GLA Intelligence Update

DMAG Demography Team

Update
09-2010
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Infant Mortality: 2002 to 2008

Background

This *Update* has been produced in response to a constituent's query to London Assembly member Darren Johnson. The GLA Demography team have previously not published any *Updates* on infant mortality, and so have acted in response to this external interest. Furthermore the GLA now holds a good time series of infant mortality data making such analysis possible.

The infant mortality rate (IMR) is the number of deaths to infants aged less than 1 year per 1,000 live births. Infant mortality is strongly associated with prematurity, low birthweight and multiple births. Prematurity and low birthweight are associated with the socio-economic status of mothers, and there is a clear trend for increased mortality among births occurring to more socially disadvantaged mothers.

Methodology

Births, deaths and IMR data are available from the Office for National Statistics (ONS). The annual IMR is provided at national, regional and local authority levels. The average IMR for 2002-08, shown in this *Update*, was calculated by summing infant deaths and births over these seven years and calculating the IMR for this period.

Ward level infant mortality was calculated using ward level births and infant deaths from ONS. The ONS disclosure control rules specify that rates based on fewer than five births or deaths (including zero) must be suppressed. The number of infant deaths at a ward level each year is very low, so in order to satisfy the disclosure conditions data had to be aggregated over several years (2002 to 2008). Aggregating the data over several years also makes the data more robust at a ward level, as the small numbers mean there will be random variation from year to year. With seven years worth of data 40.0 per cent of wards still had less than 5 deaths in total between 2002 and 2008. These wards therefore were excluded from ward level analysis. However, the deaths in these wards were included in analysis at the borough and regional level.

Results

Borough results

Table 1 shows infant mortality rates from 2002 to 2008. Infant mortality declined in both London and England and Wales over the seven years from 2002 to 2008. London experienced a greater decrease in its IMR than England and Wales as a whole. London went from having higher infant mortality than England and Wales in 2002 to infant mortality being lower in the capital compared with England and Wales as a whole. A clear decrease in infant mortality from year to year can also be seen for Inner and Outer London areas. However, in every year Inner London had higher infant mortality compared with Outer London. This is consistent with Inner London having higher levels of deprivation than Outer London.

Table 1: Infant mortality rate, England and Wales, London and London boroughs; 2002-2008

	2002	2003	2004	2005	2006	2007	2008	2002-08 average[1]
England and Wales	**5.3**	**5.3**	**5.1**	**5.0**	**5.0**	**4.8**	**4.8**	**5.0**
London	**5.6**	**5.4**	**5.2**	**5.1**	**4.9**	**4.5**	**4.3**	**5.0**
Inner London	**6.1**	**6.3**	**5.5**	**5.2**	**5.0**	**4.8**	**4.5**	**5.3**
Camden	6.3*	4.4*	6.6	4.7*	3.7*	3.5*	2.9*	4.6
City of London[1]	-	-	-	-	-	-	-	
Hackney	8.8	7.5#	3.4#	5.3#	4.4#	6.5#	6.3#	6.0
Hammersmith & Fulham	4.6*	5.1*	3.4*	3.7*	4.3*	2.6*	2.9*	3.8
Haringey	5.4	9.3	7.5	7.7	6.4	4.2*	4.9	6.4
Islington	5.2*	7.9	7.1*	5.9*	4.6*	5.0*	4.1*	5.7
Kensington & Chelsea	4.6*	3.1*	1.8*	3.7*	1.3*	3.6*	1.8*	2.8
Lambeth	7.5	7.1	5.7	6.1	5.7	5.2	5.6	6.1
Lewisham	5.2	5.1	4.2*	5.1	4.8	3.9*	6.6	5.0
Newham	7.5	7.6	8.7	4.5	7.2	6.1	4.2	6.5
Southwark	7.2	9.7	7.4	4.0*	6.7	8.3	7.0	7.2
Tower Hamlets	6.2	5.1	3.9*	4.3*	4.1*	5.1	3.1*	4.5
Wandsworth	2.2*	4.1*	3.2*	5.9	3.6*	3.2*	3.0*	3.6
Westminster	6.3*	2.2*	5.9*	5.2*	5.2*	2.7*	1.7*	4.1
Outer London	**5.3**	**4.8**	**5.0**	**5.0**	**4.8**	**4.3**	**4.1**	**4.7**
Barking & Dagenham	4.5*	5.0*	6.5*	3.7*	4.7*	4.7*	5.3*	4.9
Barnet	4.5*	3.9*	3.3*	6.8	2.9*	3.3*	4.4	4.2
Bexley	3.6*	6.1*	5.2*	4.8*	4.3*	3.4*	4.4*	4.5
Brent	10.6	4.8	4.6	4.9	6.6	4.8	6.5	6.1
Bromley	4.1*	4.7*	5.0*	2.7*	3.5*	2.5*	3.0*	3.6
Croydon	7.1	4.4	4.1	7.9	6.0	4.9	5.4	5.6
Ealing	7.4	4.2*	3.6*	4.3	4.5	2.8*	3.8	4.3
Enfield	3.3*	8.1	5.4	6.7	7.3	6.2	5.0	6.0
Greenwich	7.5	6.1	6.7	3.8*	4.7	5.4	3.7*	5.3
Harrow	4.7*	5.6*	5.9*	9.7	4.8*	4.5*	3.1*	5.4
Havering	6.6*	2.5*	3.9*	2.0*	5.8*	3.5*	2.2*	3.7
Hillingdon	4.3*	3.0*	3.5*	4.0*	4.1*	6.8	2.9*	4.1
Hounslow	1.2*	5.1*	5.5	6.3	3.1*	4.9	4.8	4.5
Kingston upon Thames	2.8*	2.2*	5.4*	3.0*	3.4*	2.3*	0.9*	2.8
Merton	3.2*	5.8*	6.0*	4.4*	5.5*	3.3*	3.6*	4.5
Redbridge	5.6*	5.3*	5.7	4.2*	5.5	6.4	4.0*	5.2
Richmond upon Thames	4.6*	3.1*	1.9*	3.1*	1.8*	2.8*	2.1*	2.7
Sutton	5.2*	4.0*	4.5*	4.3*	4.1*	3.1*	5.0*	4.3
Waltham Forest	5.3*	4.8*	7.8	4.5*	6.9	4.5	4.8	5.5

