Centre for Maternal and Child Enquiries

CMACE

Perinatal Mortality 2009

March 2011

United Kingdom

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CMACE Mission Statement

Our aim is to improve the health of mothers, babies and children by carrying out confidential enquiries and related work on a nationwide basis and by widely disseminating our findings and recommendations.

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Disclaimers

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The recommendations contained in this report represent the view of CMACE, which was arrived at after a careful consideration of the available evidence. They do not override healthcare professionals' individual responsibility to make appropriate decisions in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

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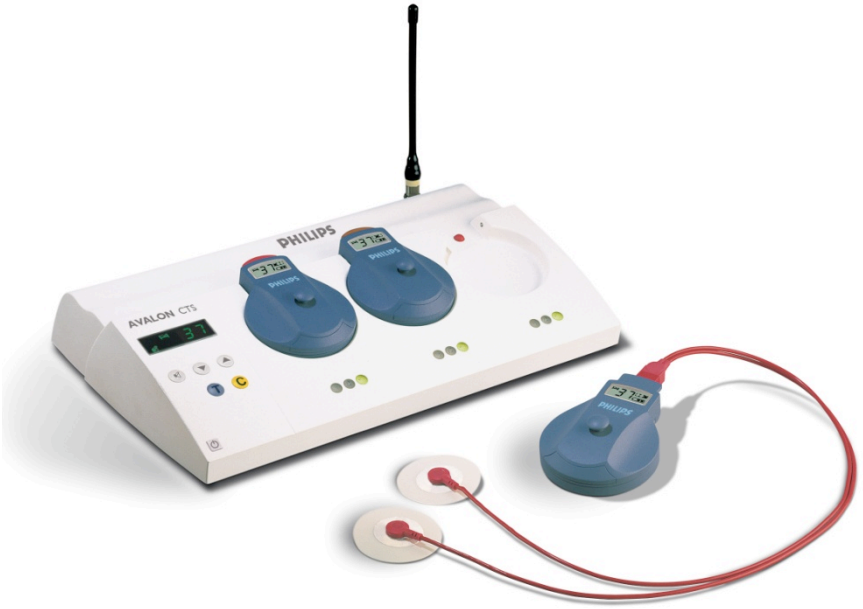

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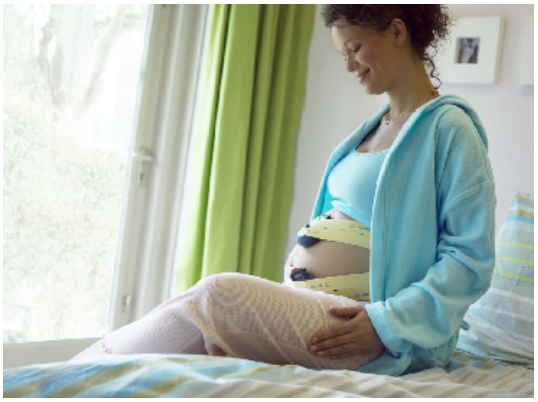

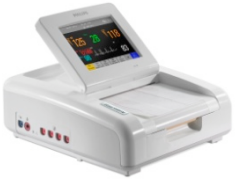

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The CMACE programme is only possible because of the commitment and involvement of practising health professionals throughout the nations covered by the enquiry. They provide data, participate as assessors and advocate the implementation of recommendations into NHS practice. CMACE cannot thank enough the many clinicians and staff who continue to provide this support for our work.

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- Professor Lelia Duley, Professor of Obstetric Epidemiology, University of Leeds and Bradford Institute for Health Research
- Dr Bryan Gill, Consultant Neonatologist & Deputy Medical Director, Leeds Teaching Hospitals NHS Trust
- Dr Steve Gould, Consultant Perinatal Pathologist, John Radcliffe Hospital, Oxford
- Dr Alison Leaf, Consultant and Academic Neonatologist, Southampton General Hospital
- Professor Neil Marlow, Professor of Neonatal Medicine, UCL Institute for Women's Health
- Professor Gordon Smith, Head of Department of Obstetrics and Gynaecology, Cambridge University.

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Abbreviations

BMI	Body Mass Index
CEMACH	Confidential Enquiry into Maternal and Child Health
CMACE	Centre for Maternal and Child Enquiries
GROS	General Register Office for Scotland
IMD	Index of Multiple Deprivation
IUGR	Intrauterine Growth Restriction
NHS QIS	National Health Service Quality Improvement Scotland
NISRA	Northern Ireland Statistics and Research Agency
NI CHS	Northern Ireland – Child Health System
ONS	Office for National Statistics
PCT	Primary Care Trust
PDN form	Perinatal Death Notification form
SHA	Strategic Health Authority
SGA	Small for Gestational Age
SSBID survey	Scottish Stillbirth and Infant Death survey

Glossary

Body Mass Index (BMI)	The body weight of an individual in kilograms divided by their height in metres squared. A BMI below 18.5 is categorised as underweight, a BMI of 18.5-24.9 is normal weight, a BMI of 25.0-29.9 is overweight and a BMI of 30 and above is obese.
Crown dependencies	The Channel Islands and the Isle of Man.
Index of Multiple Deprivation (IMD)	This combines a number of indicators, chosen to cover a range of economic, social and housing issues, into a single deprivation score for each small area in England. This allows each area to be ranked relative to one another according to their level of deprivation.
Intrauterine growth restriction (IUGR)	This is a situation where growth is good initially in pregnancy but then drops later in pregnancy (e.g. a fetus on the 97th centile dropping to the 50th centile).
Live birth	Delivery of an infant, which, after complete separation from its mother, shows sign of life.
Maternities	Pregnancy resulting in a live birth at any gestation or stillbirth occurring at 24 weeks' gestation onwards, with multiple births being counted only once.
Neonatal death	Death of a live born baby occurring before 28 completed days after birth.
Early	0-6 completed days.
Late	7-27 completed days.
Perinatal death	Death of a fetus or a newborn in the perinatal period that commences at 24 completed weeks' gestation and ends before seven completed days after birth.
Rate ratio	The ratio of the rate of a health outcome in an exposed population to the rate in the unexposed population.
Small for Gestational Age (SGA)	A baby that has a birth weight less than the 10th percentile of all babies with the same gender and gestational age.
Stillbirth	A baby delivered without signs of life after 23^{+6} weeks of pregnancy.
Termination of pregnancy	Term used to describe the deliberate ending of a pregnancy with the intention that the fetus will not survive.

Preface

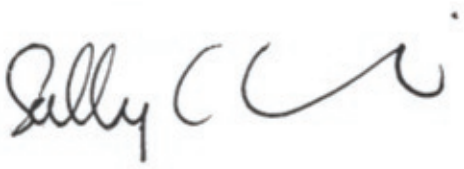
The CMACE report Perinatal Mortality 2009 completes a decade of reports from CMACE and its predecessor organizations CESDI and CEMACH. As in previous years, the findings are both heartening and challenging.

During the last decade the United Kingdom has seen a dramatic 16% increase in the number of births to just over 790,000 in 2009. Despite promising improvements, there were still 6,600 babies who died during pregnancy or in the first 4 weeks of life in 2009. The impact on mothers and families from such tragedies cannot be overestimated.

Whilst stillbirths and neonatal deaths still occur, there have been encouraging improvements with both rates of stillbirths and babies who die soon after birth falling over the decade. The improvement in neonatal mortality is particularly marked, with a reduction of nearly 20% in deaths of babies in their first four weeks of life since 2000. All staff involved in maternity and newborn care should be proud of this achievement in the face of the increasing workloads seen over the last decade. I expect that the continued monitoring and reviewing of such deaths will bring about further improvements.

The CMACE report also contains some significant findings that merit further consideration. Ethnicity and deprivation remain important associates of stillbirth and neonatal death and reducing stillbirths and neonatal deaths in these groups remains a difficult but vital public health challenge. A new finding in this report is a reduction in the uptake of post mortem examination during the decade, despite an increase in the proportion of parents being offered an autopsy. Analysis of the outcome of twin pregnancies across the decade also shows that there have been substantial reductions in twin stillbirths, probably due to improvements in obstetric and midwifery care. These improvements have not been so dramatic for neonatal deaths and further analysis appears warranted.

I know that all of the staff who have been involved in the work of CMACE over the last 10 years have taken pride in having the opportunity to contribute to these improvements in pregnancy outcome and I want to thank them. I would also like to wish Oxford University every success in continuing this work.



Dame Sally C. Davies
Chief Medical Officer
Department of Health, England

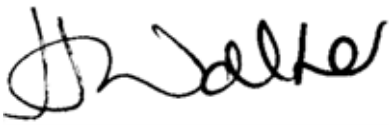
Changes to Perinatal Mortality Surveillance

Sadly this will be the last UK perinatal mortality report produced by CMACE. The National Patient Safety Agency (NPSA) recently ran a competitive tendering exercise for the future provision of the national confidential enquiries from 1 April 2011 and the contract for the maternal and newborn programme of work, which includes perinatal mortality, was awarded to the National Perinatal Epidemiology Unit at the University of Oxford.

CMACE, and its predecessor, CEMACH, had been conducting national perinatal mortality surveillance since 1 April 2003. CEMACH introduced annual national perinatal mortality reporting in addition to reporting to individual NHS trusts, Strategic Health Authorities, Neonatal Networks and Primary Care Trusts. This allowed health care providers, commissioners and policy makers to benchmark themselves against national performance indicators and other organisations. CMACE was also proud to have been able to produce perinatal mortality statistics on a UK wide basis for the first time.

CMACE considers itself privileged to have had responsibility for this work over the last eight years and would like to thank the many thousands of clinicians, medical, midwifery and nursing, up and down the UK who have given their time voluntarily in assisting us with the work during that time.

CMACE wishes every success to the National Perinatal Epidemiology Unit in taking forward the continued development of this vital work in the future. We will be handing over data so that work can continue in a seamless and uninterrupted manner. We will also endeavour to make sure that all the existing reports will continue to be available in electronic format for clinicians both in the UK and worldwide where our work is so greatly appreciated.



Professor James Walker
CMACE Chair

Executive Summary

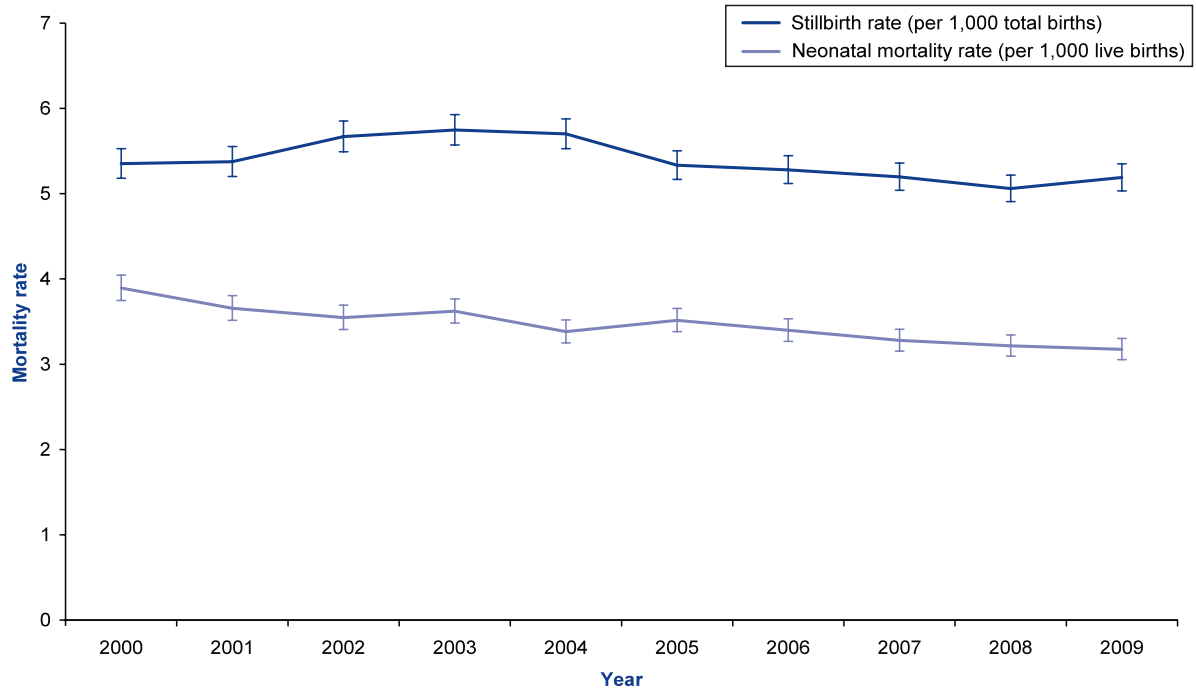
CMACE provides information on perinatal deaths at local, regional and national level for healthcare providers, commissioners and policy makers. This UK report complements the perinatal mortality reports which CMACE produces for the UK nations separately, Strategic Health Authorities (SHAs) in England and maternity providers.

Key Finding 1

Reduction in the stillbirth and neonatal mortality rates during the decade 2000 to 2009

Since 2000, stillbirth and neonatal mortality rates in the United Kingdom show a downward trend ($p<0.001$). The stillbirth rate decreased from 5.4 per 1,000 total births in 2000, to 5.2 per 1,000 total births in 2009, this is a difference of -0.2 [95% CI: -0.4, 0.1]. The neonatal mortality rate decreased from 3.9 per 1,000 live births in 2000, to 3.2 per 1,000 live births in 2009, this is a difference of -0.7 [95% CI: -0.9, -0.5]. (Pages 12 and 13)

Figure 1: Overall stillbirth and neonatal mortality rates; United Kingdom: 2000-2009



Sources: CMACE, ONS, NISRA, GROS

Key Finding 2

In England, regional variations in stillbirth and neonatal mortality rates persist

Wide variations in the adjusted* mortality rates between the Strategic Health Authorities (SHAs) in England remain in 2009. South East Coast had the lowest adjusted stillbirth rate (3.8 per 1,000 total births) and Yorkshire and the Humber the highest (5.3 per 1,000 total births). Both were statistically significantly different to the stillbirth rate for England (4.7 per 1,000 total births).

The lowest neonatal mortality rate was in South West (2.1 per 1,000 live births) and the highest was in West Midlands (3.8 per 1,000 live births). Again, both were significantly different to the neonatal mortality rate for England (2.7 per 1,000 live births). (Pages 17 to 19)

*Mortality rates are adjusted for terminations of pregnancy and babies born at less than 22 weeks' gestation.

Key Finding 3

In England, regional variations in stillbirth and neonatal deaths due to congenital anomalies reduced in 2009

There were also variations between the SHAs in the proportions of stillbirths and neonatal deaths for whom the primary cause of death was a major congenital anomaly (after removing terminations of pregnancy and babies born at less than 22 weeks' gestation). This variation was less than that seen in 2008.

South East Coast had the smallest proportion (4.1%) of stillbirths whose primary cause of death was a major congenital anomaly and the West Midlands had the largest proportion (11.0%). The proportion for South East Coast was significantly different to the proportion for England (8.0%).

East Midlands had the smallest proportion (16.1%) of neonatal deaths whose primary cause of death was a major congenital anomaly and South Central had the largest proportion (24.6%). Neither are significantly different to the proportion for England (20.3%).

Potential explanations of these differences, including chance variation, are discussed further in section 4.1 of the report. (Pages 20 and 21)

Key Finding 4

Variations exist in stillbirth and neonatal mortality rates between Primary Care Trusts (PCTs)

The average number of births in PCTs in England in 2009 was between 4,000 and 5,000 total births per year. For PCTs with this number of births, there was a 2.6 [95% CI: 1.4, 4.9] fold difference between the lowest and highest stillbirth rate and a 4.3 [1.6, 11.2] fold difference between the lowest and highest neonatal mortality rate.

With 151 PCTs being compared it is likely that much of this variation can be explained by chance. (Pages 23 to 25)

Key Finding 5

In 2009, 10% of women who had a stillbirth or neonatal death had a Body Mass Index (BMI) of 35 or more

In 2009, 10% of mothers who had a stillbirth or whose babies died in the neonatal period had a BMI of 35 or more. This is twice the UK prevalence rate (5%) of all deliveries to women with a BMI of 35 or more at any point in pregnancy, published in the CMACE Obesity in Pregnancy report. (Pages 37 and 38)

Key Finding 6

Reduced uptake of post mortems during the decade 2000-2009, despite an increase in the proportion of parents being offered an autopsy

The percentage of post mortems performed after stillbirth or neonatal death has reduced over the last 10 years ($p<0.001$): for stillbirths the reduction was from 55% in 2000 to 45% in 2009; for neonatal deaths from 29% in 2000 to 18% in 2009.

There was a reduction in the percentage of cases where a post mortem examination was not offered, from 11% in 2000 to 3% in 2009 for stillbirths ($p<0.001$) and from 23% in 2000 to 13% in 2009 for neonatal deaths ($p<0.001$). The percentage of parents who did not give consent has increased from 33% in 2000 to 51% in 2009 for stillbirths ($p<0.001$) and from 41% in 2000 to 52% in 2009 for neonatal deaths ($p<0.001$).

There has also been an increase in the percentage of neonatal deaths being referred to the coroner, from 8% in 2000 to 17% in 2009 ($p<0.001$) but no such change was seen for stillbirths. (Pages 58 to 60)

Key Finding 7

Reduction in stillbirth and neonatal mortality for twin births in the decade 2000-2009

The perinatal mortality rate in twins has decreased from 33.6 per 1,000 total births in 2000 to 24.6 per 1,000 total births in 2009 ($p<0.001$).

There has also been a downward trend in the stillbirth rates in twin births, from 16.7 per 1,000 total births in 2000 to 12.1 per 1,000 total births in 2009 ($p<0.001$) and in the neonatal mortality rate in twin births, from 21.5 per 1,000 live births in 2000 to 16.4 per 1,000 live births in 2009 ($p<0.001$). (Pages 62 to 64)

Key Finding 8

Differences in causes of death between twin and singleton births

There are clear differences in the causes of stillbirths in twins when compared to singleton births. After stillbirths with no antecedent or associated obstetric factors, the most common primary cause of a stillbirth in twins was a specific fetal condition (21%) followed by major congenital anomaly (11%). This is in marked contrast to singleton births where these factors account for 2% and 9% respectively. (Page 67)

In addition to this UK-wide report, CMACE provided the UK nations, SHAs in England and each maternity provider in all the UK nations (apart from Scotland) with a specific report showing their own data with regional and national comparators. On request, reports are also provided to Neonatal Networks, PCTs and LSCBs. CMACE knows that many organisations use these locally specific reports for comparative and monitoring purposes. This acts as a prompt to maternity and neonatal service providers to review deaths occurring within their service and to make changes to procedures and processes if felt to be necessary. Some organisations seek independent review and ask CMACE to facilitate. Reports for Scotland are produced by NHS QIS.[1]

Recommendations and CMACE recommendation policy

In this section are detailed four recommendations based on the results of this report. These are proposals made by CMACE for an appropriate course of action to be taken by external organisations and/or individuals in relation to a specific area of health care.

