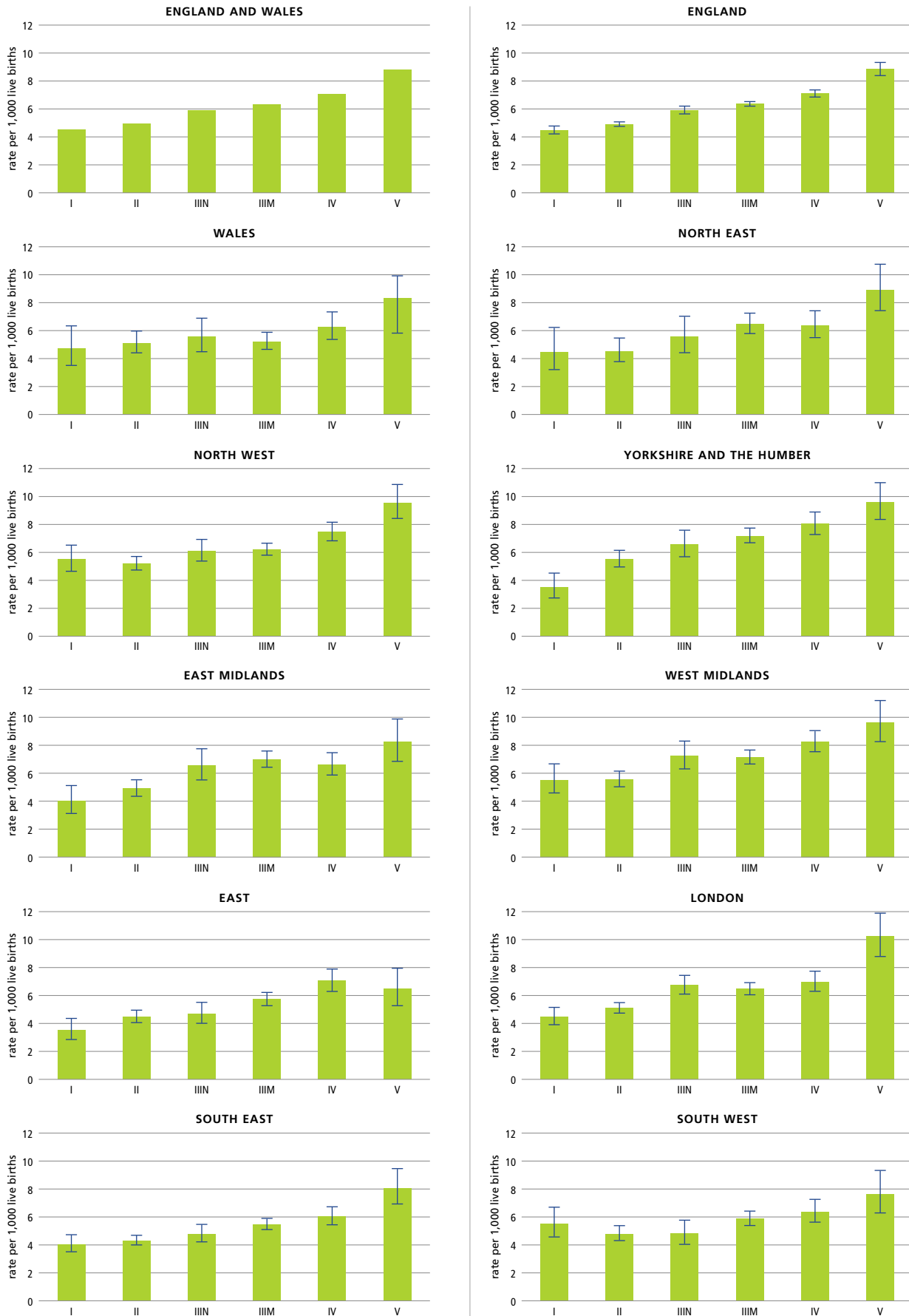
Therefore, there were large geographic differences in infant mortality even within Social Class groupings. Within Social Classes, the largest ratio of infant mortality rates between the regions with the highest and the lowest infant mortality were observed in Social Classes I and V, both had a ratio of 1.6. This contrasts with the results for adult mortality where there was little variation between the regions in the mortality of those in Social Class I (see chapter 12).