[1] Average rate is based on average of events from 2002-2008 rather than average of rates.
* Denotes a rate calculated from less than 20 events

At a smaller geography, such as local authority, the IMR fluctuates substantially from year to year because of the small number of infant deaths that occur at this level per annum. As Table 1 indicates many of the annual rates are based on less than 20 deaths. This means that genuine trends cannot be separated from changes occurring simply due to random fluctuation in the small number of events each year. Therefore an average infant mortality rate over 2002-08 was calculated to provide a robust indication of the level of infant mortality in London boroughs.

There were 14 boroughs where average infant mortality was higher than for London as a whole, 7 in Inner London and 7 in Outer London. Southwark had the highest average IMR (7.2 deaths per 1,000 births) and Richmond the lowest (2.7 deaths per 1,000 births). Just under half of all Inner London boroughs were among the ten boroughs with the highest infant mortality, while only a third of Outer London boroughs were in the worst ten. However, there is much variation within Inner and Outer London. For example, Inner London borough Kensington and Chelsea had the second lowest IMR (2.8 deaths per 1,000 births) overall in London, while Outer London borough Brent had had fourth highest IMR (6.1 deaths per 1,000 births) for all of the London boroughs.

Infant mortality and other socio-demographic measures results

As IMR is associated with deprivation and other population characteristics Table 2 shows the infant mortality rate averaged over 2002-08 and a range of other demographic and deprivation measures for London boroughs. The table contains two measures each of fertility, mortality and deprivation. The fertility measures are firstly the crude birth rate which is the number of births per 1,000 population. Secondly the total fertility rate which indicates the number of children a woman would have if she experienced the fertility rates for that year throughout her childbearing years. The mortality measures shown are the crude death rate (the number of deaths per thousand population) and life expectancy. Life expectancy at birth gives the number of years on average a person would live to if they experienced the mortality rates for that year throughout their lifetime. Life expectancy is often used as an indicator of poverty and deprivation as well as mortality measure.

Finally Table 2 contains the 2007 index of multiple deprivation (IMD) and the 2007 income deprivation affecting children index (IDACI). The IMD combines several different dimensions of deprivation to give an overall score for each super output area (SOA) in England. The IMD is based on the concept of measuring distinct dimensions of deprivation separately and then combining these to give an overall score. It is an area based measure, rather than an individual based measure, so it looks at the extent of each type of deprivation within the area and then combines these to give a figure taking into account the extent of each type of deprivation. It does this by using statistical techniques to combine information on economic and social issues to produce scores for small areas across the whole of England.

To create local authority level data the average SOA score for a borough is used to rank all local authorities in England. For this *Update* London boroughs were then ranked again based on their local authority rank for England. Boroughs are ranked from 1 for the most deprived local authority in London to 32 the least deprived borough; the City of London was not included.