These recommendations are in the order they are presented in the report rather than by importance.

Recommendation 1 Neonatal deaths of babies below 22 weeks' gestation

As agreed by a multidisciplinary expert working party, at the present time, babies born before 22 weeks' gestation are very rarely resuscitated.[2] Nonetheless, many are reported to CMACE as neonatal deaths after showing signs of life. Data matching with ONS confirms that this is also reflected in death registration. Practice however varies greatly across the country, perhaps either due to differences in assessment at birth or in how these findings are recorded/classified. In London 7.3% of early neonatal deaths are born at less than 22 weeks, whereas in the West Midlands 18.8% are born at less than 22 weeks. There are significant implications involved in registering the delivery of a pre-viable fetus as a neonatal death. Clearly this will impact on infant mortality data but it also has implications for parents, hospitals, registration offices, coroners and local safeguarding authorities. **CMACE recommends that guidelines be developed to ensure greater consistency in registration. It is also recommended that future UK perinatal mortality rates are reported using gestational age and birth weight cut-offs to enable comparisons with other countries.**

(Data and further information regarding this matter are presented on pages 21 and 22 of this report.)

Recommendation 2 Perinatal mortality outliers

There can be many reasons why a maternity and neonatal service provider appears as a mortality outlier. This may, for example reflect case mix or simply random fluctuation between one year and another, and because of these issues, should certainly not be construed as reflecting clinical practice for that provider. **Nonetheless, CMACE recommends that all providers of maternity services identified as a high perinatal mortality outlier review their data locally to ensure that they understand the reasons and take any actions that may be required.**

(Data on this issue are presented on pages 34-36 of this report.)

Recommendation 3 Intrapartum stillbirths and intrapartum-related neonatal deaths

As seen in previous CEMACH/CMACE Perinatal Mortality reports, there are some 500 intrapartum deaths each year. Previous national confidential enquiries have identified that a high proportion of the deaths where a major congenital anomaly was not a factor were associated with avoidable factors that may have affected the outcome. The National Patient Safety Agency (NPSA) has recently developed a pro-forma for reviewing intrapartum related perinatal deaths.[3] **CMACE recommends that all term intrapartum deaths with no evidence of a major congenital anomaly be fully investigated locally with a view to identifying whether there were avoidable factors and to identify any areas where future care can be improved.**

(Data on this issue are presented on pages 49, 50, 55 and 56 of this report.)

Recommendation 4 Twin births

In 2009, twins remain at a much higher risk than singletons of stillbirth (2.5 times higher) and neonatal death (6.4 times higher). This increased relative risk has reduced significantly since 2000 from 3.5 to 2.5 for stillbirths but remained unchanged for neonatal deaths. **CMACE recommends that further work is undertaken to determine whether these findings are due to prematurity and growth restriction or whether further twin specific neonatal factors need to be identified.**

(Data on this issue are presented on pages 62-70 of this report.)

All recommendations comply with the CMACE recommendation policy which aims to ensure a consistent and transparent approach to the development of recommendations, enabling stakeholders and users of CMACE reports to have a full understanding of, and confidence in, the process by which recommendations have been made. A copy of this policy is available from CMACE – http://www.cmace.org.uk/Publications-Press-Releases/Editorial-Policies.aspx.

Chapter 1 Context

The Confidential Enquiry into Maternal and Child Health (CEMACH) became an independent charity on 1st July 2009 with the new name Centre for Maternal and Child Enquiries (CMACE). The independent status and new name reflect significant developments since 2003. The organisation has broadened its range of activities beyond its core national confidential enquiry activity. Local reviews, clinical audits and research collaborations represent increasingly important parts of its work. These all support its wider mission to improve the health of mothers, babies and children.

A key part of CMACE's work is the perinatal mortality surveillance system. Data on all stillbirths and neonatal deaths that occur in England, Wales, Northern Ireland and the Crown Dependencies of the Channel Islands and the Isle of Man are collected, validated, analysed and reported on. Collaboration with NHS Quality Improvement Scotland enables CMACE to produce UK-wide mortality rates.

This report includes trends in mortality rates in the UK, and mortality rate comparisons between nations, Strategic Health Authorities (SHAs), Primary Care Trusts (PCTs), Neonatal Networks, and maternity service providers. Maternal socio-demographic factors, clinical characteristics of mothers and babies, causes of death and post mortem uptake are also included in addition to a more detailed analysis on the outcome of twin births in Chapter 7.

In addition to this UK-wide report, CMACE also provide the UK nations, SHAs in England and maternity providers with specific reports showing their own data with regional and national comparators. On request, reports are also provided to Neonatal Networks, PCTs and Local Safeguarding Children Boards (LSCBs). These reports include mortality rates adjusted for terminations of pregnancy and babies born at less than 22 weeks' gestation. Comparisons to the national mortality rates, information about transfers, obstetric factors, post mortem uptake, cause of death and comparison of rates against similar organisations are also included.

This system of multi-level reporting provides valuable information to health care providers, commissioners and policy makers. It ensures all parts of the health care delivery system are aware of perinatal mortality rates nationally, regionally, locally and comparatively. Many organisations use these reports for comparative monitoring purposes. This acts as a trigger to conducting more detailed review of the deaths occurring within their service, where variations exist, and to make changes to procedures and processes if felt to be necessary.

Chapter 2 Methodology

2.1 Data sources

CMACE collects epidemiological and clinical data on all stillbirths and neonatal deaths in England, Wales, Northern Ireland, the Crown Dependencies of the Channel Islands and the Isle of Man.

These data are collected by a network of local health professionals coordinated by the CMACE local offices. In 2009 there were four CMACE offices including one operating as part of the central team in London. In the North East, West Midlands and South West local activity is subcontracted to third parties. Northern Ireland, and the states of Jersey, Guernsey and Isle of Man contract with CMACE and the All Wales Perinatal Survey (AWPS) is affiliated with CMACE to provide perinatal mortality data. Every maternity service within England, Wales, Northern Ireland and the Crown Dependencies has a CMACE coordinator who notifies CMACE of each perinatal death that occurs in their unit. Notification is carried out by completing a paper Perinatal Death Notification (PDN) form, an example of which can be seen in Appendix B. Completed forms are sent to the relevant CMACE local office.

In addition, CMACE has in recent years established a collaboration with NHS Quality Improvement Scotland. Through this alliance, information on stillbirths and neonatal deaths in Scotland can be included, which allowed for provision of UK-wide perinatal mortality.

In 2009, questions on abuse of alcohol, substance abuse, onset of labour, intended and actual type of care at delivery, intrapartum related event and local hospital reviews were added to the PDN form.

This data collection is supplemented by additional reporting of deaths to CMACE from pathologists, coroners, child health systems and local congenital anomaly registers. This multiple source reporting leads to a very high level of ascertainment of deaths.

2.2 Data reporting and analysis

2.2.1 Reporting

Perinatal mortality data are presented using birth cohorts based on a date of delivery in 2009. Denominator data on the number of live births at individual maternity units are provided directly by the provider. Population based denominator data on maternities and live births used to calculate national, Strategic Health Authority and Primary Care Trust rates are obtained from the ONS for England and Wales, General Register Office for Scotland (GROS), the Northern Ireland Statistics and Research Agency (NISRA) and the Northern Ireland Child Health Systems (NI CHS). Additional data sources are referenced throughout the report.

There are two sources of data for Northern Ireland, NISRA and NI CHS. The NISRA provide CMACE with the total live birth figure whereas the NI CHS provide live births and maternities broken down by a number of variables (e.g. multiplicity, maternal age, gestation). The total live births differ between the two sources but the NISRA figure is more widely reported and so the NISRA figure has been used when a total number is required (e.g calculation of UK rates) and the NI CHS figures have been used when the number of live births needs to be broken down by another variable.

2.2.2 Data validation and cleaning

Data are compiled centrally and cross-matched with statutory registration data on stillbirths and neonatal deaths from the Office for National Statistics (ONS). Any cases that have been identified by ONS but not by CMACE are established and investigated to ascertain whether they meet the inclusion criteria for surveillance. Where a new case is identified, the normal procedure is to collect the required minimum dataset by sending out a PDN form to the relevant provider. Each case of stillbirth or neonatal death is allocated to the Trust where the stillbirth or death occurred.

CMACE has a bespoke database which performs logical consistency and range checks as an on-screen summary on the completion of a record. There is also an on-screen list of possible duplicate matches within a region or across regions on the completion of a record. CMACE local offices send out missing information reports to providers that have notified a case with any outstanding missing information or errors in the data supplied.

Throughout the year the CMACE local offices also send out lists, to each provider, of the cases that have been notified. This is to help identify any cases that have been incorrectly assigned to a provider and any cases that have not been notified.

In preparing this report, CMACE has assessed the risk of breach of confidentiality posed by the inclusion of small numbers in tables. Application of the guidance published by ONS indicated a low risk due to the high level of aggregation of most data. Nonetheless a number of tables have been subject to disclosure control to ensure the maintenance of confidentiality.

2.2.3 Data analysis

Statistical analysis was carried out using STATA (version 11).[4] Stillbirth and perinatal mortality rates are presented per 1,000 total births and neonatal mortality rates are per 1,000 live births. Where appropriate 95% confidence intervals are provided with mortality rates, these are calculated using the Poisson distribution. Similarities and differences between mortality rates over a number of years are explored using a test for trend, with statistical significance set at p=0.05. Rate ratios are calculated with 95% confidence intervals to show any similarities and difference between two groups within a given year.

2.2.3.1 Adjusted mortality rates

Box 1: Reasoning behind the changes to the adjusted mortality rates

In past years, adjusted mortality rates have been calculated for the UK nations and the Crown Dependencies, SHA, PCTs, Networks and providers by excluding:

- terminations of pregnancy
- babies born at less than 22 weeks' gestation
- babies with a primary cause of death of a major congenital anomaly
- babies born weighing less than 500g.

Terminations of pregnancy and babies born at less than 22 weeks' gestation are still removed. However, major congenital anomalies and babies born weighing less than 500g are no longer removed. This is due to concerns over the completeness of the data used for adjusting, for example congenital anomalies were excluded despite concerns that not all of these deaths were due to lethal anomalies. As no data were available for anomalies in surviving babies these analyses will now be presented only in locality based reports from 2009. Similarly there will have been some infants weighing under 500g at birth who have survived and therefore remained in the denominator. Further work is needed to obtain more data on surviving infants to improve this adjustment methodology.

All of these factors are shown in tables within the relevant sections of the report and the frequency of these occurring in the 2009 population is also shown for information.

2.2.3.2 Maternal deprivation

Classification of deprivation was derived from the Index of Multiple Deprivation (IMD) score 2007[5] and uses the overall indicator. This is based on the postcode of residence and the corresponding Super Output Area (SOA) as defined by ONS and is based on the entire population of England. These IMD scores were ranked and quintiles of deprivation derived for the national population. Cases were then allocated to the appropriate quintile of deprivation. These scores were based on the mothers, not babies, and for multiple pregnancies only first born babies were assigned a deprivation score, to avoid double counting.

2.2.3.3 Gestational age

Gestational age is not routinely collected on all live births in England and Wales. However, the ONS have been linking their live birth data to the NHS Numbers for Babies (NN4B) dataset which does collect gestational age. The latest data the ONS have published are based on data from 2006. We have applied the proportions within each gestational age group from this paper and applied it to the number of live births in 2009. The live birth data from Northern Ireland and the Crown Dependencies for 2009 have then been added.

2.2.3.4 Small for gestational age (SGA) & intrauterine growth restriction (IUGR)

SGA has been calculated using gender, gestational age and birth weight by comparing the CMACE dataset to a table of expected values from a British population in 1990.[6] A baby whose birth weight is less than the 10th centile for gestation is considered small for gestational age. The term IUGR is used in this report where a fetus or newborn has been clinically recognised as having poor intrauterine growth. This is a situation where growth is good initially in pregnancy but then drops later in pregnancy (e.g. a fetus on the 97th centile dropping to the 50th centile). Whilst a group of small for gestational age babies will contain such infants, a large proportion will have been small throughout pregnancy, such as due to a genetic syndrome or constitutionally small.

2.2.3.5 Classification for cause of death

Our data collection form (Appendix B) asks notifiers to identify all conditions that arose during pregnancy, caused or were associated with the death and to specify which condition was the main condition causing or associated with the death. CMACE regional managers will then use this information plus any post mortem and placental histology reports to classify the one primary cause or associated factor and up to three other causes or associated factors. In chapter 6 the primary cause or associated factor for stillbirths using the maternal and fetal classification and the primary cause or associated factor for neonatal deaths using both the maternal and fetal classification and the neonatal classification will be presented.

2.2.3.6 Major congenital anomaly as primary cause of death

There are a number of tables in this report where data for major congenital anomalies as primary cause of death are presented. For data from England, Wales, Northern Ireland and the Crown Dependencies the process described above in section 2.2.3.5 is used. Any stillbirth coded with a major congenital anomaly as the primary cause of death using the CMACE maternal and fetal classification (see page 83) or a neonatal death using the CMACE neonatal classification (see page 84) are within this group. Scotland uses a different classification for coding the stillbirths and neonatal deaths. Any stillbirth or neonatal death coded with a congenital anomaly using the Paediatric classification[7] are within this group.

2.3 Funnel plots

Funnel plots are presented for providers, Networks and Primary Care Trusts. Each plot shows the adjusted mortality rates for each organisation plotted against the number of births in that organisation. The overall mortality rate is indicated by the solid line, the 95% confidence limits are delineated by the narrower dotted lines and the 99% confidence limits are the wider dotted lines. The 95% and 99% confidence limits are calculated using the Binomial distribution.[8] Organisations whose mortality rates lie outside these confidence intervals are statistically significantly different from the overall rate. As there are multiple comparisons, chance is very likely to explain being outside the 95% confidence interval so the 99% confidence interval is considered a more robust cut-off for identifying potential data outliers.

Adjustments are made to the mortality rates by removing terminations of pregnancy and babies born at less than 22 weeks' gestation from both the numerator and the denominator.

CMACE has recently developed a policy in relation to potential data outliers. A copy of this policy is available from CMACE – http://www.cmace.org.uk/Publications-Press-Releases/Editorial-Policies.aspx

Chapter 3 Overview of perinatal and neonatal mortality in the UK

This chapter gives a summary of the numbers and mortality rates of stillbirths, perinatal and neonatal deaths in 2009. The trends in mortality rates from 2000 to 2009 are presented.

3.1 Summary of 2009 mortality rates

In 2009, there were 4,125 stillbirths, 6,070 perinatal deaths and 2,511 neonatal deaths. There were 1,945 early neonatal deaths and 566 late neonatal deaths. These 6,636 notifications were reported to CMACE and SSBID Survey, ISD Scotland by maternity units in England, Northern Ireland, Scotland and Wales. There were 6 notifications from the Crown Dependencies which will be included in the analysis in all other chapters. There were 790,781 live births and 794,906 total births in the UK in 2009 (Table 3.1).

The stillbirth rate for the UK in 2009 was 5.2 per 1,000 total births, the perinatal mortality rate was 7.6 per 1,000 total births and the neonatal mortality rate was 3.2 per 1,000 live births (Table 3.1).

The numerator used to calculate these mortality rates was all deaths occurring in the UK and the denominator was all births registered in the UK. The denominators are provided by ONS for England and Wales, NISRA for Northern Ireland and GROS for Scotland.

Table 3.1
Summary of mortality rates; United Kingdom: 2009

	Number	Rate
Live births	**790,781**	**..**
Total births	**794,906**	**..**
Total notifications[a]	6,636	..
Stillbirths	4,125	5.2 [5.0, 5.4][b]
Perinatal deaths	6,070	7.6 [7.4, 7.8][b]
Neonatal deaths	2,511	3.2 [3.1, 3.3][c]
Early neonatal deaths	1,945	2.5 [2.4, 2.6][c]
Late neonatal deaths	566	0.7 [0.7, 0.8][c]

[a]Includes stillbirths and neonatal deaths
[b]Rate per 1,000 total births
[c]Rate per 1,000 live births

Sources: CMACE, ONS, NISRA, GROS and SSBID Survey

In the decade 2000 to 2009, the perinatal mortality rate showed a downward trend from 8.3 per 1,000 total births in 2000 to 7.6 per 1,000 total births in 2009 ($p<0.001$). This decrease was due to a decrease both in the stillbirth rate from 5.4 per 1,000 total births to 5.2 per 1,000 total births ($p<0.001$) and in the early neonatal mortality rate from 2.9 per 1,000 live births to 2.5 per 1,000 live births ($p<0.001$).