### ONS classification Groups

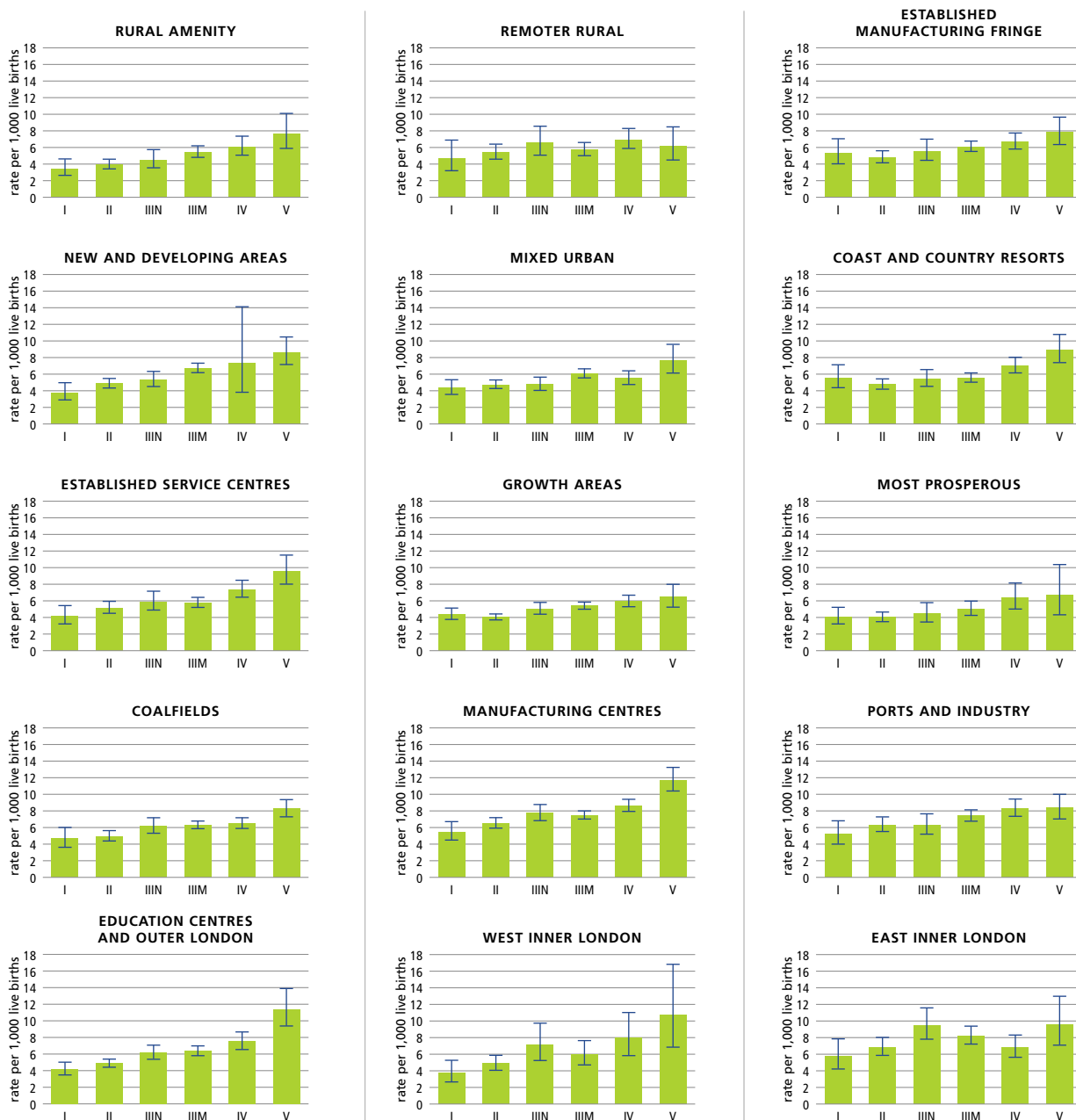
No ONS classification Group had a significantly higher or lower infant mortality rate for Social Class I than the rate in this class for England and Wales. With the exception of Social Class I, *Manufacturing Centres* had significantly higher infant mortality rates for all other Social Classes compared to England and Wales. *Ports and Industry* had significantly higher infant mortality rates for Social Class II, IIIM and IV, and *East Inner London* had significantly higher rates for Social Classes II to IIIM compared to England and Wales. *Education Centres and Outer London* was the ONS classification Group which had the steepest Social Class gradient between Social Class I and V (Figure 7.2).