The IDACI gives the proportion of children in an area who are in families living on low incomes. In practice, this is the proportion of families who are dependent on means tested benefits (including any dependents of claimants). The benefits included in the count are Income Support, Income Based Job Seekers Allowance, Pension Credit, Working Tax Credit and Child Tax Credit (limited to those on low incomes), along with asylum seekers receiving support.

Table 2: Infant mortality rate and socio-demographic measures, London boroughs

	Infant mortality rate (2002-08)	Average crude birth rate (2002-08)	TFR (2005)	Average crude death rate (2002-08)	Life expectancy (04-06)		2007 IMD London rank of average	2007 IDACI score
					Males	Females		
England and Wales	**5.0**	**12.2**	**1.8**	**9.7**	**77.2**	**81.5**	**n/a**	**n/a**
London	**5.0**	**14.5**	**1.8**	**6.6**	**77.4**	**82.0**	**n/a**	**0.34**
Inner London	**5.3**	**16.9**	**1.7**	**6.1**	**-**	**-**	**n/a**	**0.44**
Camden	4.6	13.6	1.3	6.0	76.4	81.7	13	0.41
City of London	-	7.7	-	5.7	-	-		0.20
Hackney	6.0	20.9	2.2	5.8	75.0	81.7	1	0.53
Hammersmith & Fulhan	3.8	15.6	1.6	5.8	78.0	83.5	14	0.38
Haringey	6.4	18.1	2.0	5.9	76.0	82.1	5	0.50
Islington	5.7	14.8	1.5	6.5	74.9	80.0	4	0.52
Kensington & Chelsea	2.8	12.8	1.3	5.1	83.1	87.2	18	0.22
Lambeth	6.1	17.5	1.8	6.1	75.1	80.1	6	0.43
Lewisham	5.0	16.9	1.9	7.3	75.7	80.3	11	0.37
Newham	6.5	21.7	2.4	6.0	75.0	79.4	3	0.52
Southwark	7.2	17.4	1.9	6.1	76.6	81.6	9	0.42
Tower Hamlets	4.5	19.2	1.8	5.8	75.2	80.2	2	0.66
Wandsworth	3.6	16.8	1.5	6.6	76.6	81.2	23	0.30
Westminster	4.1	12.5	1.3	5.4	80.2	84.0	15	0.38
Outer London	**4.7**	**14.9**	1.9	**7.9**	**-**	**-**	**n/a**	**0.28**
Barking & Dagenham	4.9	18.0	2.4	9.2	75.9	79.8	7	0.41
Barnet	4.2	14.4	1.8	7.9	79.0	83.4	21	0.24
Bexley	4.5	12.5	1.8	8.9	78.5	82.5	25	0.20
Brent	6.1	16.8	1.9	6.1	78.2	83.4	12	0.40
Bromley	3.6	12.4	1.8	9.2	79.2	83.3	29	0.18
Croydon	5.6	14.5	1.9	7.7	77.8	81.2	20	0.28
Ealing	4.3	16.1	1.9	6.6	77.7	82.1	17	0.33
Enfield	6.0	15.7	2.1	7.9	77.9	81.9	16	0.37
Greenwich	5.3	17.8	2.1	8.5	75.0	80.7	8	0.40
Harrow	5.4	13.7	1.8	7.4	78.9	83.1	27	0.24
Havering	3.7	11.0	1.8	10.2	78.2	81.9	26	0.19
Hillingdon	4.1	14.5	1.9	7.9	77.3	82.2	24	0.26
Hounslow	4.5	17.1	2.0	7.2	76.7	80.6	19	0.32
Kingston upon Thames	2.8	13.2	1.6	7.6	79.0	82.8	31	0.16
Merton	4.5	15.2	1.7	6.9	79.0	83.1	28	0.22
Redbridge	5.2	14.7	1.9	7.9	77.9	82.1	22	0.27
Richmond upon Thame	2.7	15.0	1.7	7.4	79.4	83.1	32	0.12
Sutton	4.3	12.8	1.7	8.5	78.5	82.5	30	0.17
Waltham Forest	5.5	18.4	2.2	7.7	75.3	80.7	10	0.39
Pearsons Correlation Coefficient		**0.56**	**0.57**	**-0.22**	**0.54**	**0.61**	**-0.66**	**0.64**

Table 2 enables examination of relationships between infant mortality and some other demographic and social characteristics on an area. Analysis published by ONS showed that socio-economic status is strongly associated with deaths less than one year, with a clear trend observed for increased mortality among births occurring to more socially disadvantaged mothers.[1] Therefore we would expect areas with higher levels of child poverty and have a high IMD rank to have higher levels of infant mortality and visa versa. These relationships can be seen in London. For example, Newham had the highest