Table 3.2
Overall stillbirth, perinatal and neonatal mortality rates; United Kingdom: 2000-2009

Year	Live births	Stillbirth rate[a]	Perinatal mortality rate[a]	Neonatal mortality rate[b]		
				Early (<7 days)	Late (7-27 days)	Total
2000	678,718	5.4 [5.2, 5.5]	8.3 [8.1, 8.5]	2.9 [2.8, 3.1]	0.9 [0.9, 1.0]	3.9 [3.7, 4.0]
2001	668,849	5.4 [5.2, 5.6]	8.1 [7.9, 8.3]	2.8 [2.6, 2.9]	0.9 [0.8, 1.0]	3.7 [3.5, 3.8]
2002	668,569	5.7 [5.5, 5.9]	8.4 [8.2, 8.6]	2.7 [2.6, 2.9]	0.8 [0.8, 0.9]	3.5 [3.4, 3.7]
2003	695,331	5.7 [5.6, 5.9]	8.5 [8.3, 8.8]	2.8 [2.7, 2.9]	0.8 [0.7, 0.9]	3.6 [3.5, 3.8]
2004	715,996	5.7 [5.5, 5.9]	8.3 [8.1, 8.5]	2.6 [2.5, 2.8]	0.7 [0.7, 0.8]	3.4 [3.3, 3.5]
2005	723,094	5.3 [5.2, 5.5]	8.0 [7.8, 8.2]	2.7 [2.6, 2.8]	0.8 [0.8, 0.9]	3.5 [3.4, 3.7]
2006	749,056	5.3 [5.1, 5.4]	7.9 [7.7, 8.1]	2.6 [2.5, 2.7]	0.8 [0.7, 0.9]	3.4 [3.3, 3.5]
2007	772,815	5.2 [5.0, 5.4]	7.7 [7.6, 7.9]	2.6 [2.5, 2.7]	0.7 [0.7, 0.8]	3.3 [3.2, 3.4]
2008	795,004	5.1 [4.9, 5.2]	7.5 [7.4, 7.7]	2.5 [2.4, 2.6]	0.7 [0.7, 0.8]	3.2 [3.1, 3.3]
2009	790,781	5.2 [5.0, 5.4]	7.6 [7.4, 7.8]	2.5 [2.4, 2.6]	0.7 [0.7, 0.8]	3.2 [3.1, 3.3]

[a]Rate per 1,000 total births
[b]Rate per 1,000 live births

Sources: CMACE, ONS, NISRA, GROS and SSBID Survey

CMACE has been recording the organisation who sent the first notification for each stillbirth and neonatal death since 2005. Other organisations reporting these deaths other than the hospital where the babies die are ONS, pathology services, coroners, child health systems and congenital anomaly registers. The proportions of stillbirths and neonatal death notified by the hospitals are very high with the rest mainly notified by ONS. The proportion notified by ONS has decreased from 8% in 2005 to 5% in 2009 for stillbirths and from 15% to 10% for neonatal deaths.

3.2 Mortality in UK nations and Crown Dependencies

Table 3.3 shows the adjusted stillbirth, perinatal and neonatal mortality rates for England, Northern Ireland, Scotland, Wales and the Crown Dependencies (Jersey, Guernsey and the Isle of Man). The data used to create these rates are shown in Appendix C.

The numerator used to calculate these mortality rates was all resident deaths occurring in the UK removing terminations of pregnancy and babies born at less than 22 weeks' gestation and the denominator was the resident births registered in the UK removing terminations of pregnancy and babies born at less than 22 weeks' gestation. The denominators are provided by ONS for England and Wales, NISRA for Northern Ireland, GROS for Scotland and the individual Islands for the Crown Dependencies.

There was no statistically significant difference between the mortality rates of the nations (Table 3.3). The slight variation between these rates may reflect differences in the population, and so should not be interpreted as an indicator of quality of care. The adjusted stillbirth rate in Scotland was significantly higher than in England (Table 3.3 and Figure 3.1). There was, however, no difference in the crude rates, so this appears to be due to problems identifying and removing of terminations of pregnancy from the Scotland cohort for the adjusted analysis.

Table 3.3
Adjusted stillbirth, perinatal and neonatal mortality rates by nation: 2009

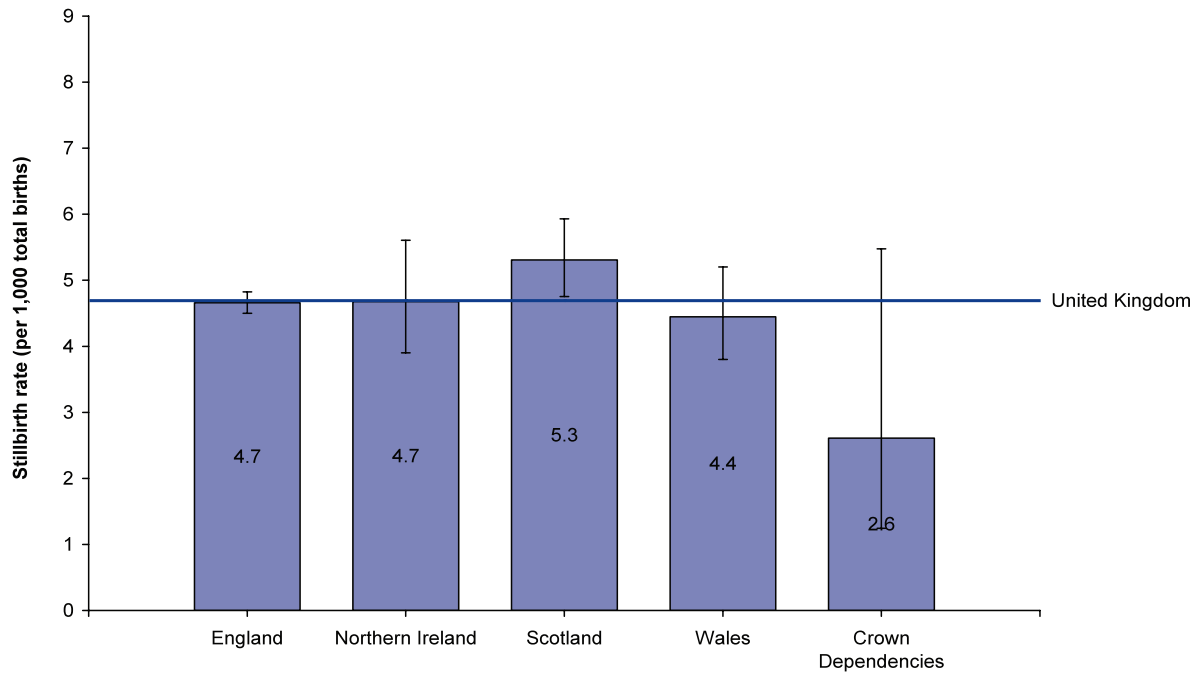
	Stillbirth rate[a,b]	Perinatal mortality rate[a,b]	Neonatal mortality rate[a,c]
UK[d]	4.7 [4.5, 4.8]	6.8 [6.6, 6.9]	2.8 [2.7, 2.9]
England	4.7 [4.5, 4.8]	6.7 [6.5, 6.9]	2.7 [2.6, 2.9]
Northern Ireland	4.7 [3.9, 5.6]	7.5 [6.5, 8.7]	3.5 [2.8, 4.3]
Scotland[e]	5.3 [4.8, 5.9]	7.3 [6.7, 8.0]	2.8 [2.4, 3.2]
Wales	4.4 [3.8, 5.2]	6.6 [5.8, 7.5]	2.9 [2.4, 3.5]
Crown Dependencies	2.6 [1.2, 5.5]	6.3 [3.9, 10.2]	4.5 [2.5, 7.9]

[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation
[b]Rate per 1,000 total births
[c]Rate per 1,000 live births
[d]Includes the Crown Dependencies
[e]The data from Scotland may include some terminations of pregnancy. The Scottish data collection form does not ask if the case was a termination of pregnancy so these cases cannot be removed.

Sources: CMACE, ONS, NISRA, GROS and SSBID Survey

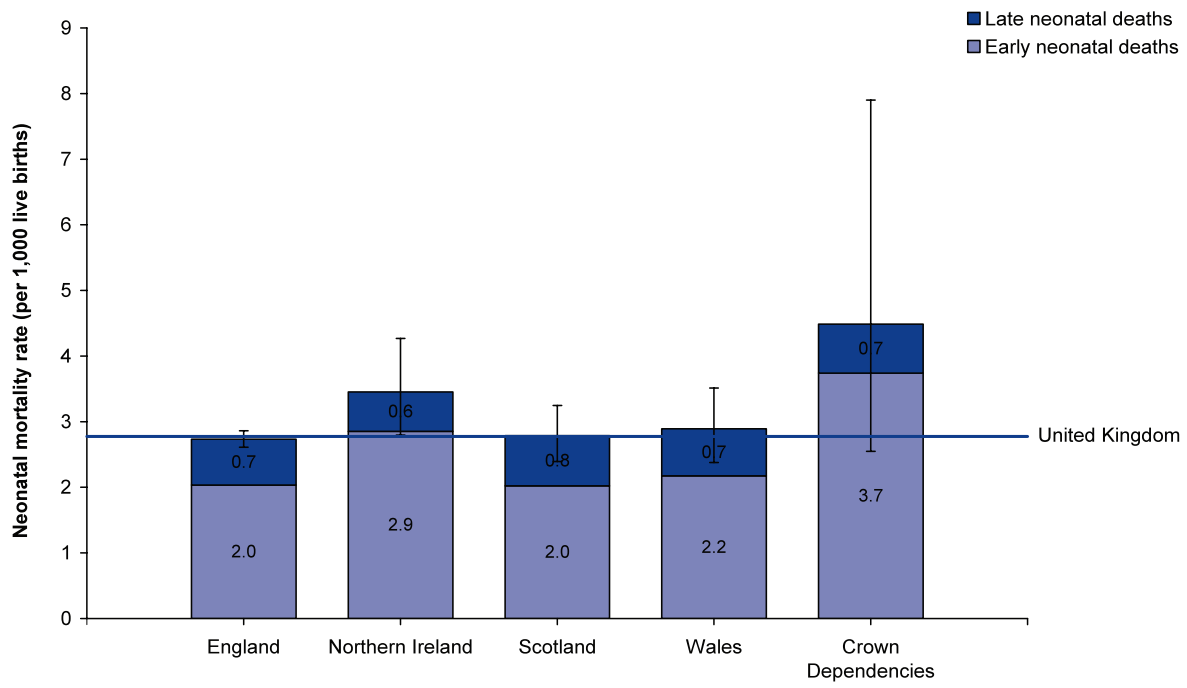
The adjusted stillbirth rates and associated 95% confidence intervals for each UK nation and the Crown Dependencies are shown in Figure 3.1. The adjusted neonatal mortality rates and associated 95% confidence intervals for each UK nation and the Crown Dependencies are shown in Figure 3.2.

Figure 3.1
Adjusted[a] stillbirth rates by nation with associated 95% confidence intervals: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 3.2
Adjusted[a] neonatal mortality rates by nation with associated 95% confidence intervals: 2009



[a] Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

High risk factors for stillbirths and neonatal deaths are shown in Tables 3.4 and 3.5 and the frequency of these occurring in the 2009 population is also shown for information. Terminations of pregnancy and babies born at less than 22 weeks' gestation are still removed when calculating mortality rates but CMACE no longer removes babies with a primary cause of death of a major congenital anomaly and babies born weighing less than 500g. Please see Box 1 in the methodology chapter for the reasoning behind the changes to the adjustments.

Table 3.4
Number of stillborn infants with major congenital anomaly as primary cause of death and <500g birth weight by nation: 2009

	n (%)		
	Major congenital anomaly as primary cause of death[a,b]	**<500g birth weight[a,b]**	**Number of stillbirths after exclusions[c]**
UK[d]	352 (8.6)	325 (8.0)	3,099 (76.0)
England	278 (8.0)	266 (7.7)	2,626 (75.9)
Northern Ireland	15 (12.6)	7 (5.9)	96 (80.7)
Scotland	49 (15.6)	36 (11.5)	239 (76.1)
Wales	10 (5.7)	15 (8.5)	132 (75.0)
Crown Dependencies	*	*	6 (66.7)

[a]Some stillbirths are counted in more than one category
[b]Excludes terminations of pregnancy
[c]Excludes terminations of pregnancy, major congenital anomalies and babies born weighing <500g
[d]Includes the Crown Dependencies
*Suppression of low cell count

Sources: CMACE and SSBID Survey

Table 3.5
Number of neonatal deaths with major congenital anomaly as primary cause of death and <500g birth weight by nation: 2009

	n (%)		
	Major congenital anomaly as primary cause of death[a,b]	**<500g birth weight[a,b]**	**Number of neonatal deaths after exclusions[c]**
UK[d]	533 (21.5)	138 (5.6)	1,516 (61.3)
England	427 (20.3)	116 (5.5)	1,294 (61.6)
Northern Ireland	40 (40.0)	5 (5.0)	41 (41.0)
Scotland	41 (27.2)	11 (7.3)	99 (65.6)
Wales	24 (22.2)	5 (4.6)	72 (66.7)
Crown Dependencies	*	*	10 (76.9)

[a]Some neonatal deaths are counted in more than one category
[b]Excludes terminations of pregnancy and babies born at <22 weeks' gestation
[c]Excludes terminations of pregnancy, babies born at <22 weeks' gestation, major congenital anomalies and babies born weighing <500g
[d]Includes the Crown Dependencies
*Suppression of low cell count

Sources: CMACE and SSBID Survey

Chapter 4 Perinatal and neonatal mortality in Strategic Health Authorities, Primary Care Trusts, Neonatal Networks and providers

This chapter gives a summary of the stillbirth, perinatal and neonatal mortality rates in Strategic Health Authorities (SHAs), Primary Care Trusts (PCTs) and Neonatal Networks in England, and providers including Hospital Trusts in England, Northern Ireland and the Crown Dependencies and Health Boards in Wales.

CMACE produces annual reports for SHAs in England and maternity providers showing their own data with regional and national comparators. On request, reports are also provided to Neonatal Networks, PCTs and Local Safeguarding Children Boards (LSCBs). These reports compare mortality rates against the national rates, and for all organisations apart from providers, it compares the mortality rates of the constituent providers within them.

4.1: Strategic Health Authorities (England)

Strategic Health Authorities (SHAs) were introduced in 2002 to manage the NHS locally. The original 28 SHAs were reduced to 10 on 1st July 2006. Their regional oversight role includes ensuring that local health services are of high quality and are performing well. In July 2010 the government published the white paper *Equity and excellence: Liberating the NHS*.[9] This included the aim of abolishing SHAs in England and replacing them with an NHS Commissioning Board and commissioning of services by GP consortia by April 2013.

Table 4.1 shows the adjusted stillbirth, perinatal and neonatal mortality rates for each SHA for 2007-2009. Data used to create the rates are included in Appendix D.

Deaths are assigned to an SHA using the mother's postcode of residence. Variations in mortality rates between SHAs may reflect socio-demographic differences between the local maternity populations and should not necessarily be used as a measure of the quality of maternity care provided.

SHA specific reports are provided to every SHA in England. These reports include adjusted mortality rates and comparisons to the national mortality rates, information about transfers, obstetric factors, post mortem uptake, cause of death, comparisons to other SHAs, mortality rates of the providers within the SHA and comparisons to all other providers.

There has been an increase in the stillbirth rate for East Midlands ($p=0.003$). There were no differences seen in any other SHA.

Table 4.1
Adjusted stillbirth, perinatal and neonatal mortality rates by SHA; England: 2007-2009

	Stillbirth rate[a,b]			Perinatal mortality rate[a,b]			Neonatal mortality rate[a,c]		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
England	4.6	4.6	4.7	6.8	6.7	6.7	2.9	2.8	2.7
East Midlands	4.0	4.1	5.2	6.5	6.6	7.3	3.2	3.4	2.8
East of England	3.9	3.8	4.3	6.0	5.6	6.1	2.5	2.4	2.4
London	5.2	4.9	4.8	7.3	6.8	6.9	2.9	2.5	2.8
North East	4.4	5.4	4.2	6.7	7.4	6.2	2.8	3.0	2.6
North West	4.8	4.6	4.6	6.8	6.8	6.6	2.8	3.0	2.8
South Central	4.1	4.1	4.2	5.9	6.2	6.0	2.3	2.6	2.3
South East Coast	4.1	4.2	3.8	5.8	6.0	5.5	2.3	2.4	2.2
South West	3.9	4.1	4.5	5.6	6.0	6.0	2.4	2.5	2.1
West Midlands	5.0	5.2	5.2	8.2	8.1	8.0	3.9	3.7	3.8
Yorkshire and the Humber	5.1	5.1	5.3	7.7	7.2	7.4	3.5	3.0	3.0

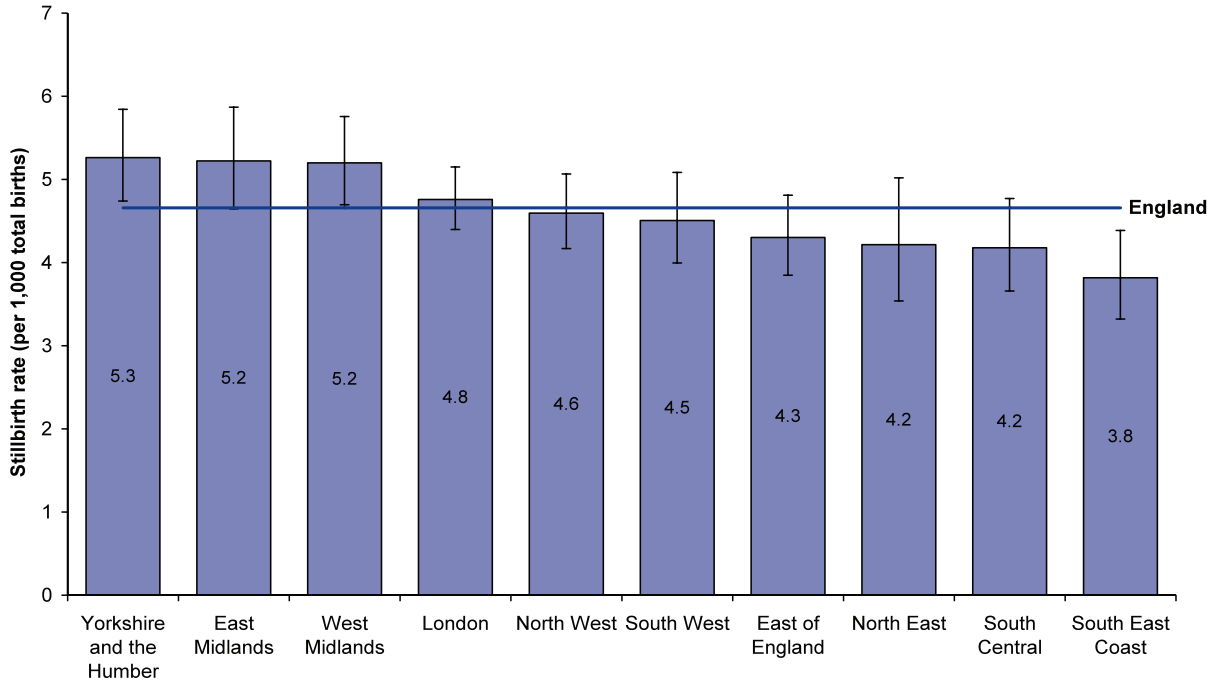
[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation
[b]Rate per 1,000 total births
[c]Rate per 1,000 live births

Sources: CMACE, ONS

The adjusted stillbirth rates and associated 95% confidence intervals for each SHA are shown in Figure 4.1. South East Coast had the lowest stillbirth rate of 3.8 per 1,000 total births and Yorkshire and the Humber had the highest stillbirth rate of 5.3 per 1,000 total births. West Midlands and Yorkshire and the Humber's stillbirth rates were both significantly higher than the rate for England, and South East Coast's stillbirth rate was statistically significantly lower than the rate for England.