*Growth Areas* had significantly lower infant mortality rates for Social Classes II, IIIM, IV, and V compared to England and Wales. *Most Prosperous* had a significantly lower infant mortality rate for Social Classes II and IIIM compared to England and Wales. *Remoter Rural* had the lowest infant mortality for Social Class V. However, this was not significantly lower than the rate for England and Wales because of the small number of deaths involved.

**Figure 7.1**  
**Infant mortality rates by Social Class, country and region**  
**England and Wales 1993-1997**



**Figure 7.2**  
**Infant mortality rates by Social Class and ONS classification Group**  
**England and Wales 1993-1997**



**7.7 Mother’s country of birth**

Mother’s country of birth indicates immigrant status but is not a good indicator of ethnic group, with second generation mothers from minority ethnic groups classified as United Kingdom born. The number of women from ethnic minority groups born in the United Kingdom has increased and the number born outside the United Kingdom has decreased. However, mother’s country of birth is currently used as a proxy to identify a child’s ethnicity, as ethnicity is not recorded at birth or death registration.

Infant mortality data for England and Wales by mother’s country of birth for the years 1993-1997 inclusive has been aggregated to provide a large enough data set for analysis. However, the number of infant deaths for the combined years was still only sufficiently large to calculate infant mortality rates at a country or regional level for selected groups of mother’s country of birth. The groups studied are mothers born in England or Wales, those born outside England and outside Wales which is further sub-divided into Scotland, other European Union, Bangladesh, India and Pakistan.

Table 7.7

**Live births and infant mortality rates\* by mother's country of birth, country and region  
England and Wales 1993-1997**
**Infant deaths by mother's country of birth**

Mother's country of birth;	England or Wales	Not born in England or Wales	Scotland	Other European Union	Bangladesh	India	Pakistan
<i>Country</i>							
England and Wales	16,366	3,366	285	246	223	202	736
England	15,403	3,310	277	242	218	200	728
Wales	963	56	8	4	5	2	8
<i>Government Office Region</i>							
North East	896	78	30	10	3	1	16
North West	2,420	311	36	26	24	24	112
Yorkshire and the Humber	1,859	320	28	17	17	10	187
East Midlands	1,376	158	19	25	7	20	28
West Midlands	1,977	391	22	9	21	50	181
East	1,522	203	24	21	16	8	47
London	1,873	1,311	48	65	113	72	73
South East	2,073	407	52	50	14	13	73
South West	1,407	131	18	19	3	2	11

**Live births by mother's country of birth**

Mother's country of birth;	England or Wales	Not born in England or Wales	Scotland	Other European Union	Bangladesh	India	Pakistan
<i>Country</i>							
England and Wales	2,796,830	476,227	48,776	44,725	33,093	34,102	62,916
England	2,630,603	466,805	47,382	43,353	32,341	33,830	62,256
Wales	166,227	9,422	1,394	1,372	752	272	660
<i>Government Office Region</i>							
North East	144,232	10,024	2,824	1,247	951	330	1,061
North West	386,605	42,729	6,645	3,088	3,361	3,233	10,738
Yorkshire and the Humber	279,633	34,392	4,447	2,778	1,658	1,947	13,798
East Midlands	224,696	25,595	4,209	2,630	898	3,903	2,391
West Midlands	296,808	42,529	3,236	2,357	4,030	5,986	14,554
East	291,151	37,303	5,202	4,657	2,273	1,428	3,797
London	330,786	192,814	7,547	13,590	16,926	13,449	10,152
South East	422,531	59,301	9,148	8,957	1,735	2,975	5,228
South West	254,161	22,118	4,124	4,049	509	579	537

**Infant mortality rates\* by mother's country of birth**

Mother's country of birth;	England or Wales	Not born in England or Wales	Scotland	Other European Union	Bangladesh	India	Pakistan
<i>Country</i>							
England and Wales	5.9	7.1	5.8	5.5	6.7	5.9	11.7
England	5.9	7.1	5.8	5.6	6.7	5.9	11.7
Wales	5.8	5.9	-	-	-	-	-
<i>Government Office Region</i>							
North East	6.2	7.8	* 10.6	-	-	-	-
North West	* 6.3	7.3	5.4	8.4	7.1	7.4	10.4
Yorkshire and the Humber	* 6.6	* 9.3	6.3	-	-	-	13.6
East Midlands	6.1	6.2	-	* 9.5	-	5.1	11.7
West Midlands	* 6.7	* 9.2	6.8	-	8.4	8.4	12.4
East	~ 5.2	~ 5.4	4.6	4.5	-	-	12.4
London	5.7	6.8	6.4	5.6	6.7	5.4	~ 7.2
South East	~ 4.9	6.9	5.7	5.6	-	-	14.0
South West	5.5	5.9	-	-	-	-	-