[1] Oakley L, Maconochle N, Doyle P, Dattani N and Moser K (2009) 'Multivariate analysis of infant death in England and Wales in 2005-06, with focus on socio-economic status and deprivation', *Health Statistics Quarterly* **42**, 22-39

infant mortality rate (6.5) of all London boroughs and was also the third most deprived London borough and had the fourth highest proportion of children living in income deprivation (0.52). Male and female life expectancy was also low in Newham, which may be an indication of overall poor health in the borough. The TFR and crude birth rate indicate the area has a high fertility level. Hackney also had a high average IMR (6.0) and was the most deprived London borough and had the second highest proportion of children living in income deprivation in London (0.53). Richmond and Kensington and Chelsea show the relationships that would be expected at the other end of the scale. Richmond had the lowest average IMR of all London boroughs and was the lowest ranked London borough for deprivation by the IMD and had the lowest proportion of children living in income deprivation (0.12). Kensington and Chelsea had a low proportion of children living in income deprivation (0.22), had the highest male and female life expectancies of all London boroughs and infant mortality was second lowest of all the London boroughs.

However, these relationships do not hold true for all areas in London. For example Tower Hamlets had the highest proportion of children living in poverty and was second most deprived London borough, however, infant mortality in Tower Hamlets was below the rate for Greater and Inner London. While Brent had a high IMR (6.1 deaths per 1,000 births) but does not show any links with any of the variables in Table 2.

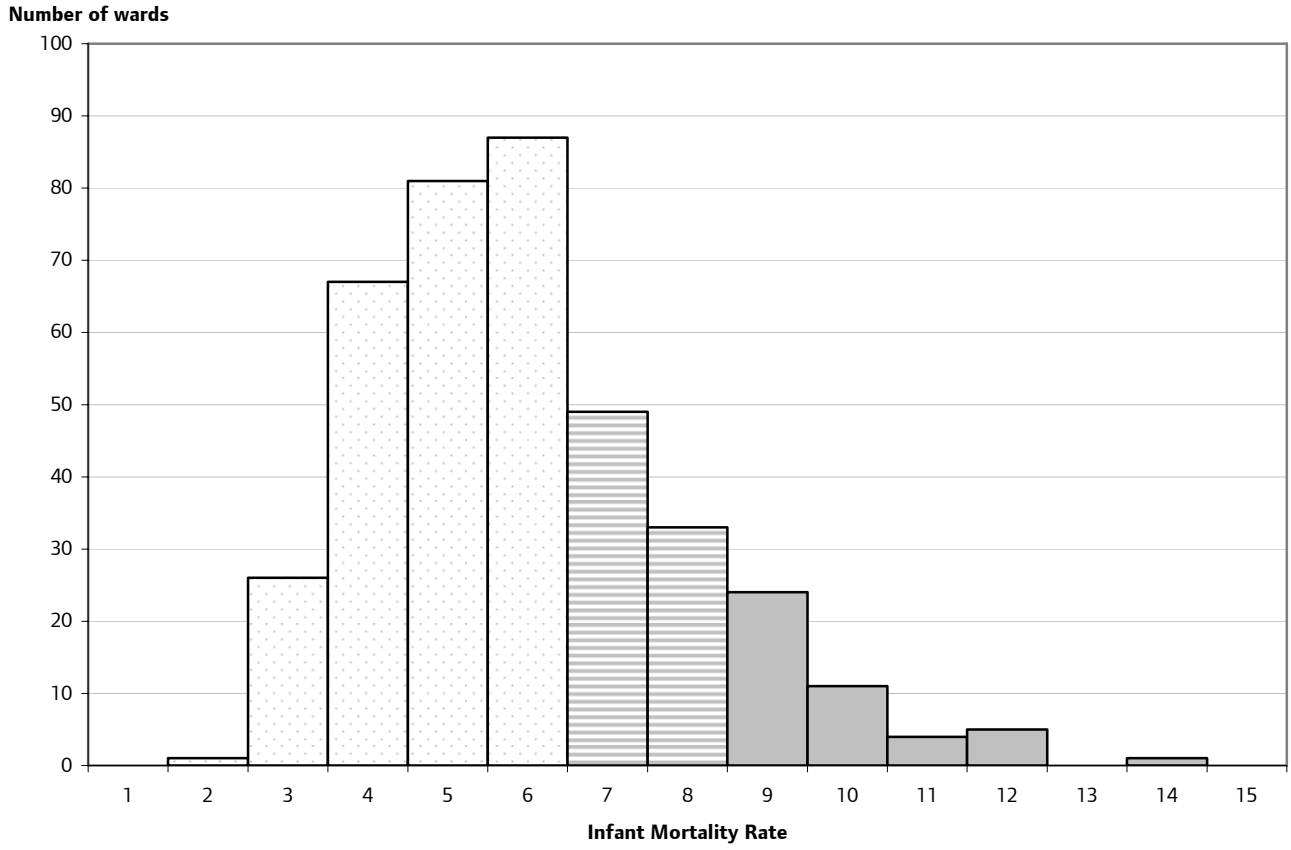
Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. The main result of a correlation is called the correlation coefficient. It ranges from -1.0 to +1.0. The closer r is to +1 or -1, the more closely the two variables are related. If the correlation coefficient is close to 0, it means there is no relationship between the variables. If coefficient is positive, it means that as one variable gets larger the other gets larger. If the coefficient is negative it means that as one gets larger, the other gets smaller (an "inverse" correlation). Values between 0 and 0.3 (0 and -0.3) indicate a weak positive (negative) linear relationship. Values between 0.3 and 0.7 (0.3 and -0.7) indicate a moderate positive (negative) linear relationship. Values between 0.7 and 1.0 (-0.7 and -1.0) indicate a strong positive (negative) linear relationship.