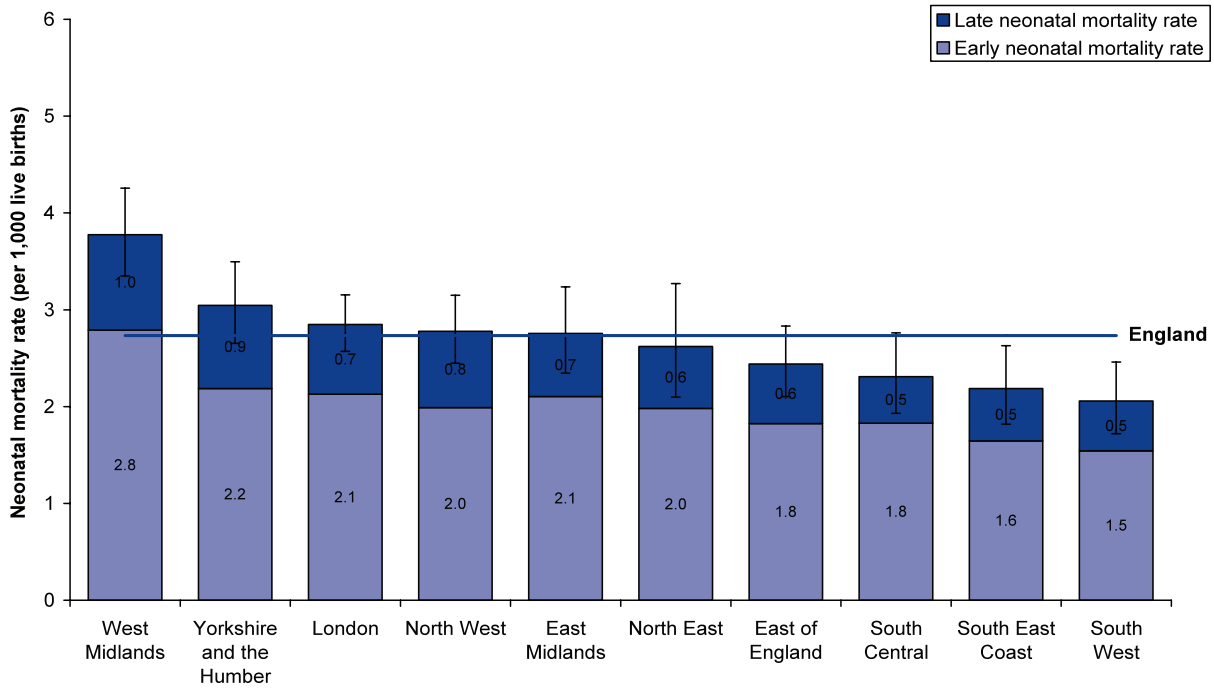
The adjusted neonatal mortality rates and associated 95% confidence intervals for each SHA are shown in Figure 4.2. South West had the lowest neonatal mortality rate of 2.1 per 1,000 live births and West Midlands had the highest neonatal mortality rate of 3.8 per 1,000 live births. West Midlands' neonatal mortality rate was significantly higher than the rate for England, and South East Coast and South West's neonatal mortality rates were significantly lower than the rate for England.

Figure 4.1
Adjusted[a] stillbirth rates by SHA and associated 95% confidence intervals; England: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.2
Adjusted[a] neonatal mortality rates by SHA and associated 95% confidence intervals; England: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

High risk factors for stillbirths and neonatal deaths are shown in Tables 4.2 and 4.3 and the frequency of these occurring in the 2009 population is also shown for information. Terminations of pregnancy and babies born at less than 22 weeks' gestation are still removed when calculating mortality rates but CMACE no longer removes babies with a primary cause of death of a major congenital anomaly and babies born weighing less than 500g. Please see Box 1 in the methodology chapter for the reasoning behind the changes to the adjustments.

Tables 4.2 and 4.3 show the proportions of congenital anomalies among stillbirths and neonatal deaths within the SHAs in England. South East Coast had the smallest proportion (4.1%, 95% CI: 1.5, 6.7) of stillbirths whose primary cause of death was a major congenital anomaly after removing terminations of pregnancy and babies born at less than 22 weeks' gestation and West Midlands had the highest proportion (11.0%, 95% CI: 8.0, 14.0), the proportion for South East Coast was significantly different to the proportion for England as a whole (8.0%, 95% CI: 7.1, 8.9).

East Midlands had the smallest proportion (16.1%, 95% CI: 9.7, 22.5) of neonatal deaths whose primary cause of death was a major congenital anomaly after removing termination of pregnancy and babies born at less than 22 weeks' gestation and South Central had the highest proportion (24.6%, 95% CI: 15.4, 33.8). Neither of these were statistically different to the proportion for England as a whole (20.3%, 95% CI: 18.6, 22.0). Although these differences may just be due to chance, there are a number of potential explanations for these variations including a true variation in anomaly rates, better screening accuracy, differences in data collection or classification, or differences in the frequency of termination of pregnancy for anomaly. Further data is needed to determine the contribution of these and other reasons.

Table 4.2
Number of stillborn infants with major congenital anomaly as primary cause of death and <500g birth weight by SHA; England: 2009

	n (%)		
	Major congenital anomaly as primary cause of death[a,b]	**<500g birth weight[a,b]**	**Number of stillbirths after exclusions[c]**
England	278 (8.0)	266 (7.7)	2,626 (75.9)
East Midlands	21 (6.9)	31 (10.2)	232 (76.3)
East of England	26 (7.6)	12 (3.5)	272 (79.5)
London	64 (9.2)	60 (8.6)	499 (71.8)
North East	6 (4.3)	7 (5.1)	115 (83.3)
North West	39 (8.7)	30 (6.7)	338 (75.3)
South Central	21 (8.5)	15 (6.0)	183 (73.8)
South East Coast	9 (4.1)	13 (6.0)	177 (81.2)
South West	16 (5.7)	23 (8.2)	228 (80.9)
West Midlands	45 (11.0)	47 (11.5)	288 (70.2)
Yorkshire and the Humber	31 (8.3)	28 (7.5)	294 (79.0)

[a]Some stillbirths are counted in more than one category
[b]Excludes terminations of pregnancy
[c]Excludes terminations of pregnancy, major congenital anomalies and babies born weighing <500g

Source: CMACE

Table 4.3
Number of neonatal deaths with major congenital anomaly as primary cause of death and <500g birth weight by SHA; England: 2009

	n (%)		
	Major congenital anomaly as primary cause of death[a,b]	**<500g birth weight[a,b]**	**Number of neonatal deaths after exclusions[c]**
England	427 (20.3)	116 (5.5)	1,294 (61.6)
East Midlands	28 (16.1)	15 (8.6)	106 (60.9)
East of England	47 (22.0)	12 (5.6)	115 (53.7)
London	77 (19.4)	19 (4.8)	272 (68.5)
North East	19 (22.4)	3 (3.5)	56 (65.9)
North West	53 (18.5)	14 (4.9)	176 (61.5)
South Central	34 (24.6)	9 (6.5)	78 (56.5)
South East Coast	24 (19.2)	5 (4.0)	84 (67.2)
South West	27 (19.4)	4 (2.9)	89 (64.0)
West Midlands	72 (22.5)	21 (6.6)	175 (54.7)
Yorkshire and the Humber	46 (20.5)	14 (6.3)	143 (63.8)

[a]Some neonatal deaths are counted in more than one category
[b]Excludes terminations of pregnancy and babies born at <22 weeks' gestation
[c]Excludes terminations of pregnancy, babies born at <22 weeks' gestation, major congenital anomalies and babies born weighing <500g

Source: CMACE

Table 4.4 shows the numbers and proportions of early neonatal deaths born at less than 22 weeks' gestation by SHA in England. At the present time, after birth pre-22 week fetuses are incapable of sustaining a separate existence and must be considered pre-viable. This is supported by a large population study (EPICure) undertaken in the UK which found that there were no survivors within a cohort delivered before 22 weeks' gestation.[10] After birth a pre-viable fetus may exhibit signs of activity which are reflex and physiological, including limb movements, cardiac and respiratory activity. It can also be argued that despite these, a pre-viable fetus is unable to sustain separate existence. Uncertainty about whether to classify the case as a neonatal death or a fetal loss may account for the variation in the numbers of neonatal deaths, even at a regional level. For example, London had the smallest apparent proportion (7.2%, 95% CI: 4.3, 10.1) of early neonatal deaths born at less than 22 weeks' gestation and North West had the highest (18.9%, 95% CI: 13.7, 24.1). The proportion for London was statistically significantly different to the proportion for England (14.4%, 95% CI: 12.7, 16.1).

In total, 235 such deaths were reported to CMACE in 2009. The data matching carried out with ONS indicates that this is reflected in death registrations. There are significant implications for all parties concerned, and for infant mortality data. The development of a consistent approach would clearly require sensitivity and care (see Recommendation 1).

Table 4.4
Early neonatal deaths born at less than 22 weeks' gestation by SHA; England: 2009

	Number of early neonatal deaths <22 weeks	Percentage of all early neonatal deaths (%)	Number of live births	Rate (per 1,000 live births)
England	235	14.4	671,058	0.35
East Midlands	22	15.8	53,746	0.41
East of England	32	18.8	71,335	0.45
London	22	7.2	129,245	0.17
North East	7	10.6	29,776	0.24
North West	41	18.9	87,549	0.47
South Central	17	15.0	51,980	0.33
South East Coast	10	10.3	51,689	0.19
South West	17	15.6	58,338	0.29
West Midlands	47	18.8	71,042	0.66
Yorkshire and the Humber	20	12.0	66,358	0.30

Source: CMACE

Table 4.5 shows where mothers booked and the stillbirth occurred according to the SHA of residence. Overall, 90% of mothers who had a stillbirth booked and delivered within the SHA they were resident in, 1% booked outside the SHA of residence but were transferred back into the SHA before the stillbirth, 1% transferred outside the SHA they were resident in and 2% were cared for outside the SHA they were resident in.

Table 4.5
Location of booking and place of birth for stillbirths according to maternal residence; England: 2009

SHA of residence	Percentage (%)					
	Booked and delivered	Transferred into the SHA	Transferred out of the SHA	Cared for outside the SHA	Place of booking or delivery is other[a]	Place of booking or delivery is not known
East Midlands	84.5	2.6	1.6	9.5	0.3	1.3
East of England	88.3	0.6	2.3	5.6	1.2	2.0
London	85.8	0.4	1.0	0.9	1.7	10.2
North East	92.8	0.7	-	-	2.2	4.3
North West	96.0	0.2	0.7	0.4	1.1	1.6
South Central	79.4	1.2	1.6	6.5	1.6	9.7
South East Coast	88.5	1.4	0.5	2.3	0.5	6.9
South West	92.2	0.7	1.8	-	1.8	3.5
West Midlands	91.2	-	1.0	0.5	1.0	6.3
Yorkshire and the Humber	96.0	0.8	0.5	0.3	0.8	1.6

[a]Place of booking and/or delivery other includes unbooked, home, in transit and outside the UK

Source: CMACE

Table 4.6 shows where mothers booked and the neonatal deaths occurred according to the SHA of residence. Overall, 80% of mothers whose babies died in the neonatal period booked and their babies died within the SHA they were resident in, 1% transferred into the SHA they were resident in before the death, 6% transferred outside the SHA they were resident in and 3% were cared for outside the SHA they were resident in. Table 4.5 and 4.6 are intended to provide information on where care is delivered in SHAs.

Table 4.6
Location of booking and death for all neonatal deaths according to maternal residence; England: 2009

SHA of residence	Percentage (%)					
	Booked and died	Transferred into the SHA	Transferred out of the SHA	Cared for outside the SHA	Place of booking or death is other[a]	Place of booking or death is not known
East Midlands	73.6	1.1	8.6	7.5	2.3	6.9
East of England	78.5	-	7.5	7.5	0.5	6.1
London	75.3	1.5	3.3	0.3	2.8	16.9
North East	96.5	1.2	-	-	-	2.4
North West	88.8	0.3	3.1	0.3	1.0	6.3
South Central	75.4	1.4	5.1	9.4	0.7	8.0
South East Coast	53.6	1.6	18.4	5.6	1.6	19.2
South West	84.2	0.7	7.2	0.7	0.7	6.5
West Midlands	87.5	-	3.4	1.9	1.9	5.3
Yorkshire and the Humber	85.3	1.3	5.8	-	0.9	6.7

[a]Place of booking and/or death other includes unbooked, home, in transit and outside the UK

Source: CMACE

4.2. Primary Care Trusts (England)

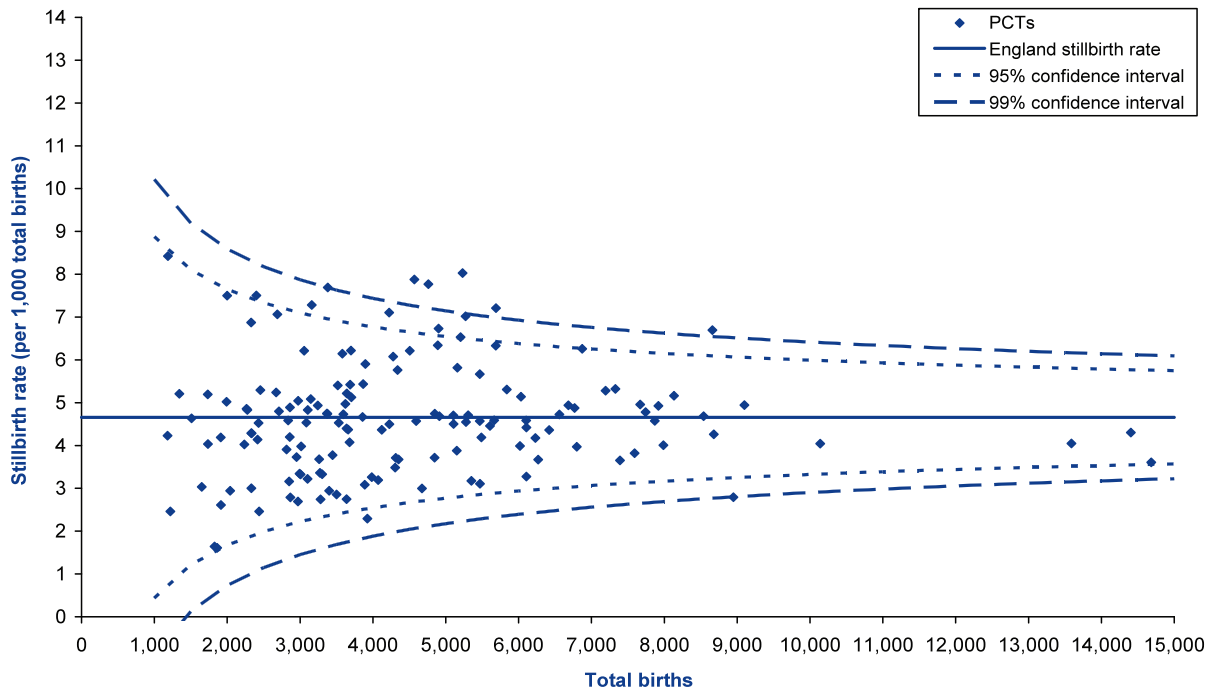
Primary Care Trusts (PCTs) decide what health services a local community needs and are responsible for ensuring that they are provided. The PCT must ensure that there are enough services for people within their local area and that the services are accessible. PCTs make decisions about the type of services that hospitals provide and are responsible for making sure that the quality of services is high enough. They also control funding for hospitals. There are 151 PCTs in England. Following the recent white paper[9] it is anticipated that these will be phased out and replaced by GP consortia.

Figures 4.3-4.5 show the adjusted stillbirth, perinatal and neonatal mortality rates for each PCT for 2009. Deaths are assigned to a PCT using the mother's postcode of residence. Variations in mortality rates between PCTs may not be a measure of the quality of maternity care provided but could be a chance finding or reflect socio-demographic differences of the local maternity populations. By chance alone, 2.5% of PCTs may be expected to be above and 2.5% of PCTs below the 95% confidence limit. As this will result in a large number of PCTs being flagged as a possible problem this report also presents a 99% confidence limit. PCTs outside this range should take steps to understand their position and may need to consider their population risk factors and quality of care especially if this has occurred for more than one year.