\* rate per 1,000 live births \*significantly higher than the England and Wales rate ~ significantly lower than the England and Wales rate

- The rates for areas with less than 20 infant deaths for the combined 1993-1997 period have not been calculated because of the small numbers involved

### England, Wales and Government Office Regions

The infant mortality rate for babies born to mothers from England or Wales was 5.9 per 1,000 live births for England, compared to a rate of 5.8 for Wales (Table 7.7). Babies born to mothers from outside England or Wales accounted for 18 per cent of all live births in England, and 21 per cent of all infant deaths in England. The infant mortality rate for babies born to mothers from outside England or Wales was 7.1 per 1,000 live births for England. In Wales, babies born to mothers from outside England or Wales accounted for only 6 per cent of both live births and infant deaths. There were only 56 infant deaths in Wales to mothers born outside England or Wales, with a rate of 5.9 per 1,000 live births. The small number of infant deaths in Wales to mothers born outside England or Wales means that further analysis by mother's country of birth is not meaningful.

The infant mortality rate in England was highest for infants of mothers born in Pakistan (11.7 per 1,000 live births), double the rate for babies of mothers born in England or Wales. Previous analysis of infant death by birthweight and mother's country of birth showed that babies of women born in Pakistan had exceptionally high infant mortality rates and a higher incidence of low birthweight babies compared with other groups of babies.<sup>9</sup> The West Midlands, and Yorkshire and the Humber, had the highest number of births to mothers born in Pakistan and also high infant mortality rates for mothers born in Pakistan. The infant mortality rate for England for babies born to mothers from Bangladesh was 15 per cent higher than the rate for babies born to mothers from England or Wales.

Over 41 per cent of all live births in England, to mothers born outside England or Wales, occurred to mothers resident in London. London also accounted for 40 per cent of all the infant deaths in England to babies born to mothers outside England or Wales. For those mothers born in Bangladesh and India, 52 per cent and 40 per cent respectively of all live births in England occurred to women resident in London. However, London had a lower infant mortality rate than England for babies born to mothers from India and a significantly lower infant mortality rate for babies born to mothers from Pakistan than England and Wales as a whole.

The West Midlands and Yorkshire and the Humber had significantly higher infant mortality rates for babies born to mothers outside England or Wales, and the East of England had significantly lower rates. The North East had a significantly higher infant mortality rate for mothers born in Scotland (10.6 per 1,000 live births) compared to England and Wales. The East Midlands had a significantly higher infant mortality rate for mothers from other European Union countries (9.5 per 1,000 live births) compared to England and Wales.

Analysis by mother's country of birth and region shows a wide variation in infant mortality rates by region for specific countries, which may reflect the small numbers involved. These infant mortality rates show only those babies born to first generation immigrant mothers and therefore, is not a complete picture of infant mortality by ethnicity.

### 7.8 Cause of death

The ONS cause classification is currently used to classify the causes of infant deaths. It is a cause grouping for infant deaths that has been derived to provide the maximum information about preventability and yet meets the national and international responsibilities of ONS.<sup>18</sup> The classification is a hierarchical one. For neonates all conditions mentioned on the death certificate, and for postneonates the underlying cause of death, is used to direct the death to the first appropriate class of the nine mutually exclusive categories, as shown in Box 7.2.

The infant mortality rate for deaths attributed to congenital anomalies for both England and Wales was 1.5 per 1,000 live births. Twenty-six per cent of all infant deaths in England and 27 per cent in Wales had a mention of congenital anomaly on the death certificate. The West Midlands and Yorkshire and the Humber had a significantly higher rate of infant deaths from congenital anomalies than England and Wales (Table 7.8). There were significantly lower rates of infant deaths from congenital anomalies in the East of England and South East. The rate ratio between the regions with the highest and lowest rates was 1.5. For further analysis and explanation of the geographic variations in infant deaths from congenital anomalies see chapter 8 of this volume.