Correlation analysis found the 2002-08 average infant mortality rate correlated significantly with all variables in Table 2 except the crude death rate. However, although correlations were significant the coefficient values indicate only moderate relationships between infant mortality and the other variables. Table 2 shows the correlation value for each measure with the IMR. The correlation values range from 0.43 to (-)0.66, not including the crude death rate value. The two variables that correlated the strongest with infant mortality were the two deprivation measures (Correlation coefficient values of -0.66 and 0.64), which corresponds with the findings published by the ONS mentioned earlier.

Ward results

The following ward level analysis only presents data for wards that cumulatively had five or more infant deaths between 2002 and 2008, following ONS disclosure rules. For London this was 60.0 per cent of wards (389 out of 648). Figure 2 shows the distribution of the ward level infant mortality rates for London. The graph is shaded to show wards that had an average IMR less than 0.5 standard deviations from the mean (dotted), wards that had an average IMR between 0.5 and 1.5 standard deviations from the mean (horizontal stripes) and wards that had an average IMR above 1.5 standard deviations from the mean (solid). This division indicates wards that are within normal range, wards with an IMR slightly above average and wards greatly above average. The distribution of London ward level infant mortality has a positive skew, meaning the bulk of infant mortality lies below the mean. There is a tail of high infant mortality rates, with one ward a notable outlier with an IMR of 14 infant deaths per 1,000 births. Due to disclosure rules this ward cannot be identified.

Figure 1: Infant mortality rate distribution, London wards, 2002-08



The average (mean) infant mortality for London wards (2002-08) was 6.0 infant deaths per 1,000 births. Just over two fifths (42.0 per cent) of wards had infant mortality above the mean. The standard deviation of infant mortality was 1.95 deaths per 1,000 births. Nearly one in ten (9.3 per cent) wards had an IMR that was notably above average, because it was over 1.5 standard deviations from the mean (i.e. IMR above 8.9 infant deaths per 1,000 births). The median average infant mortality across London wards (2002-08 average) was 5.7 infant deaths per 1,000 births. The mean ward IMR is slightly higher than the median because the tail of values to the right slightly skews the mean.

Table 3 shows the wards where infant mortality levels were 1.5 or more standard deviations from the mean. Due to ONS disclosure rules the accompanying ward IMRs cannot be published here. Also please note the wards are presented alphabetically by borough, and are not in ranked order so IMR values cannot be drawn from Figure 1. Table 3 shows the London wards with the highest IMRs are spread across 20 different boroughs. These boroughs are spread across London and cover both Inner and Outer London.

Table 3: Wards with infant mortality over 1.5 standard deviations from mean ward IMR

Borough	Ward
Barking & Dagenham	Gascoigne
	Heath
	River
Barnet	Colindale
Brent	Dudden Hill
	Fryent
	Northwick Park
	Willesden Green
Camden	St Pancras and Somers Town
Croydon	Broad Green
	Woodside
Ealing	Cleveland
Enfield	Lower Edmonton
	Upper Edmonton
Greenwich	Woolwich Common
Hackney	Dalston
	Hoxton
Haringey	Northumberland Park
	Tottenham Green
	White Hart Lane
Harrow	Harrow Weald
	Queensbury
Hillingdon	Eastcote and East Ruislip
Hounslow	Brentford
Islington	Canonbury
	Holloway
Lambeth	Brixton Hill
	Thurlow Park
Lewisham	Telegraph Hill
Newham	West Ham
Redbridge	Mayfield
Southwark	Chaucer
	East Walworth
	Newington
Waltham Forest	Chingford Green
	Markhouse