In 2009, the average size of a PCT (after removing terminations of pregnancy and babies born at less than 22 weeks' gestation) in England was 4,463 total births per year. For PCTs with total births 500 either side of the average, stillbirth rates ranged from 3.0 to 7.9 per 1,000 total births and the neonatal death rates range from 1.2 to 5.0 per 1,000 live births. When looking at the stillbirth rates for all PCTs the highest rate was 5.2 times larger [95% CI: 1.4, 19.0] than the lowest and for neonatal mortality rates the highest rate was 17.1 times larger [2.2, 131.4] than the lowest. As can be seen by the confidence intervals around these estimates, these findings are likely to have occurred by chance. Other possible explanations for the variations seen in the mortality rates include reporting differences, variation in the risk factor profiles of women and babies cared for by PCTs and the socio-demographic characteristics of the local maternity population. For example, in a prognostic model to predict differences in perinatal and infant mortality rates between PCTs in England, it was found that high rates of birth associated with Black ethnicity and higher deprivation significantly increased the perinatal mortality rate (PMR), while high proportions of mothers over the age of 35 significantly lowered the PMR. High birth rates associated with Pakistani ethnicity slightly, though still significantly, increased the PMR.[11]

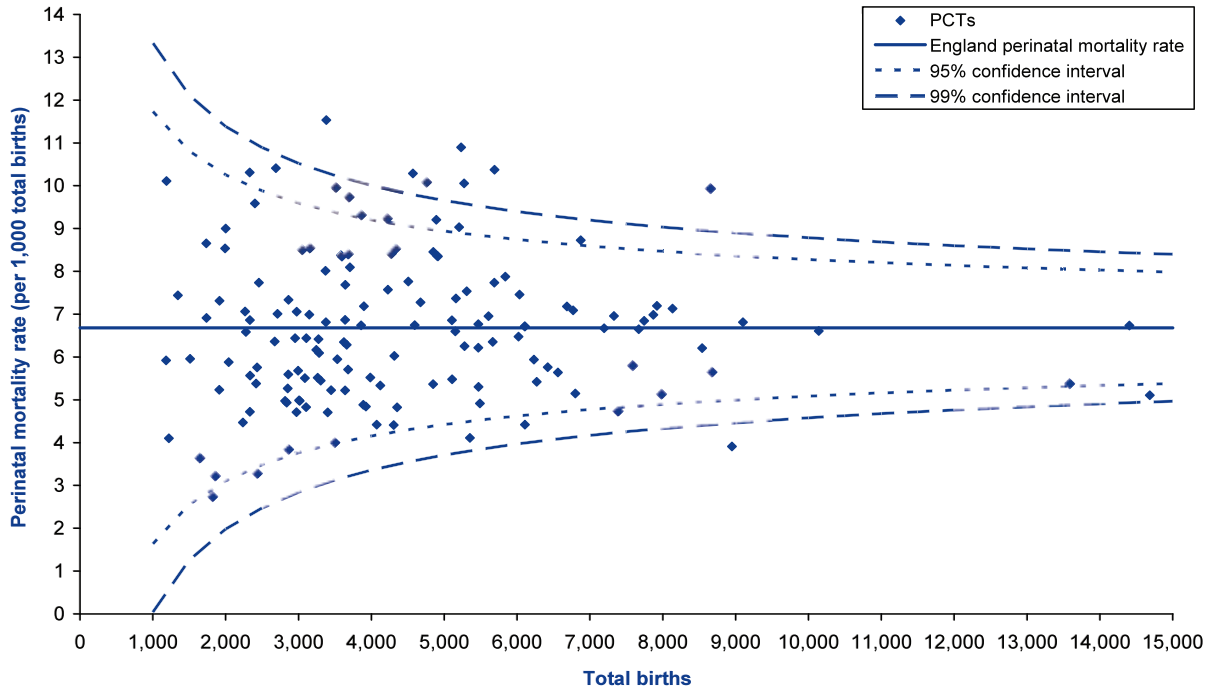
PCT specific reports can be obtained from CMACE. These reports include adjusted mortality rates and comparisons to regional and national mortality rates, information about transfers, obstetric factors, post mortem uptake, cause of death, comparisons to other PCTs, mortality rates of the providers within the PCT and comparisons to all other providers.

Figure 4.3
Adjusted[a] PCT stillbirth rates compared to the England stillbirth rate and associated 95% and 99% confidence intervals: England, 2009



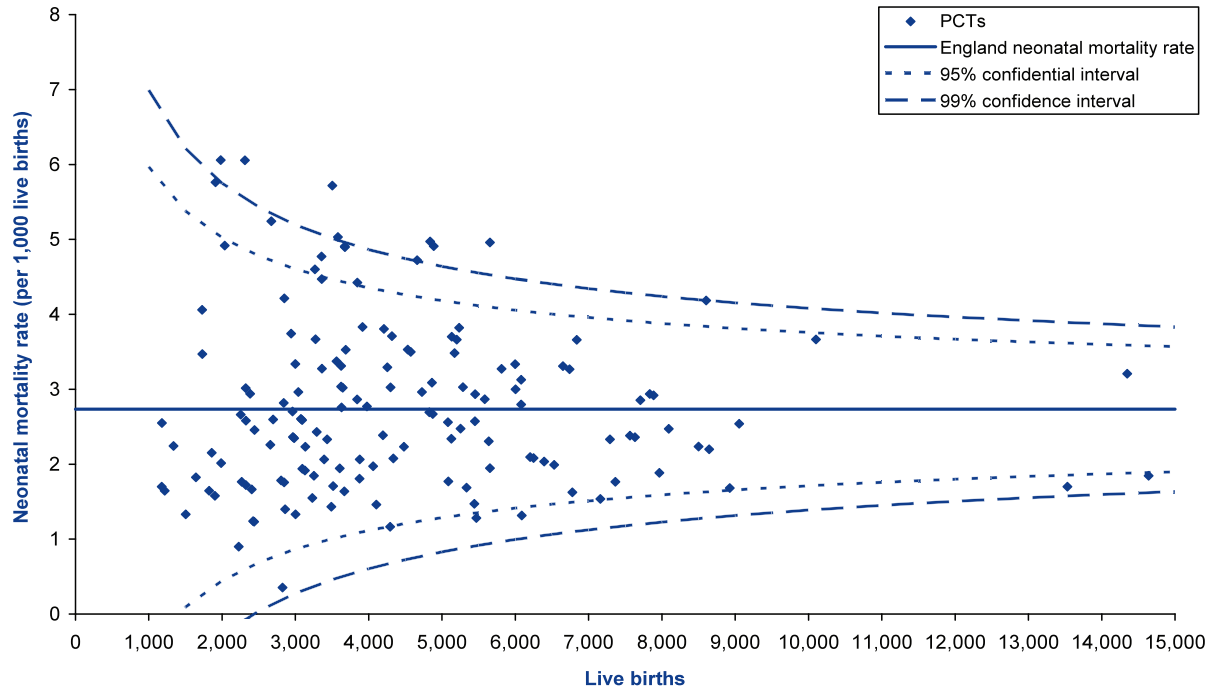
[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.4
Adjusted[a] PCT perinatal mortality rates compared to the England perinatal mortality rate and associated 95% and 99% confidence intervals: England, 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.5
Adjusted[a] PCT neonatal mortality rates compared to the England neonatal mortality rate and associated 95% and 99% confidence intervals: England, 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

4.3: Neonatal Networks (England)

There are 24 Neonatal Networks in England. They were developed as a result of recommendations from the Department of Health's 'National Strategy for Improvement' published in 2003. Networks aim to provide families with access to appropriate care, resources and skilled staff as close to home as possible, whilst reducing unnecessary transfers to units further away from home.

To achieve this, within each Network different hospitals provide a mix and range of levels of care as agreed by that Network. Except for one Network in England, at least one hospital in each Network provides neonatal intensive care (level 3) facilities, offering a wide range of specialist expertise and experience for the sickest infants. The level 3 neonatal intensive care unit(s) work closely with their Network special care (level 1) and neonatal (level 2) units. The exceptional Network is geographically very closely aligned to two other Networks and has chosen to commission intensive care (level 3) services from these two adjoining Networks. In 2010 there were changes to the configuration of these three Networks.

Following the recently published Department of Health's Toolkit for High-Quality Neonatal Services[12] these categories have changed to special care units (level 1), local neonatal units (level 2) units and neonatal intensive care units (level 3) according to Network designation.

Network specific reports can be purchased from CMACE. These reports include adjusted mortality rates and comparisons to national mortality rates, information about transfers, obstetric factors, post mortem uptake, cause of death, comparisons to other Networks, mortality rates of the providers within the Network and comparisons to all other providers.

Table 4.7 shows the adjusted stillbirth, perinatal and neonatal mortality rates for each Network for 2007-2009. Data used to create the rates are included in Appendix E.

Table 4.7
Adjusted stillbirth, perinatal and neonatal mortality rates by Neonatal Network; England: 2007-2009

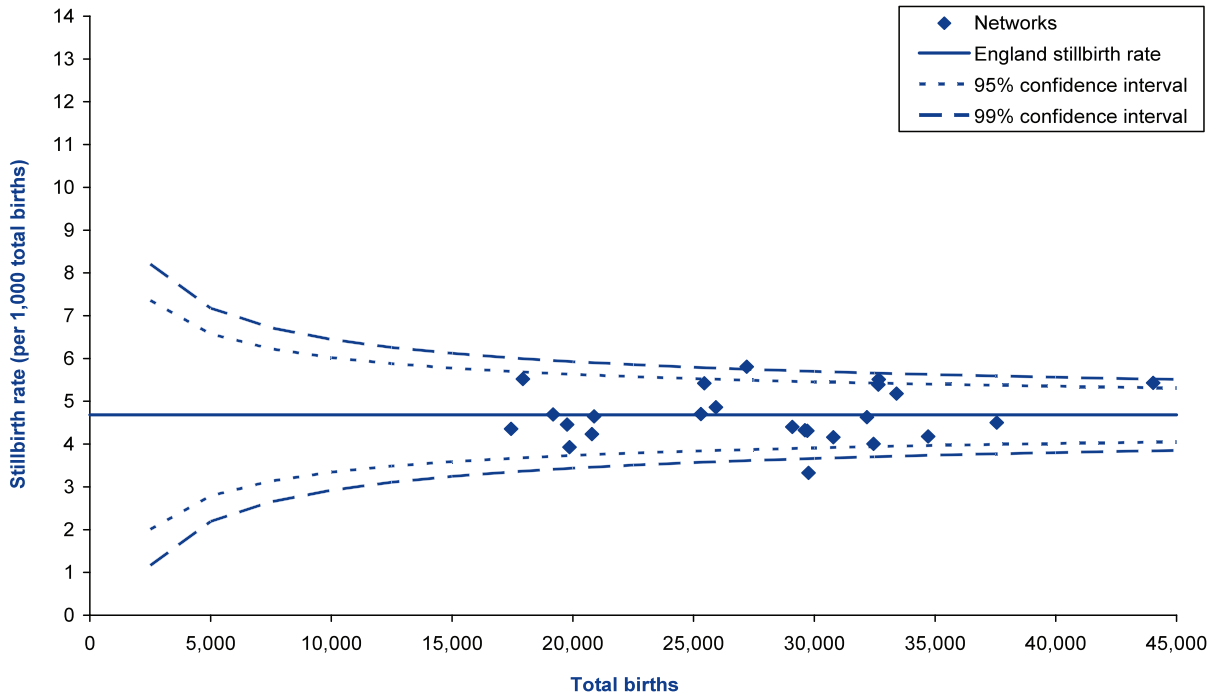
Neonatal Network	Stillbirth rate[a,b]			Perinatal mortality rate[a,b]			Neonatal mortality rate[a,c]		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
England	4.6	4.6	4.7	6.8	6.7	6.7	2.9	2.8	2.6
Beds and Herts	4.3	3.9	4.5	6.3	5.8	6.8	2.1	2.1	2.8
Central	4.2	4.8	5.2	6.7	7.2	7.4	3.3	2.9	2.6
Central South Coast	3.5	3.7	4.2	5.2	5.6	5.7	2.0	2.3	1.9
Cheshire and Merseyside	4.5	4.1	4.3	6.4	6.5	6.5	2.6	3.2	3.0
Essex	3.5	3.7	3.9	4.9	5.2	4.8	1.4	1.7	1.1
Greater Manchester	5.2	4.8	4.5	7.6	7.1	6.7	3.1	3.1	2.8
Kent and Medway	4.5	4.9	4.6	6.4	7.0	5.8	2.3	2.9	1.5
Lancashire and South Cumbria	4.7	4.9	5.5	6.4	6.7	7.6	2.3	2.3	3.1
Norfolk, Suffolk and Cambridgeshire	3.8	3.5	4.4	6.1	5.3	6.1	2.9	2.5	2.3
North Central London	3.4	3.4	4.7	5.3	5.3	6.7	2.3	2.0	2.3
North East London and North Middlesex	5.9	5.1	5.4	8.1	6.6	7.7	3.0	1.9	3.0
North Trent	4.9	4.3	4.9	7.4	5.9	6.5	3.1	2.7	2.4
North West London	5.2	4.8	4.0	7.4	6.8	6.2	3.2	3.1	3.2
Northern	4.4	5.2	4.2	6.8	7.3	6.3	3.0	3.2	2.7
South Central North	4.8	4.3	4.3	6.9	6.5	6.5	2.6	2.7	2.6
South East London	6.7	5.7	5.8	9.6	8.6	8.1	4.3	3.8	3.4
South West London	3.7	4.7	4.2	5.6	6.0	6.3	2.1	1.4	2.6
South West Peninsula	4.6	4.5	4.4	6.3	6.2	6.0	2.2	2.2	1.8
Southern West Midlands	5.7	5.3	5.5	9.0	8.1	8.6	3.6	3.4	4.1
Staffordshire, Shropshire and Black Country	4.9	5.3	5.4	8.2	7.9	7.5	4.0	3.1	2.8
Surrey and Sussex	3.8	3.8	3.3	5.1	5.2	4.8	1.6	1.9	1.8
Trent	4.0	3.8	4.7	6.2	6.8	6.9	2.8	3.7	2.8
Western	3.7	4.0	4.6	5.2	5.9	6.2	2.3	2.4	2.2
Yorkshire	5.2	5.5	5.4	7.5	7.7	7.7	3.3	3.0	3.1

[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation
[b]Rate per 1,000 total births
[c]Rate per 1,000 live births

Source: CMACE

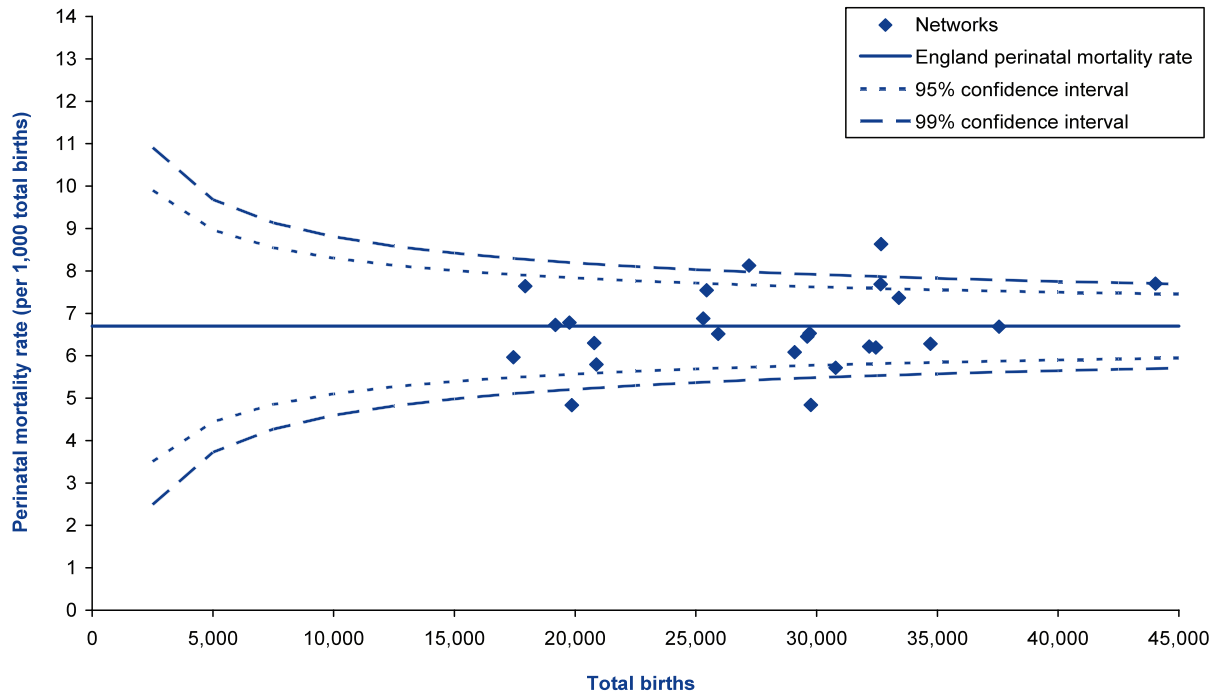
Differences in the risk factor profiles of women and babies cared for by Networks and the socio-demographic characteristics of the local maternity population may be reasons for the variations seen in the mortality rates. Chance findings are once again an important consideration as by definition 2.5% of Networks will be above the 95% confidence limit and 2.5% of Networks will be below by chance alone.

Figure 4.6
Adjusted[a] Network stillbirth rates compared to the England stillbirth rate and associated 95% and 99% confidence intervals; England: 2009



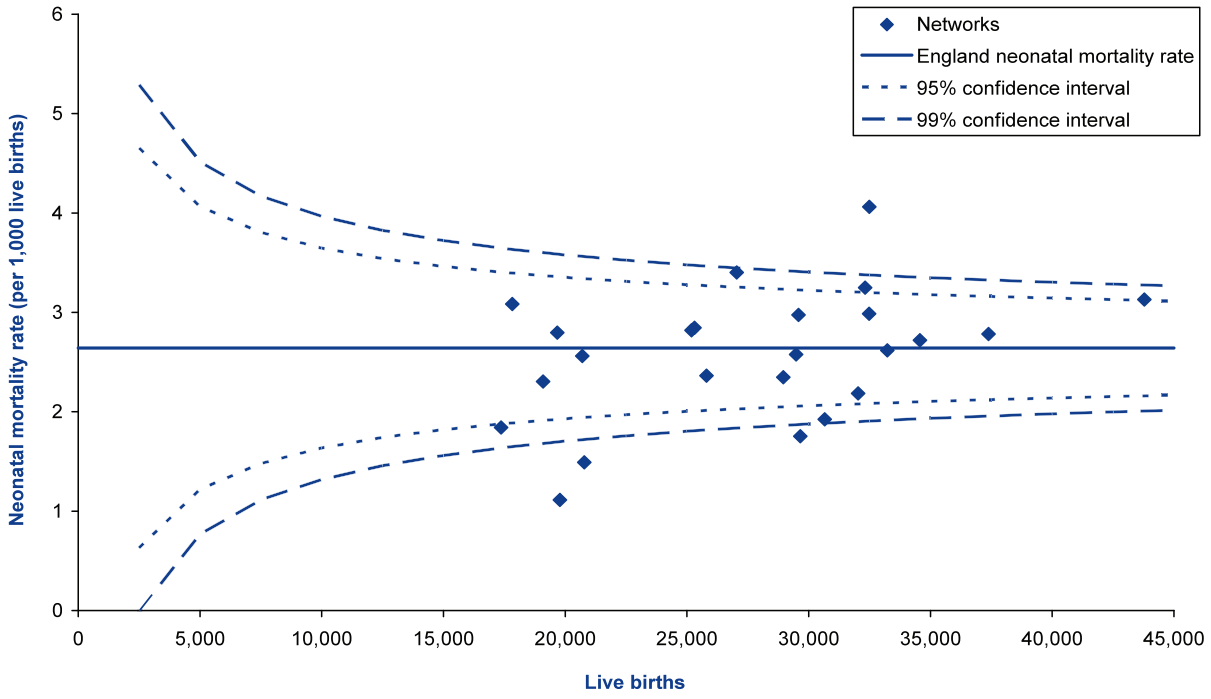
[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.7
Adjusted[a] Network perinatal mortality rates compared to the England perinatal mortality rate and associated 95% and 99% confidence intervals; England: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.8
Adjusted[a] Network neonatal mortality rate compared to the England neonatal mortality rate and associated 95% and 99% confidence intervals; England: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

High risk factors for stillbirths and neonatal deaths are shown in Tables 4.8 and 4.9 and the frequency of these occurring in the 2009 population is also shown for information. Terminations of pregnancy and babies born at less than 22 weeks' gestation are still removed when calculating mortality rates but CMACE no longer removes babies with a primary cause of death of a major congenital anomaly and babies born weighing less than 500g. Please see Box 1 in the methodology chapter for the reasoning behind the changes to the adjustments.