There were 96 infant deaths from antepartum infections in England and 5 in Wales. The West Midlands had a significantly higher rate of infant deaths from antepartum infections, compared with the rate for England and Wales as a whole.

In England and Wales, infant deaths from immaturity-related conditions resulted in the highest infant mortality rate. This was 2.2 per 1,000 live births in England. In comparison, Wales had a significantly lower rate of infant death from immaturity-related conditions than England and Wales, a rate of 1.9 per 1,000 live births. Thirty-seven per cent of infant deaths in England and 33 per cent of infant deaths in Wales, were from immaturity-related conditions. Yorkshire and the Humber, East Midlands and West Midlands all had significantly higher rates of infant death from immaturity-related conditions compared with the rate for England and Wales. The East of England, South East, South West all had significantly lower rates of infant death from immaturity-related conditions. Infant deaths from immaturity-related conditions have a strong correlation to preterm birth reflected by low birthweight babies. The West Midlands had a significantly higher rate of infant death from immaturity-related conditions compared to England and Wales and was one of the regions with the highest percentage of live births weighing less than 1,500 grams. The South East with the lowest proportion of live births weighing under 1,500 grams had the lowest rate of infant deaths from immaturity-related conditions.

There were 1,581 infant deaths attributed to asphyxia, anoxia or trauma in England and 96 in Wales, a rate of 0.5 per 1,000 live births for both England and for Wales. No region had a significantly higher or lower rate for infant deaths from asphyxia, anoxia or trauma compared with the rate for England and Wales.

**Box 7.2 ONS classification of infant deaths and associated codes from the International Classification of Diseases, Ninth Revision (ICD9)**

Group	Description	ICD9 codes
1	Congenital anomalies	Main or other infant conditions: 270-273, 277, 279.0, 279.2-9, 282, 284.0, 286.0-4, 287.3, 288.1-2, 330, 335.0, 343, 348.0, 359.0-3, 424.0-3, 425.0-1, 425.3-4, 426, 571.4-9, 655.1, 740-743, 745-746, 747.1-9, 748, 749.0-2, 750.1-751.9, 752.4, 752.6-9, 753, 754.3, 754.8, 755.2-757.3, 757.8-9, 758, 759, 774.0, 777.0
2	Antepartum infections	Main or other infant conditions: 090, 279.1, 762.7, 770.0, 771.0-2  Main or other maternal conditions: 655.3
3	Immaturity-related conditions	Main infant conditions: 761.0-1, 761.8, 765.0-1, 769.0, 770.2, 770.4-5, 770.7-8, 772.1, 774.2, 774.7, 776.6, 777.5, 779.6  Main or other maternal conditions: 761.0-1, 761.8, 765.0-1, 769.0, 770.2, 770.4-5, 770.7-8, 772.1, 774.2, 774.7, 776.6, 777.5, 779.6
4	Asphyxia, anoxia, or trauma	Main or other infant conditions: 760.0, 761.6-7, 762.0-2, 762.4-6, 763, 764, 766-768, 770.1, 772.2, 779.0-2  Main or other maternal conditions: 641-642, 760.0, 761.6-7, 762.0-2, 762.4-6, 763, 764, 766-768, 770.1, 772.2, 779.0-2
5	External conditions	Main infant conditions: 260-263, 507.0-8, 778.1-3, 779.3, 800-999
6	Infections	Main or other infant conditions: 001-088.0, 091-139.0, 254.1, 320-326.0, 382, 420-422, 460-466.1, 475-476.1, 480-491, 494.0, 510-511, 513.0-1, 540-542.0, 567, 590, 599.0, 771.3-8
7	Other specific conditions	Main or other infant conditions: 254.1-9, 255, 283, 286.7, 762.8-9, 772.0, 772.3-9, 773.0-5, 774.1, 774.3-6, 775, 776.0-5, 776.7-9, 777.1-4, 777.6-9, 778.0, 778.4-9, 779.4-5  Main or other maternal conditions: 140-253, 254.1-9, 255, 283, 286.7, 331, 423, 427, 441-442, 493, 556-558, 760.2, 760.5-6, 762.3, 762.8-9, 772.0, 772.3-9, 773.0-5, 774.0-1, 774.3-6, 775, 776.0-5, 776.7-9, 777.1-4, 777.6-9, 778.0, 778.4-9, 779.4-5, 785.5
9	Sudden infant death	Main or other infant conditions: 798.0-2, 798.9, 799.1
0	Other conditions	All other codes