Analysing infant mortality at ward level reveals features that were hidden at a higher geography. Analysis published by ONS showed deprived wards had relatively poor infant mortality rate even within larger areas with apparently better rates.[2] Similarly, the least deprived wards within region and areas with relatively poor infant mortality experienced lower rates. Local authority level analysis can conceal pockets of higher infant mortality and deprivation within boroughs.

[2] Norman P, Gregory I, Dorling D and Baker A (2008) 'Geographical trends in infant mortality: England and Wales, 1970-2006', *Health Statistics Quarterly* **40**, 18-29

Figure 2: Infant mortality rate, London wards, 2002-08

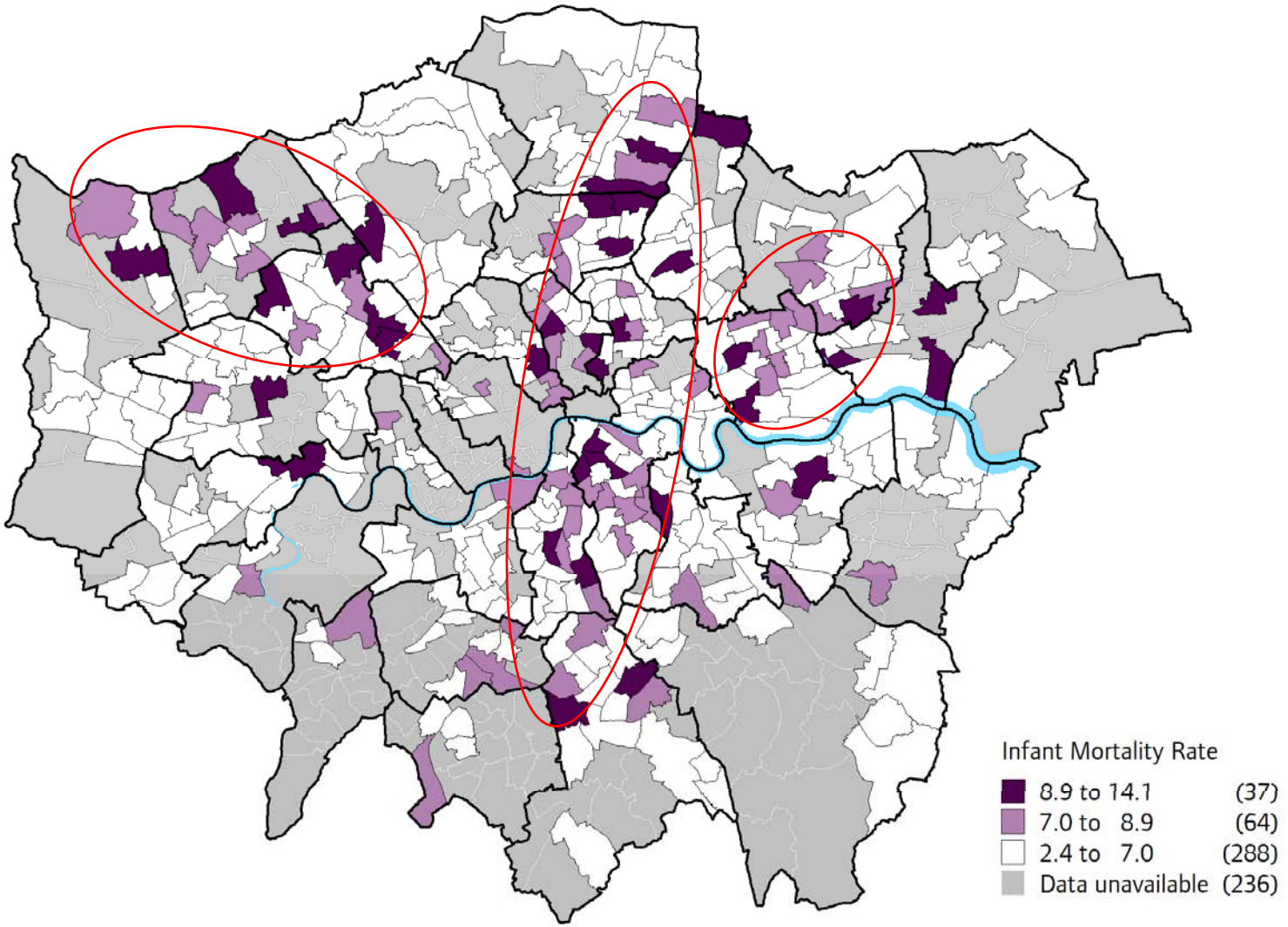
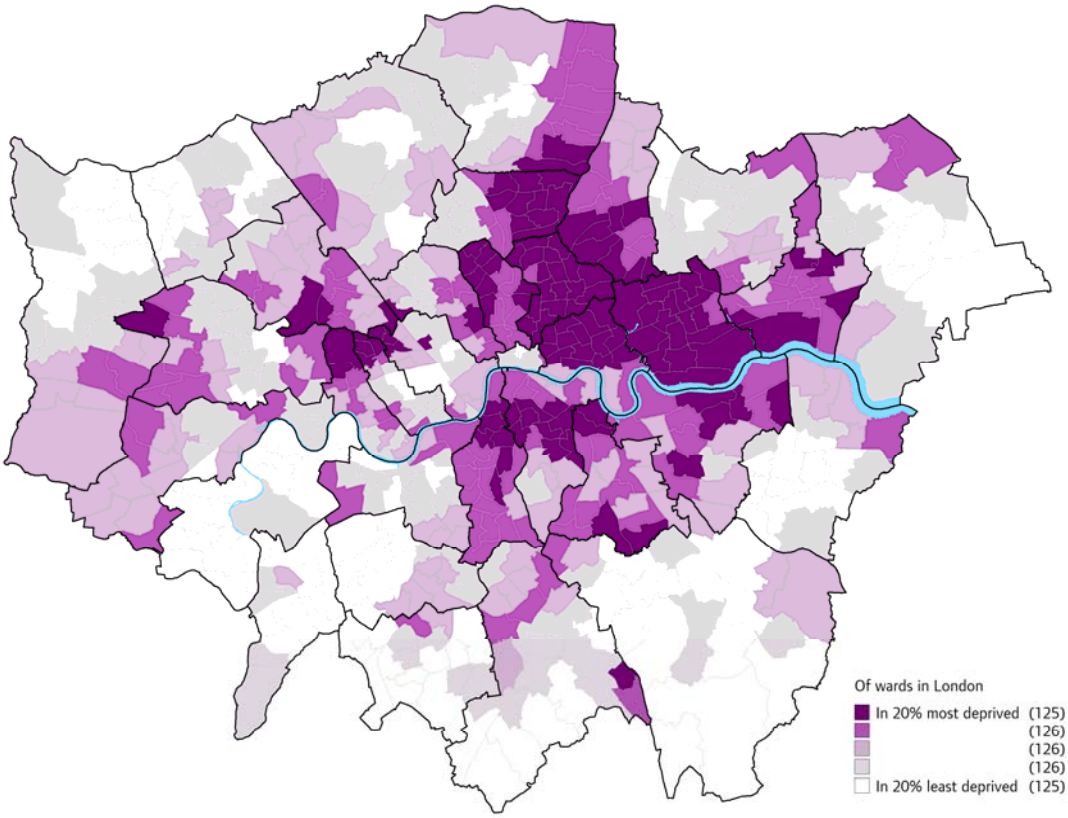