Table 4.8
Number of stillborn infants with major congenital anomaly as primary cause of death and <500g birth weight by Neonatal Network; England: 2009

Network of delivery	n (%)		
	Major congenital anomaly as primary cause of death[a,b]	<500g birth weight[a,b]	Number of stillbirths after exclusions[c]
England	276 (8.0)	259 (7.5)	2,624 (75.7)
Beds and Herts	6 (5.9)	5 (5.0)	77 (76.2)
Central	18 (9.3)	18 (9.3)	140 (72.2)
Central South Coast	5 (3.6)	8 (5.8)	115 (83.9)
Cheshire and Merseyside	10 (6.3)	12 (7.6)	106 (67.1)
Essex	4 (4.7)	2 (2.4)	73 (85.9)
Greater Manchester	17 (8.9)	9 (4.7)	144 (75.8)
Kent and Medway	4 (3.7)	9 (8.3)	85 (78.7)
Lancashire and South Cumbria	11 (10.4)	8 (7.5)	81 (76.4)
Norfolk, Suffolk and Cambridgeshire	15 (10.9)	3 (2.2)	111 (81.0)
North Central London	6 (5.9)	10 (9.9)	74 (73.3)
North East London and North Middlesex	16 (8.4)	17 (8.9)	144 (75.4)
North Trent	8 (6.1)	13 (9.8)	105 (79.5)
North West London	10 (6.2)	14 (8.6)	107 (66.0)
Northern	7 (4.4)	9 (5.7)	132 (83.5)
South Central North	14 (9.3)	7 (4.6)	108 (71.5)
South East London	26 (14.9)	12 (6.9)	122 (69.7)
South West London	8 (8.2)	9 (9.2)	72 (73.5)
South West Peninsula	7 (8.6)	8 (9.9)	63 (77.8)
Southern West Midlands	24 (11.9)	27 (13.4)	132 (65.3)
Staffordshire, Shropshire and Black Country	14 (9.6)	13 (8.9)	115 (78.8)
Surrey and Sussex	8 (7.3)	5 (4.5)	86 (78.2)
Trent	7 (5.5)	11 (8.7)	102 (80.3)
Western	8 (5.0)	13 (8.1)	129 (80.1)
Yorkshire	23 (9.0)	17 (6.6)	201 (78.5)

[a]Some stillbirths are counted in more than one category
[b]Excludes terminations of pregnancy
[c]Excludes terminations of pregnancy, major congenital anomalies and babies born weighing <500g

Source: CMACE

Table 4.9
Number of neonatal deaths with major congenital anomaly as primary cause of death and <500g birth weight by Network; England: 2009

Network of death	n (%)		
	Major congenital anomaly as primary cause of death[a,b]	<500g birth weight[a,b]	Number of neonatal deaths after exclusions[c]
England	381 (18.8)	120 (5.9)	1,260 (62.3)
Beds and Herts	14 (21.5)	5 (7.7)	36 (55.4)
Central	18 (17.0)	10 (9.4)	60 (56.6)
Central South Coast	12 (16.4)	3 (4.1)	45 (61.6)
Cheshire and Merseyside	10 (9.4)	5 (4.7)	73 (68.9)
Essex	3 (10.7)	4 (14.3)	15 (53.6)
Greater Manchester	21 (17.5)	7 (5.8)	76 (63.3)
Kent and Medway	*	*	28 (84.8)
Lancashire and South Cumbria	11 (17.2)	3 (4.7)	41 (64.1)
Norfolk, Suffolk and Cambridgeshire	15 (15.6)	*	51 (53.1)
North Central London	10 (20.4)	6 (12.2)	28 (57.1)
North East London and North Middlesex	9 (9.1)	4 (4.0)	84 (84.8)
North Trent	10 (13.9)	4 (5.6)	48 (66.7)
North West London	25 (22.5)	4 (3.6)	77 (69.4)
Northern	23 (22.5)	3 (2.9)	68 (66.7)
South Central North	23 (28.4)	7 (8.6)	46 (56.8)
South East London	36 (35.0)	5 (4.9)	51 (49.5)
South West London	9 (16.4)	3 (5.5)	41 (74.5)
South West Peninsula	8 (18.6)	*	23 (53.5)
Southern West Midlands	35 (21.3)	12 (7.3)	85 (51.8)
Staffordshire, Shropshire and Black Country	13 (14.8)	6 (6.8)	53 (60.2)
Surrey and Sussex	9 (14.8)	5 (8.2)	38 (62.3)
Trent	15 (19.5)	8 (10.4)	48 (62.3)
Western	17 (22.7)	*	51 (68.0)
Yorkshire	33 (21.9)	10 (6.6)	94 (62.3)

[a]Some neonatal deaths are counted in more than one category
[b]Excludes terminations of pregnancy and babies born at <22 weeks' gestation
[c]Excludes terminations of pregnancy, babies born at <22 weeks' gestation, major congenital anomalies and babies born weighing <500g
*Suppression of low cell count

Source: CMACE

Table 4.10 details where mothers booked according to the Network in which the stillbirth occurred. Overall, 90% of mothers who had a stillbirth booked and delivered within the same Network, 3% transferred into another Network during pregnancy and 1% were unbooked before their baby died within a Network.

Table 4.11 details where mothers booked and babies were born according to the Network in which the neonatal death occurred. Overall, 76% of mothers whose babies died in the neonatal period booked, delivered and their babies died within the same Network, 6% transferred into another Network during pregnancy, 4% transferred into another Network after delivery and 2% were unbooked before their baby died within a Network.

There is a wide variation of mothers/babies transferring into the Networks; this may have an impact on the stillbirth and neonatal mortality rates.

Table 4.10
Network of booking and birth for all stillbirths; England: 2009

Network of birth	Percentage (%)				
	Booked and delivered	Transferred into the Network during pregnancy	Unbooked and delivered in the Network	Booking other[a]	Booking not known
Beds and Herts	92.1	3.0	-	2.0	3.0
Central	92.3	4.1	0.5	1.0	2.1
Central South Coast	82.5	2.2	1.5	5.8	8.0
Cheshire and Merseyside	84.8	1.3	0.6	9.5	3.8
Essex	95.3	2.4	1.2	-	1.2
Greater Manchester	94.7	1.6	1.1	1.1	1.6
Kent and Medway	88.0	2.8	-	1.9	7.4
Lancashire and South Cumbria	95.3	1.9	0.9	0.9	0.9
Norfolk, Suffolk and Cambridgeshire	92.7	0.7	1.5	4.4	0.7
North Central London	84.2	8.9	3.0	-	4.0
North East London and North Middlesex	74.3	2.1	-	0.5	23.0
North Trent	93.9	2.3	0.8	1.5	1.5
North West London	84.0	3.1	1.9	0.6	10.5
Northern	93.7	0.6	1.3	1.9	2.5
South Central North	86.8	1.3	1.3	3.3	7.3
South East London	85.1	7.4	4.0	1.7	1.7
South West London	87.8	3.1	2.0	-	7.1
South West Peninsula	91.4	3.7	3.7	-	1.2
Southern West Midlands	90.1	3.0	1.0	-	5.9
Staffordshire, Shropshire and Black Country	94.5	2.1	0.7	1.4	1.4
Surrey and Sussex	89.1	1.8	0.9	0.9	7.3
Trent	95.3	3.1	0.8	0.8	-
Western	90.7	0.6	0.6	3.7	4.3
Yorkshire	95.3	1.2	0.8	1.6	1.2

[a]Other includes home, in transit, a hospital without neonatal services and outside of England

Source: CMACE

Table 4.11
Network of booking, delivery and death for all neonatal deaths; England: 2009

Network of death	Percentage (%)					
	Booked, delivered and died	Transferred into the Network during pregnancy	Transferred into the Network after birth	Unbooked and died in the Network	Booking and/or delivery other[a]	Booking and/or delivery not known
Beds and Herts	75.4	6.2	4.6	-	7.7	6.2
Central	79.2	0.9	2.8	3.8	3.8	9.4
Central South Coast	78.1	5.5	2.7	-	6.8	6.8
Cheshire and Merseyside	64.2	11.3	5.7	2.8	12.3	3.8
Essex	89.3	-	-	-	7.1	3.6
Greater Manchester	73.3	7.5	6.7	1.7	4.2	6.7
Kent and Medway	54.5	-	6.1	3.0	3.0	33.3
Lancashire and South Cumbria	84.4	6.3	3.1	-	1.6	4.7
Norfolk, Suffolk and Cambridgeshire	74.0	7.3	10.4	1.0	3.1	4.2
North Central London	67.3	18.4	8.2	2.0	-	4.1
North East London and North Middlesex	56.6	6.1	2.0	1.0	-	34.3
North Trent	84.7	6.9	4.2	-	4.2	-
North West London	67.6	9.9	7.2	4.5	3.6	7.2
Northern	88.2	5.9	1.0	1.0	2.9	1.0
South Central North	84.0	3.7	1.2	1.2	4.9	4.9
South East London	56.3	11.7	12.6	6.8	5.8	6.8
South West London	74.5	5.5	9.1	1.8	1.8	7.3
South West Peninsula	81.4	-	-	-	11.6	7.0
Southern West Midlands	77.4	12.2	4.3	1.2	1.2	3.7
Staffordshire, Shropshire and Black Country	88.6	1.1	3.4	2.3	1.1	3.4
Surrey and Sussex	68.9	9.8	4.9	1.6	8.2	6.6
Trent	84.4	5.2	2.6	1.3	2.6	3.9
Western	73.3	2.7	2.7	1.3	16.0	4.0
Yorkshire	87.4	-	2.0	2.0	0.7	7.9

[a]Other includes home, in transit, a hospital without neonatal services and outside of England

Source: CMACE

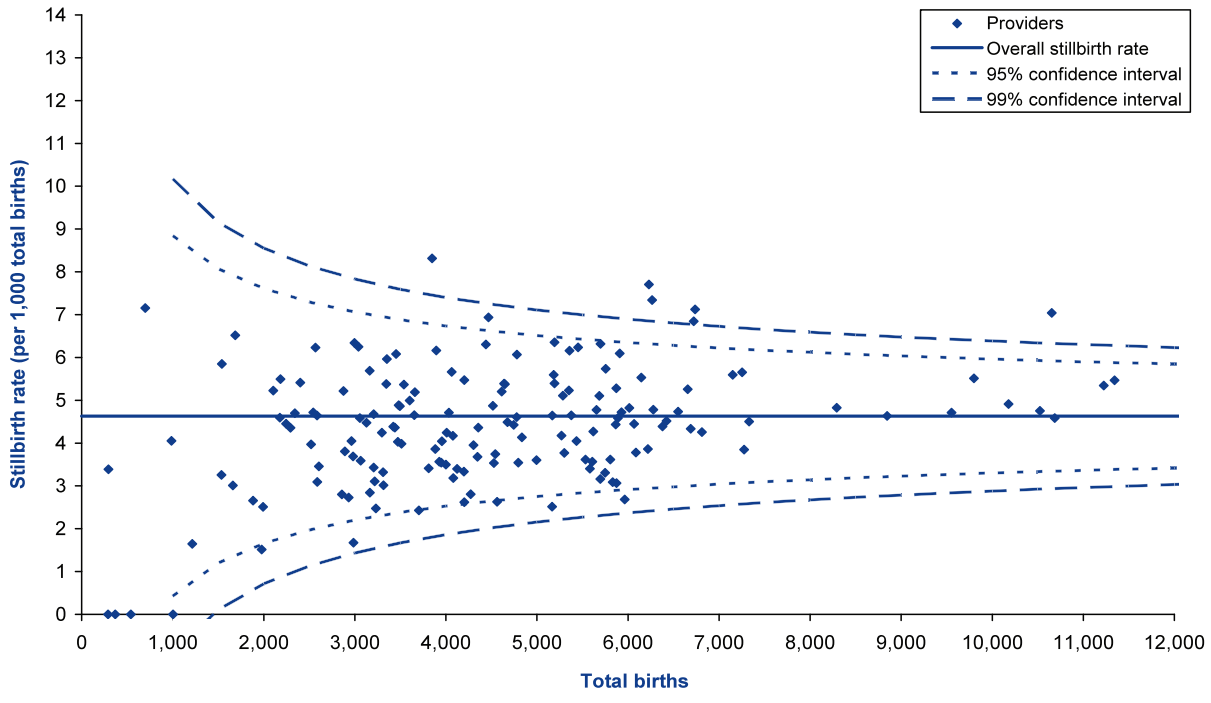
4.4: Providers including Hospital Trusts

Figures 4.9-4.11 show the adjusted stillbirth, perinatal and neonatal mortality rates for each provider for 2009.

Differences in the risk factor profiles of women and babies cared for by providers and the socio-demographic characteristics of the local maternity population may be reasons for the variations seen in the mortality rates. Chance is once again likely to be an important explanation as by definition 2.5% of providers will be above the 95% confidence limit and 2.5% of providers will be below by chance alone. This may result in a large number of providers being flagged as a possible problem so in this report a 99% confidence limit is also presented. Providers outside this range may need to consider their population risk factors and quality of care especially if this occurs for more than one year. As a previous study has shown that level 3 units have higher rates of neonatal death,[13] Figures 4.11 and 4.12 show the adjusted mortality rates for providers with no or level 1 neonatal units and providers with level 2 units, whilst providers with level 3 units are shown separately in Figure 4.13.

Provider specific reports are given to every provider of maternity services in England, Wales, Northern Ireland and the Crown Dependencies. These reports show adjusted rates, information about transfers, obstetric factors, post mortem uptake, cause of death and comparisons to other providers.

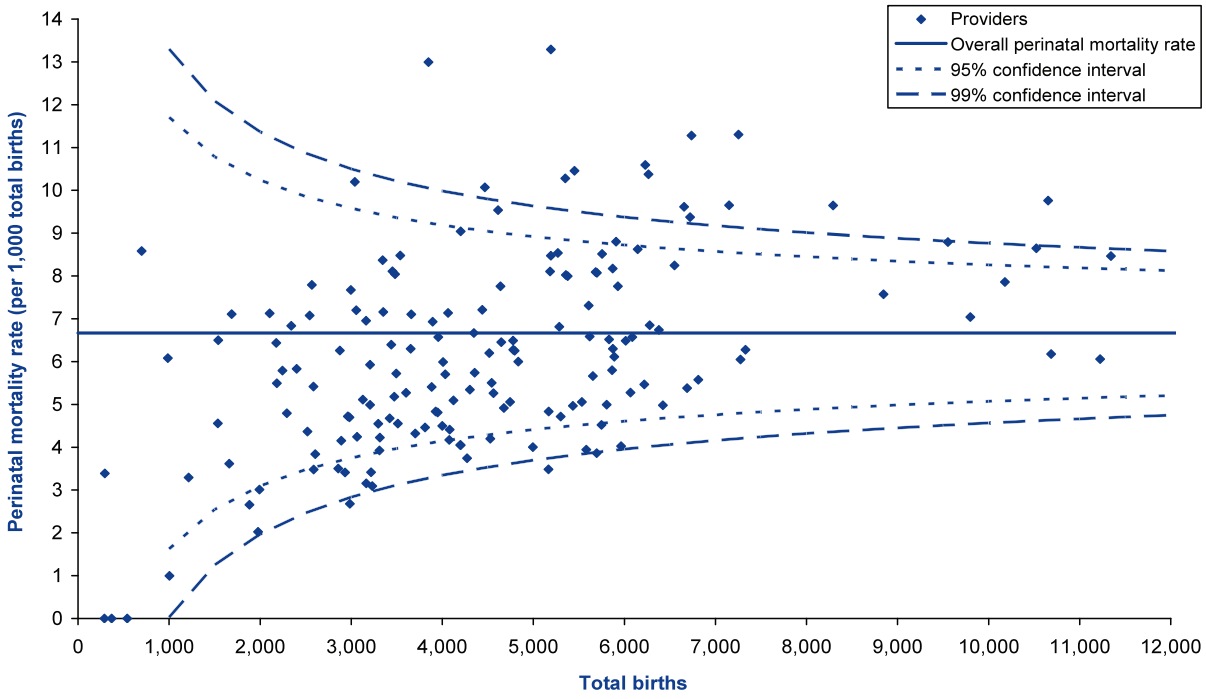
Figure 4.9
Adjusted[a] provider stillbirth rates compared to the overall stillbirth rate and associated 95% and 99% confidence intervals; England, Wales, Northern Ireland and the Crown Dependencies: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.10