Table 7.8

**Infant mortality rates\* by cause of death and region  
England and Wales 1993-1997**
**Number of deaths**

	Congenital anomalies	Antepartum infections	Immaturity related conditions	Asphyxia, anoxia or trauma	External conditions	Infections	Other specific conditions	Sudden infant death	Other conditions
	1	2	3	4	5	6	7	9	0
England and Wales	5,058	101	7,168	1,677	360	1,591	354	1,908	1,364
England	4,790	96	6,834	1,581	345	1,503	333	1,795	1,293
Wales	268	5	334	96	15	88	21	113	71
North East	234	3	343	92	19	75	11	130	57
North West	690	9	972	191	64	218	42	325	198
Yorkshire and the Humber	563	13	773	191	57	171	53	185	163
East Midlands	397	2	608	131	19	119	26	126	94
West Midlands	656	27	878	193	42	182	38	193	140
East	442	9	622	144	25	163	32	153	119
London	780	15	1,246	283	49	277	53	287	238
South East	621	10	861	233	44	181	53	234	164
South West	407	8	531	123	26	117	25	162	120

**Rates**

	Congenital anomalies	Antepartum infections	Immaturity related conditions	Asphyxia, anoxia or trauma	External conditions	Infections	Other specific conditions	Sudden infant death	Other conditions
	1	2	3	4	5	6	7	9	0
England and Wales	1.5	0.0	2.2	0.5	0.1	0.5	0.1	0.6	0.4
England	1.5	0.0	2.2	0.5	0.1	0.5	0.1	0.6	0.4
Wales	1.5	0.0	~ 1.9	0.5	0.1	0.5	0.1	0.6	0.4
North East	1.5	0.0	2.2	0.6	0.1	0.5	0.1	* 0.8	0.4
North West	1.6	0.0	2.3	0.4	0.1	0.5	0.1	* 0.8	0.5
Yorkshire and the Humber	* 1.8	0.0	* 2.5	0.6	* 0.2	0.5	* 0.2	0.6	* 0.5
East Midlands	1.6	0.0	* 2.4	0.5	0.1	0.5	0.1	0.5	0.4
West Midlands	* 1.9	* 0.1	* 2.6	0.6	0.1	0.5	0.1	0.6	0.4
East	~ 1.3	0.0	~ 1.9	0.4	0.1	0.5	0.1	~ 0.5	0.4
London	1.5	0.0	2.4	0.5	0.1	0.5	0.1	0.5	0.5
South East	~ 1.3	0.0	~ 1.8	0.5	0.1	~ 0.4	0.1	~ 0.5	0.3
South West	1.5	0.0	~ 1.9	0.4	0.1	0.4	0.1	0.6	0.4

\* rate per 1,000 live births

\* significantly higher than the England and Wales rate

~ significantly lower than the England and Wales rate

There were 345 infant deaths from external conditions in England and 15 in Wales, both with a rate of 0.1 per 1,000 live births. Yorkshire and the Humber had a significantly higher rate of infant deaths from external conditions compared to the rate for England and Wales.

Infections accounted for 8 per cent of all infant deaths in England and 9 per cent in Wales. The infant mortality rate for infant deaths from infections for both England and for Wales was 0.5 per 1,000 live births. The South East had a significantly lower rate (0.4) of infant deaths from infections compared to the rate for England and Wales.

In England there were 333 infant deaths classified as 'other specific conditions' and 21 in Wales, both with a rate of 0.1 per 1,000 live births. The category 'other specific conditions' groups together all other conditions that specifically relate to infants and are not previously mentioned in the ONS cause classification. Yorkshire and the Humber had a significantly higher rate for infant deaths from 'other specific conditions' compared with England and Wales.

Ten per cent of all infant deaths in England and 11 per cent of all infant deaths in Wales were assigned to the category 'sudden infant death', both with a rate of 0.6 per 1,000 live births. These figures were based on the ONS cause classification of infant deaths and do not represent all mentions of Sudden Infant Death Syndrome, as published in other ONS publications.<sup>19,20</sup> Analysis shows the North East and North West both experienced significantly higher rates for sudden infant death compared with the rate for England and Wales. The East of England and South East both had significantly lower rates of sudden infant death compared with England and Wales.