Figure 2 shows the distribution of infant mortality across wards in London. The wards are separated into three groups (as in Figure 1); wards where the IMR is below 0.5 standard deviations from the mean, wards that are between 0.5 and 1.5 standard deviations from the mean and wards that are over 1.5 standard deviations from the mean. The legend in Figure 2 gives the IMR values for these standard deviation bands. The map particularly highlights wards that are over 0.5 standard deviations from the mean IMR, indicating wards that had infant mortality moderately or significantly above average. There are three distinct areas of above average infant mortality in London. There is a cluster of wards with above average IMRs in East London (Newham, Redbridge, Barking and Dagenham), a corridor of wards running from north to south through the centre of London (through Enfield, Haringey, Camden, Islington, Lambeth and Southwark) and a cluster of wards in north-west London (Harrow and Brent and north of Hillingdon).

Analysis by ONS has shown that small area deprivation is more strongly related to levels of infant mortality than larger area geography.[3] This can be seen when there is a reduction in disparities between the most and least deprived areas there is a parallel reduction in infant mortality. Figures 3 and 4 show the London ward level 2007 IMD and IDACI distribution. There is some correspondence between the map on infant mortality (Figure 2) and the two deprivation maps (Figures 3 and 4). The central north to south corridor of infant mortality is also present on the deprivation maps. Even down to the clear division between east and west Enfield which is present on both the map on infant mortality and maps of deprivation. The area of above average infant mortality in east London (particularly Newham) matches a significant area of deprivation. However, the high level of deprivation shown in Tower Hamlets by both the IMD and IDACI is not reflected in its infant mortality (4.5 deaths per 1,000 births), as this is below the Inner London average IMR (5.3 deaths per 1,000 births). Similarly there is a notable area of deprivation in north Kensington and Chelsea and north Hammersmith and Fulham that is not matched by corresponding above average infant mortality. Conversely the area of infant mortality in north-west London is not visible on the deprivations maps. So although some linkages can be drawn between the ward level distribution of infant mortality and deprivation the geographical relationship is not markedly similar.

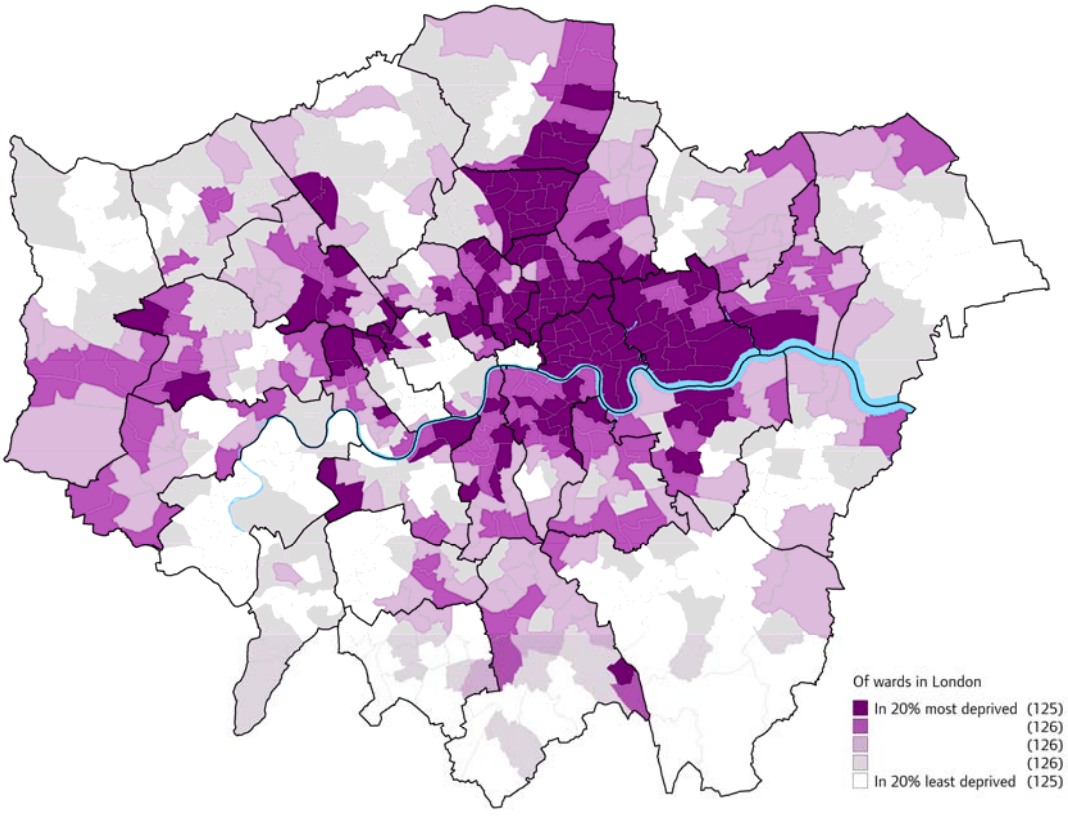
[3] Norman P, Gregory I, Dorling D and Baker A (2008) 'Geographical trends in infant mortality: England and Wales, 1970-2006', *Health Statistics Quarterly* **40**, 18-29,

Figure 3: Average Rank ward level summary of IMD2007, London wards



Source: Department for Communities and Local Government, Indices of Deprivation 2007

Figure 3: 2007 Income Deprivation Affecting Children Index, London wards



Source: Department for Communities and Local Government, Indices of Deprivation 2007

Availability of Data

Data on infant mortality, both raw birth and deaths data and infant mortality rates, are available to from the ONS. The ONS use births and deaths data obtained from vital events registration. This data is available to local authorities on request (for a charge) from the Vital Statistics Outputs Branch (vsob@ons.gsi.gov.uk). Births, infant deaths and IMR data are available in Table VS1 at national, regional and local authority level (Table VS1). Births and infant deaths are available at ward level in Table VS4.

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