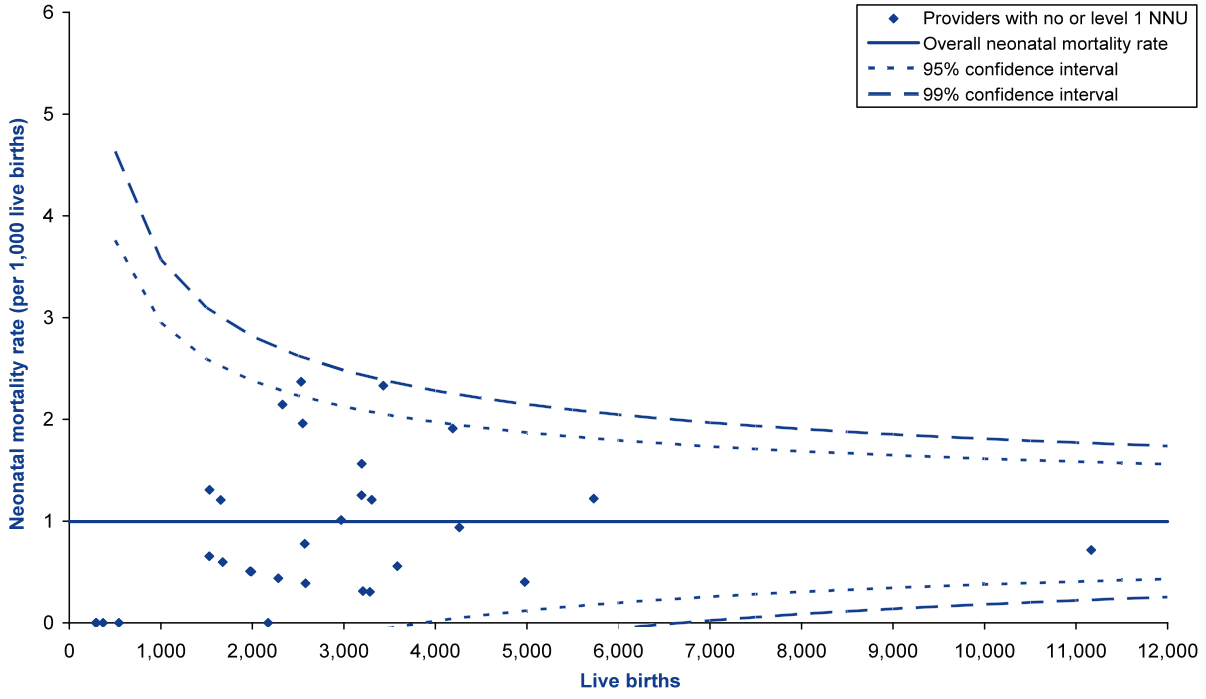
Adjusted[a] provider perinatal mortality rates compared to the overall perinatal mortality rate and associated 95% and 99% confidence intervals; England, Wales, Northern Ireland and the Crown Dependencies: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

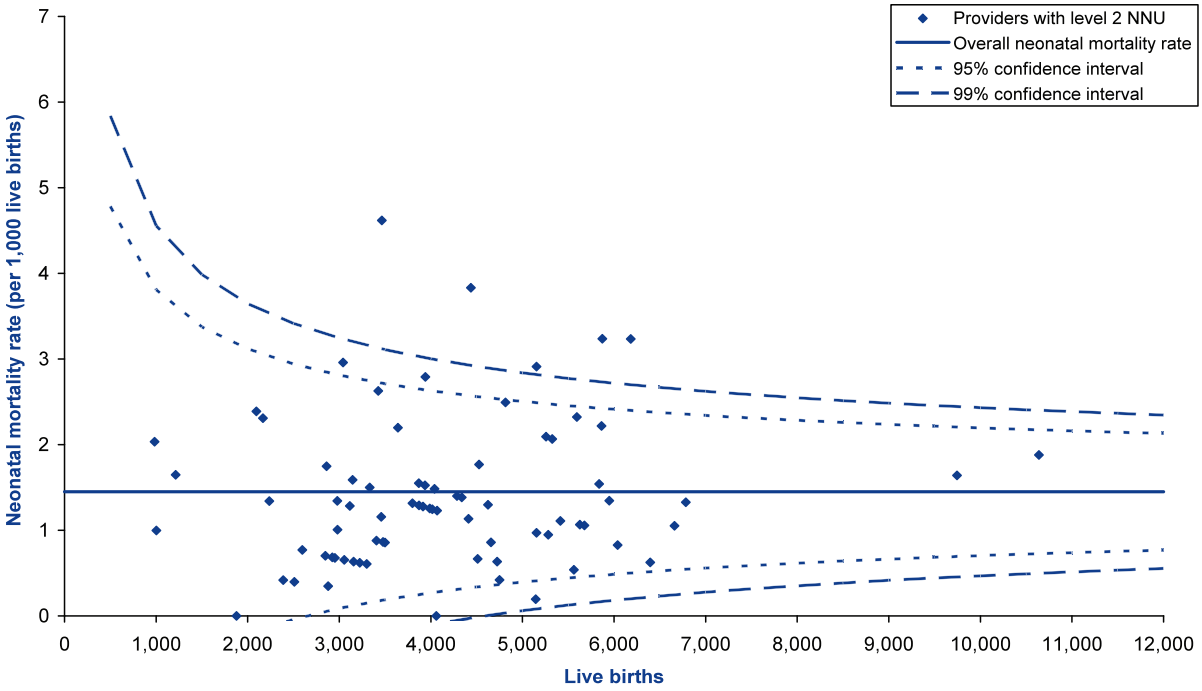
Figure 4.11

Adjusted[a] neonatal mortality rates compared to the overall neonatal mortality rate and associated 95% and 99% confidence intervals for providers with no or level 1 neonatal units; England, Wales, Northern Ireland and the Crown Dependencies: 2009



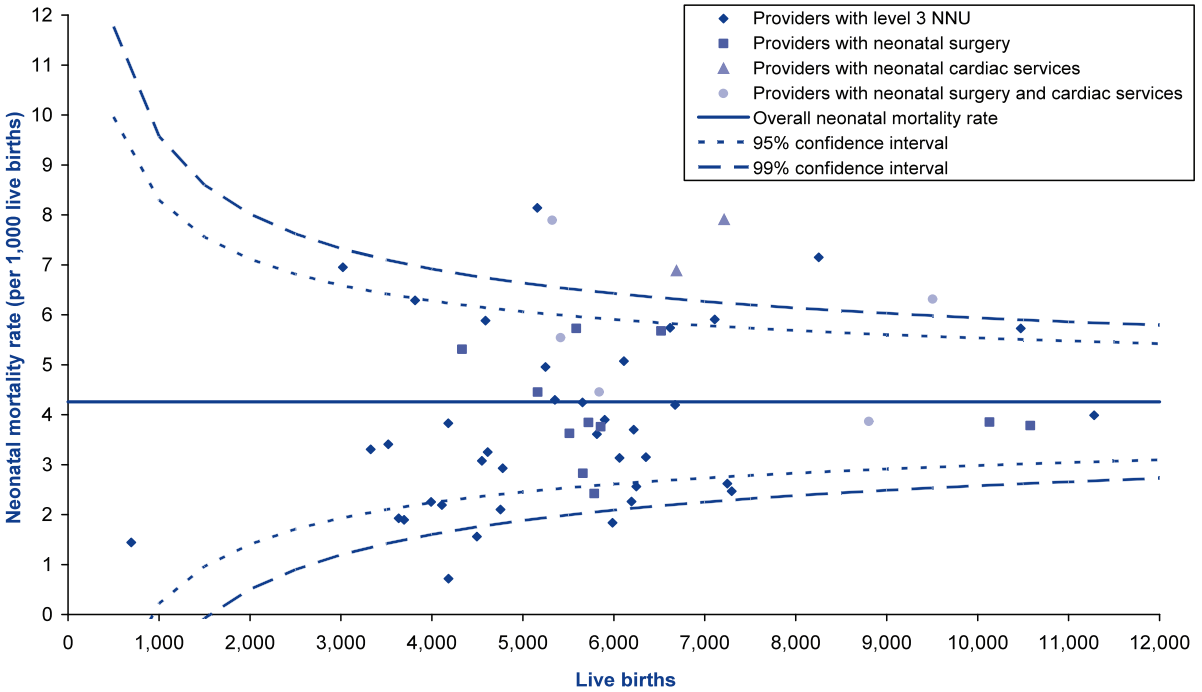
[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.12
Adjusted[a] neonatal mortality rates compared to the overall neonatal mortality rate and associated 95% and 99% confidence intervals for providers with level 2 neonatal units; England, Wales, Northern Ireland and the Crown Dependencies: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Figure 4.13
Adjusted[a] neonatal mortality rates compared to the overall neonatal mortality rate and associated 95% and 99% confidence intervals for providers with level 3 neonatal units; England, Wales, Northern Ireland and the Crown Dependencies: 2009



[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Chapter 5 Socio-demographic and clinical factors

This chapter gives a summary of the characteristics of the mothers, pregnancies, labours and babies. Where possible the data from the general maternity population are shown as a comparator.

5.1 Characteristics of the mothers

Tables 5.1 and 5.2 show the characteristics of the mothers who had stillbirths and neonatal deaths, compared to the general maternity population where possible.

The distribution of maternal age among the mothers who had stillbirths and neonatal deaths is significantly different to the general maternity population. Mothers who had stillbirths and neonatal deaths were more likely to be younger (<25 years old) and older (40+ years old). The youngest (<20 years old) mothers were 1.4 [95% CI: 1.2, 1.6] times more likely to have a stillbirth and 1.2 [95% CI: 1.0, 1.4] times more likely to have a neonatal death than mothers of 25-29. The older (40+ years old) mothers were 1.7 [1.4, 1.9] and 1.3 [1.1, 1.6] times more likely to have a stillbirth or neonatal death respectively compared to mothers of 25-29.

In 2009, 10% of mothers who had stillbirths and 10% of mothers whose babies died in the neonatal period had a BMI of 35 or more. In December 2010, CMACE published data on the prevalence of Obesity in Pregnancy between the 1st March and 30th April 2009 in the UK. This report showed the UK prevalence rate of women with a known BMI of 35 or more at any point in pregnancy was 5%.[14]

Mothers who had stillbirths and neonatal deaths were also significantly more deprived than the general maternity population. Comparing mothers in the most deprived with those in the least deprived areas of England, they were 1.6 [95% CI: 1.4, 1.8] times more likely to have a stillbirth and 1.6 [1.4, 1.9] times more likely to have a neonatal death.

Fifty-seven percent of mothers who had stillbirths were in employment at the time of booking as were 56% of mothers who had neonatal deaths. Maternal employment status for the general maternity population is not currently published, so the figures cannot be compared and rates cannot be calculated.

Ethnicity was also significantly different, with mothers from ethnic minority groups being more likely to have stillbirths and neonatal deaths. Mothers of Black ethnic origin were 2.1 [95% CI: 1.8, 2.3] times more likely to have a stillbirth and 2.4 [2.1, 2.8] times more likely to have a neonatal death than mothers of White ethnic origin. Similarly, mothers of Asian ethnic origin were 1.6 [1.4, 1.7] times more likely to have a stillbirth and 1.6 [1.4, 1.8] times more likely to have a neonatal death than mothers of White ethnic origin. Apparent racial differences may reflect confounding variables and further examination of the importance of race, age, employment status and deprivation is needed. Ethnicity is often self reported so there should be some caution taken when interpreting these data. There is likely to be some differences in how ethnicity is assigned between the numerator and denominator.

Table 5.1
Characteristics of the mothers who had stillbirths and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	General maternity population	Stillbirths[a]		Neonatal deaths[a]	
	%	Number (%)	Rate [95% CI][b]	Number (%)	Rate [95% CI][c]
Maternal age					
<20	6.1	283 (7.7)	6.3 [5.6, 7.1]	157 (7.3)	3.5 [3.0, 4.1]
20-24	19.3	720 (19.5)	5.1 [4.8, 5.5]	451 (21.0)	3.2 [2.9, 3.5]
25-29	27.6	913 (24.8)	4.6 [4.3, 4.9]	587 (27.4)	2.9 [2.7, 3.2]
30-34	27.1	921 (25.0)	4.7 [4.4, 5.0]	506 (23.6)	2.6 [2.4, 2.8]
35-39	16.1	643 (17.4)	5.5 [5.1, 5.9]	338 (15.8)	2.9 [2.6, 3.2]
40+	3.8	208 (5.6)	7.6 [6.6, 8.7]	104 (4.9)	3.8 [3.1, 4.6]
Not known	..	84	..	117	..
Body Mass Index (BMI)					
<18.5		94 (2.8)		62 (3.5)	
18.5-24.9		1,493 (43.9)		814 (46.2)	
25.0-29.9		967 (28.4)		490 (27.8)	
30.0-34.9		506 (14.9)		228 (12.9)	
35+		344 (10.1)		169 (9.6)	
Unbooked		44		33	
Not known		324		464	
Deprivation (England)					
1 (least deprived)	15.3	405 (12.0)	4.0 [3.6, 4.4]	223 (11.8)	2.2 [1.9, 2.5]
2	16.1	472 (13.9)	4.4 [4.0, 4.8]	243 (12.9)	2.3 [2.0, 2.6]
3	18.4	586 (17.3)	4.8 [4.4, 5.2]	311 (16.5)	2.5 [2.3, 2.8]
4	22.3	764 (22.6)	5.2 [4.8, 5.5]	448 (23.8)	3.0 [2.8, 3.3]
5 (most deprived)	27.9	1,157 (34.2)	6.3 [5.9, 6.6]	659 (35.0)	3.6 [3.3, 3.8]
Not known	..	55	..	34	..
Employment status					
Employed		1,944 (57.3)		1,063 (56.4)	
Not employed		1,446 (42.7)		821 (43.6)	
Not known		382		376	
Ethnicity (England)					
White	79.2	2,348 (70.8)	4.5 [4.3, 4.7]	1,249 (69.2)	2.4 [2.2, 2.5]
Black	5.4	331 (10.0)	9.2 [8.3, 10.3]	205 (11.4)	5.7 [5.0, 6.5]
Asian	10.3	478 (14.4)	7.0 [6.4, 7.7]	262 (14.5)	3.8 [3.4, 4.3]
Chinese	0.7	20 (0.6)	4.5 [2.9, 7.0]	6 (0.3)	1.3 [0.6, 3.0]
Mixed	1.6	50 (1.5)	4.6 [3.5, 6.1]	38 (2.1)	3.5 [2.6, 4.8]
Other	2.7	89 (2.7)	4.9 [4.0, 6.0]	45 (2.5)	2.5 [1.8, 3.3]
Not known	..	123	..	113	..

[a]Second and subsequent deaths from pregnancies with multiple losses are excluded
[b]Rate per 1,000 maternities

Sources: CMACE, ONS, NI CHS, HES

Table 5.2 shows the numbers and proportions of pre-existing medical problems and previous pregnancy problems in mothers who had stillbirths or whose babies died in the neonatal period.

For mothers who had stillbirths, 29% were recorded as having a pre-existing medical problem. Four percent had psychiatric disorders, 3% had diabetes and 2% had endocrine disorders. Sixty-four percent had previous pregnancies and 41% of those had a previous pregnancy problem. The most common problems the mothers had were pre-term birth or mid trimester loss (7% of all multiparous mothers who had a stillbirth), pre-eclampsia (6%) and three or more miscarriages (4%).

For mothers whose babies died in the neonatal period, 33% were recorded as having a pre-existing medical problem. The most common problems were psychiatric disorders (6%), cardiac disease (3%) and endocrine disorders (2%). Sixty-seven percent had previous pregnancies and 42% of those had a previous pregnancy problem. The most common previous problems for the mothers were pre-term birth or mid trimester loss (10%), three or more miscarriages (5%) and a previous neonatal death (4%).

Table 5.2
Pre-existing medical problems and previous pregnancy problems among mothers who had stillbirths and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Stillbirths[a]		Neonatal deaths[a]	
	Number	Percentage[b] (%)	Number	Percentage[b] (%)
Pre-existing medical problems	1,021	29.0	654	32.8
Cardiac disease	62	1.8	52	2.6
Epilepsy	37	1.0	18	0.9
Endocrine disorders	82	2.3	41	2.1
Renal disease	22	0.6	18	0.9
Haematological disorders	33	0.9	20	1.0
Psychiatric disorders	154	4.4	121	6.1
Inflammatory disorders	19	0.5	15	0.8
Drug or substance abuse	62	1.8	40	2.0
Diabetes	110	3.1	39	2.0
Other	642	18.2	408	20.5
Previous pregnancy problems	953	40.7	596	42.1
Three or more miscarriages	104	4.4	71	5.0
Pre-term birth or mid trimester loss	162	6.9	139	9.8
Stillbirth	97	4.1	46	3.2
Neonatal death	35	1.5	55	3.9
Baby with congenital anomaly	72	3.1	52	3.7
Infant requiring intensive care	62	2.6	46	3.2
Placenta praevia	7	0.3	3	0.2
Placental abruption	34	1.5	19	1.3
Pre-eclampsia	147	6.3	38	2.7
Post partum haemorrhage requiring transfusion	35	1.5	10	0.7
Other	317	13.5	241	17.0

Source: CMACE

[a]Second and subsequent deaths from pregnancies with multiple losses are excluded
[b]Percentages are calculate removing missing values. Percentages for previous pregnancy problems are out of the number of women with previous pregnancies

5.2 Characteristics of the pregnancies

Table 5.3 shows the characteristics of the pregnancies of mothers who had stillbirths and neonatal deaths.

Within the Department of Health's 'Maternity Matters' Report (April 2007),[15] it states that women should book for antenatal care by 10-12 completed weeks' gestation. Sixty-two percent of mothers who had a stillbirth and 60% of mothers whose babies died in the neonatal period booked before 12 weeks. This compares to the proportion (56%) seen in the National Perinatal Epidemiology Unit (NPEU) Recorded Delivery Report[16] looking at a sample of live births in England in 2006.

Twenty-seven percent of mothers who had stillbirths and 28% of mothers whose babies died in the neonatal period smoked during pregnancy. This compares to 14.6% of women in the general maternity population in England in 2008/09.[17]

One percent of mothers who had stillbirths and of mothers whose babies died in the neonatal period were known to abuse alcohol. Also around 2.5% of mothers were known to be substance users. However, we do not know the prevalence of these in the general maternity population.

There appears to be very little difference in the parity of mothers having stillbirths and neonatal deaths. Forty-eight percent of mothers who had stillbirths and 47% mothers whose babies died in the neonatal period were nulliparous.

Table 5.3
Characteristics of the pregnancies of the mothers who had stillbirths and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Stillbirth[a]		Neonatal deaths[a]	
	Number	Percentage (%)	Number	Percentage (%)
Booking for antenatal care				
<12^{+0} weeks	2,199	62.0	1,126	59.7
12^{+0} to 19^{+6} weeks	1,015	28.6	593	31.5
≥20^{+0} weeks	278	7.8	123	6.5
Unbooked	55	1.6	43	2.3
Not known	225	..	375	..
Smoking status				
Never	2,329	66.0	1,251	64.9
Gave up prior to pregnancy	248	7.0	147	7.6
Gave up in pregnancy	151	4.3	74	3.8
Current	802	22.7	456	23.7
Not known	242	..	332	..
Known to abuse alcohol				
Yes	36	1.0	22	1.1
No	3,563	99.0	1,993	98.9
Not known	173	..	245	..
Known substance user				
Yes	94	2.6	49	2.4
No	3,502	97.4	1,963	97.6
Not known	176	..	248	..
Parity				
Nulliparous	1,733	47.6	983	47.0
Multiparous	1,908	52.4	1,108	53.0
Not known	131	..	169	..