## 7.9 Discussion

Analysis of the known risk factors of infant mortality in this chapter helps to explain some of the geographic variations in infant mortality presented in chapter 6 by demonstrating that when some factors were controlled for excess infant mortality was reduced.

Chapter 6 showed that within England, regions in the north and the Midlands had higher infant mortality rates than regions in the south. Further analysis has shown much of the difference in rates can be explained by the percentage of live births that were of low birthweight. However, even when we look at infant mortality rates for babies of a particular birthweight, differences between the countries and the regions still exist. London had a significantly lower infant mortality rate for babies born weighing less than 1,500 grams despite being the region with the highest percentage of live births of this birthweight. This could be considered the result of a range of factors and may be a reflection of the intensive care and the medical facilities available to babies in London.<sup>21,22</sup> Infant deaths from immaturity-related conditions were seen to be directly related to the percentage of low birthweight live births in any given region. Other studies have clearly shown that both birthweight and gestational age have

independent associations with mortality.<sup>3</sup> Unfortunately, information about gestational age of the baby at birth is not collected at birth registration in England and Wales. Therefore, no analysis by gestational age could be undertaken.

Analysis of mother's age showed that babies born to mothers aged under 20 had the highest infant mortality rate and in addition it is likely that a greater percentage were of low birthweight.<sup>7</sup> However, geographic differences in infant mortality rates still exist when looking at particular mother's age groups alone. Yorkshire and the Humber and the West Midlands both had higher rates for mothers aged 20-29 and 30-39 and the latter also had higher rates for mothers aged 40 and over. For all age groups, lower rates by mother's age occurred in regions in the south of England.

The East of England and South East had low infant mortality rates for births both inside marriage and outside marriage registered by both parents. Yorkshire and the Humber and West Midlands both had high infant mortality rates for births inside marriage. The infant mortality rate for births registered outside marriage by the mother alone was significantly higher in London than elsewhere. The percentage of births inside marriage varies strongly by Social Class of the baby's father and by the mother's country of birth. Analysis of all the Social Classes shows that Yorkshire and the Humber and the West Midlands regions had higher than average infant mortality rates for Social Class IIN, IIM and IV. Lower than average infant mortality rates by Social Class occurred in the East of England and South East.

As expected, analysis by mother's country of birth shows that the overall geographic pattern was repeated for babies born to mothers born in England or Wales. The North West, Yorkshire and the Humber and West Midlands all had high rates and East of England and South East had low rates for babies born to mothers from England or Wales. For babies born to mothers outside England or Wales, Yorkshire and the Humber and West Midlands had significantly higher rates whilst the East of England had a significantly lower rate. The rates seen in babies born to mothers from England or Wales will include an increasing number of second generation immigrant mothers and the rates may be a reflection of this.<sup>23</sup> Finally, the lower infant mortality rates for babies to mothers born in Pakistan but resident in London compared to the rate for England could be the result of many factors including good access to facilities and support for these mothers.<sup>24</sup> Statistics examining average birthweight and infant deaths by mothers country of birth show that babies of women born in Pakistan have exceptionally high mortality rates and a higher incidence of low birthweight compared with other groups of babies.<sup>9</sup>

Analysis of infant deaths from congenital anomalies and immaturity-related conditions showed a clear north-south split. For both causes of death, Yorkshire and the Humber and West Midlands had high infant mortality rates compared to England, with the regions in the south having lower rates. The regions in the south also had lower infant mortality rates for sudden infant death and regions of the north had higher infant mortality from sudden infant death. Infant deaths from

immaturity related conditions have a strong correlation to pre-term birth reflected by low birthweight babies. This was clearly demonstrated in the West Midlands and South East.

It has been clearly demonstrated that the known risk factors for infant mortality are interrelated. Low birthweight is a main factor contributing to immaturity related deaths. Birthweight is affected by mother's age and country of birth as well as factors which are not routinely measured, including mother's nutrition and the availability of social support. Mother's age, mother's country of birth and Social Class all influence the parents' marital status. Birthweight remains the strongest and most important risk factor associated with neonatal mortality.<sup>4</sup> Over 67 per cent of the infant deaths referred to in this chapter occurred in the neonatal period, thus making birthweight a very important risk factor in infant mortality. The differentials in infant mortality rates that exist between regions suggests the potential for improvement in infant mortality rates in the future.

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