[a]Second and subsequent deaths from pregnancies with multiple losses are excluded

Sources: CMACE

5.3 Characteristics of the labour

Tables 5.4 and 5.5 show the characteristics of the labour of the mothers who had stillbirths and neonatal deaths.

The majority of stillbirths and neonatal deaths were vertex presentation at delivery (76% and 68% respectively). Twenty-one percent of stillbirths and 28% of neonatal deaths are breech presentation, of these 87% of stillbirths and 67% of neonatal deaths are delivered vaginally. It should be noted that presentation is unlikely to be causally related to death.

Table 5.4
Presentation at delivery of the stillbirths and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

Presentation at delivery	Stillbirths		Neonatal deaths	
	Number	Percentage (%)	Number	Percentage (%)
Vertex	2,715	75.9	1,397	67.6
Breech	772	21.6	582	28.1
Vaginal	668	18.7	391	18.9
Caesarean section	94	2.6	187	9.0
Not known	10	0.3	4	0.2
Compound	74	2.1	60	2.9
Other	15	0.4	29	1.4
Not known	236	..	280	..

Source: CMACE

Mode of delivery of intrapartum stillbirths is not significantly different from the mode of delivery of total births, however, the difference is significant for neonatal deaths. The neonatal mortality rate for spontaneous vaginal deliveries was 2.6 per 1,000 live births compared to 1.4 per 1,000 live births for ventouse deliveries, 0.8 per 1,000 live births for forceps deliveries and 3.7 per 1,000 live births for caesarean sections.

Table 5.5
Mode of delivery of the stillbirths and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

Mode of delivery	General maternity population	Intrapartum stillbirths		Neonatal deaths	
	%	Number (%)	Rate [95% CI][a]	Number (%)	Rate [95% CI][b]
Spontaneous vaginal	62.6	201 (66.3)	0.4 [0.4, 0.5]	1,396 (63.2)	3.0 [2.9, 3.2]
Ventouse	6.0	8 (2.6)	0.2 [0.1, 0.3]	67 (3.0)	1.4 [1.1, 1.8]
Forceps	6.3	11 (3.6)	0.3 [0.1, 0.5]	38 (1.7)	0.9 [0.6, 1.2]
Caesarean section	25.1	83 (27.4)	0.5 [0.1, 3.2]	709 (32.1)	3.9 [3.6, 4.1]
Elective		5 (1.7)		70 (3.2)	
Scheduled		3 (1.0)		34 (1.5)	
Urgent		9 (3.0)		145 (6.6)	
Emergency		58 (19.1)		363 (16.4)	
Not known		-		97 (4.4)	
Not known	..	1	..	138	..

[a]Rate per 1,000 total births
[b]Rate per 1,000 live births

Sources: CMACE, HES, NI CHS

5.4 Characteristics of the babies

Table 5.6 shows the gestation-specific and sex-specific mortality rates for stillbirths and neonatal deaths. As expected, for neonatal deaths the mortality rates decrease as the gestation increases. Babies born pre-term (<37 weeks) have a much higher risk of mortality than babies born at term (37+ weeks). Gestation-specific mortality rates have not been calculated for stillbirths as we would need more detailed denominator data by week of gestation. To calculate the rates correctly by week of gestation we would need to use the number of continuing pregnancies.

For stillbirths, there was no significant difference between the mortality rates for male and female babies but neonatal mortality is higher among males than females (1.2 times, 95% CI: 1.1, 1.3).

Table 5.6
Characteristics of stillbirths and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Stillbirths		Neonatal deaths	
	Number	Rate [95% CI][a]	Number	Rate [95% CI][b]
Gestational age (completed weeks)				
<24	..		607	757.1 [699.2, 819.8]
24-27	929		567	203.7 [187.6, 221.1]
28-31	620		216	33.2 [29.0, 37.9]
32-36	930		280	6.2 [5.5, 6.9]
37-41	1,228		547	0.8 [0.8, 0.9]
42+	32		22	0.7 [0.5, 1.1]
Not known	73		109	..
Sex (all except Jersey)				
Male	1,985	5.3 [5.0, 5.5]	1,268	3.4 [3.2, 3.6]
Female	1,786	5.0 [4.7, 5.2]	1,045	2.9 [2.8, 3.1]
Indeterminate	30	..	27	..
Not known	11	..	8	..

[a]Rate per 1,000 total births
[b]Rate per 1,000 live births

Sources: CMACE, ONS, NI CHS

Twenty-eight percent of stillbirths and 15% of neonatal deaths were less than the 3rd birth weight centile and 42% of stillbirths and 25% of neonatal deaths were less than the 10th birth weight centile (Table 5.7). These are substantially higher than expected (3% and 10% respectively) in a normal population distribution.

Table 5.7
Birth weight centiles for stillbirths and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Stillbirths		Neonatal deaths[a]	
	Number	Percentage (%)	Number	Percentage (%)
<3rd centile	1,026	27.8	269	14.9
3rd-9th centile	502	13.6	178	9.8
10th-49th centile	1,272	34.5	849	46.9
50th-90th centile	647	17.6	416	23.0
91st-97th centile	115	3.1	54	3.0
>97th centile	123	3.3	45	2.5
Not known	127	..	127	..

[a]Excluding babies born at ≤22 weeks gestation, as the centile cannot be calculated at these gestations

Source: CMACE

Table 5.8 shows the condition of babies, shortly after delivery, who died in the neonatal period, whether they were admitted to a neonatal unit and whether they were transferred to another hospital (removing those that were terminations of pregnancy or born at less than 22 weeks' gestation). Sixty-six percent of babies who died in the neonatal period had absent or ineffective respiratory activity at 5 mins and 30% had a heart rate that was persistently less than 100. Seventy-one percent of babies who died in the neonatal period get admitted to a neonatal unit and 76% stay within the unit of delivery for the rest of their care. Twenty-nine percent of neonatal deaths occurred outside the neonatal unit without admission to the neonatal unit such as dying at home or on labour ward.

Table 5.8
Condition and transfer of neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Neonatal deaths[a]	
	Number	Percentage (%)[b]
Absent or ineffective respiratory activity at 5 mins		
Yes	1,113	66.4
No	562	33.6
Not known	382	..
Admitted to a neonatal unit		
Yes	1,319	70.9
No	542	29.1
Not known	196	..
Heart rate persistently <100		
Yes	541	30.4
No	1,240	69.6
Not known	276	..
Transferred to another unit after birth		
Yes	462	23.9
No	1,475	76.1
Not known	120	..

[a]Excluding terminations of pregnancy and babies born at less than 22 weeks' gestation
[b]Percentages are calculated after removing not knowns

Source: CMACE

Chapter 6 Cause of death

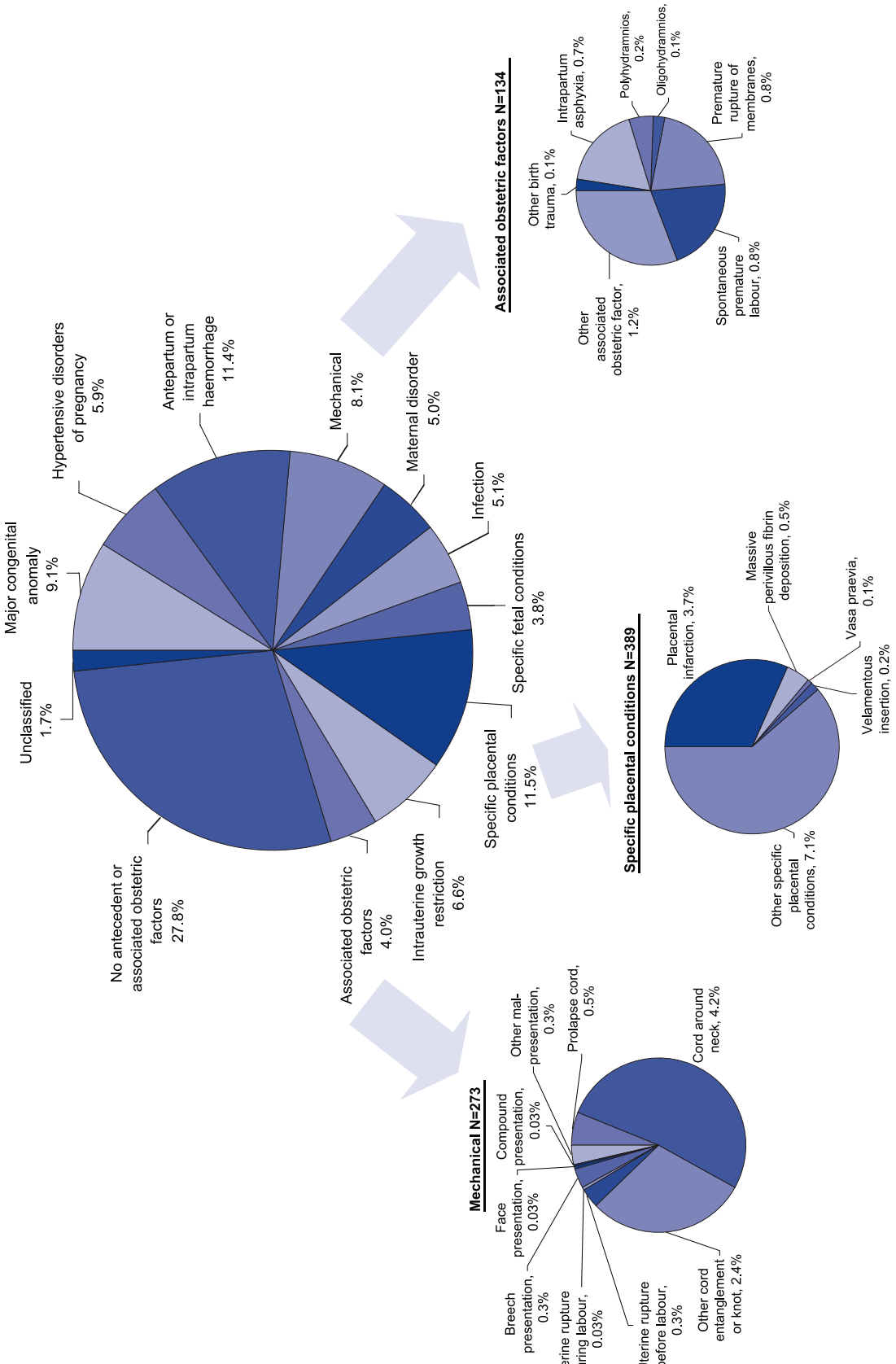
This chapter presents the cause of stillbirths and neonatal deaths according to the new CMACE classification that was described in last year's report (Perinatal Mortality 2008). This chapter also focuses on placental pathology and it is hoped that this and increased reporting of placental histology results will also improve classification. The uptake of post mortem examinations and the numbers of placentas being examined by histopathologists are therefore also presented.

Our data collection form (Appendix B) asks notifiers to identify all conditions that arose during pregnancy, either directly or associated with the death, and to specify which condition was the main condition causing or associated with the death. CMACE regional managers then use this information plus any post mortem and placental histology reports to classify the one primary cause or associated factor and up to three other causes or associated factors. It is intended that this approach of picking the main cause/associated factor reflects local clinical opinion of those involved in the case. It is recognised that it is very difficult to be certain about whether a factor caused or is associated with the death[18] and an attempt is not made to delineate this clearly. This chapter presents the primary cause or associated factor for stillbirths using the maternal and fetal classification and the primary cause or associated factor for neonatal deaths using both the maternal and fetal classification and the neonatal classification.

6.1 Causes of stillbirths

Figure 6.1 shows the primary cause/association for stillbirths in 2009. This classification has helped to reduce the number of cases that, in the old classification, were classified as unexplained. Twenty-eight percent of stillbirths in 2009 were unexplained (no antecedent or associated obstetric factors) compared to around 50% in earlier reports. The biggest causes/associated factors for stillbirths were major congenital anomaly (9%), antepartum or intrapartum haemorrhage (11%) and specific placental conditions (12%). It is possible that some of this placental pathology was caused by a clinical condition that went unrecognised before the stillbirth or was only identified after subsequent investigation. The examination and reporting of the placenta where no consent has been granted for post mortem has been encouraged by CMACE as described below in section 6.4.

Figure 6.1
Primary cause of stillbirths using the CMACE maternal and fetal classification; England, Wales, Northern Ireland and the Crown Dependencies: 2009 (excluding terminations of pregnancy) N=3,373



6.1.1 Associated obstetric factors

Table 6.1 shows a further exploration of the factors that may be related to stillbirth where an associated obstetric factor was given as the primary cause/association. There were associated obstetric factors in four percent of stillbirths. It should be noted that these factors were, in these cases felt to be important features of the pregnancy: their mere presence is insufficient for the association to be recorded. Premature rupture of membranes was present in 0.8%, spontaneous premature labour in 0.8% and 0.7% of deaths were associated with intrapartum asphyxia (Figure 6.1). In this category, the cause of the intrapartum asphyxia is unexplained. This category also covers polyhydramnios, oligohydramnios, intracranial haemorrhage, birth injury to scalp and other birth trauma.

Table 6.1 shows the gestational age distribution among the categories within the associated obstetric factors group. The majority of cases that died from intrapartum asphyxia (75.0%) or were associated with polyhydramnios (66.7%) were born at term (37+ weeks). Whereas, the majority of cases that died in association with premature rupture of membranes or spontaneous premature labour occured at very low gestations (24-27 weeks).

Table 6.1
Percentage of infants in gestational age groups according to primary cause/association of death (obstetric factors); England, Wales, Northern Ireland and the Crown Dependencies: 2009

Primary cause of death	Gestation Percentage of primary cause (%)[a]				
	n	<27 weeks	27-31 weeks	32-36 weeks	37+ weeks
Intracranial haemorrhage	-	-	-	-	-
Birth injury to scalp	-	-	-	-	-
Other birth trauma	3	-	-	66.7	33.3
Intrapartum asphyxia	24	12.5	-	12.5	75.0
Polyhydramnios	6	-	-	33.3	66.7
Oligohydramnios	5	-	60.0	20.0	20.0
Premature rupture of membranes	27	70.4	7.4	7.4	11.1
Spontaneous premature labour	28	60.7	21.4	14.3	-
Other associated obstetric factor	41	17.1	14.6	22.0	39.0

[a]Percentages are calculated after removing missing values

Source: CMACE

6.1.2 Intrauterine growth restriction

Nineteen percent of stillbirths are associated with intrauterine growth restriction (IUGR) when all cases are counted not just those classified as the primary cause. Table 6.2 shows further detail of the cases associated with IUGR.

Pregnancy induced hypertension was seen in 7.1% of mothers who had a stillbirth associated with IUGR. This is significantly higher than the proportion for all stillbirths (4.3%). Of the stillbirths associated with IUGR, 27.4% of the mothers smoked throughout pregnancy and 5.2% gave up during pregnancy, a significantly higher proportion than seen in all stillbirths (23.3% and 4.4% respectively).

Younger (20-24) and older (40+) mothers and women of Black ethnicity were significantly over represented in the group who had stillbirths associated with IUGR. Previous research has shown that, often, minority ethnic groups have higher rates of perinatal mortality, but that growth restriction is not necessarily related to, or the direct cause of death.[19]

Smoking was more common in the mothers who had a stillbirth that was associated with IUGR, which agrees with previously published research.[20] Wilcox[19] has suggested that small babies of mothers who smoke may be at higher risk of perinatal mortality. IUGR was not a factor in the increased risk of stillbirth associated with maternal obesity. Twenty-seven percent of mothers who had stillbirths associated with IUGR were obese compared to 25% of all stillbirths.

Table 6.2
Association of factors with stillbirths due to IUGR; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Percentage of all stillbirths %	Stillbirths with IUGR as primary cause of death		P-value
		Number[a]	Percentage (%)[b]	
Pregnancy induced hypertension				
Yes	4.3	46	7.1	<0.001
No	95.7	598	92.9	
Smoking status				
Never	65.1	382	62.0	
Gave up prior to pregnancy	7.3	33	5.4	
Gave up in pregnancy	4.4	32	5.2	0.003
Current	23.3	169	27.4	
Not known		28	..	
Maternal age				
<20	8.0	47	7.3	
20-24	20.0	159	24.7	
25-29	24.9	154	23.9	
30-34	24.6	142	22.0	0.02
35-39	17.0	101	15.7	
40+	5.4	41	6.4	
Not known		-	..	
Ethnicity				
White	72.7	453	71.1	
Black	9.6	80	12.6	
Asian	13.3	83	13.0	
Chinese	1.3	8	1.3	0.01
Mixed	0.5	5	0.8	
Other	2.6	8	1.3	
Not known		7	..	
Body Mass Index (BMI)				
<18.5	2.7	17	2.8	
18.5-24.9	43.6	255	41.7	
25.0-29.9	28.2	176	28.8	0.7
30.0-34.9	15.0	102	16.7	
35+	10.4	62	10.1	
Not known		32	..	

[a]Second and subsequent deaths from pregnancies with multiple losses are excluded
[b]Percentages are calculated after removing not knowns

Source: CMACE

6.1.3 Intrapartum stillbirths

In 2009, there were 288 intrapartum stillbirths which accounts for 8% of stillbirths. Before 2008, intrapartum stillbirths were identified using the Wigglesworth classification whereas from 2008 intrapartum related deaths were identified by use of a specific question. It is hoped that this new method of identifying intrapartum stillbirths will provide important additional information for investigation as it has been suggested that a significant proportion of these deaths could be prevented with improved perinatal care.[21]

Of the intrapartum stillbirths, 144 (50.0%) were delivered at term (≥37 weeks) and 266 (92.4%) had no major congenital anomaly either causing or associated with the death. There were 135 intrapartum stillbirths that delivered at term with no signs of a major congenital anomaly, amounting to 4% of stillbirths. Of the 288 intrapartum stillbirths, 62 presented in breech position, with 54 of these born vaginally, and eight by caesarean section. Of these breech intrapartum stillbirths, only eight of the 62 were born at term and two were ascribed to anoxia.

Table 6.3
Possible risk factors among the stillbirths alive at onset of care in labour; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Number	Percentage (%)
Gestational age		
<32	94	32.6
32-37	47	16.3
37+	144	50.0
Not known	3	..
Major congenital anomaly		
Yes	22	7.6
No	266	92.4
Mode of delivery		
Spontaneous vaginal	154	53.5
Ventouse	8	2.8
Forceps	11	3.8
Assisted breech/breech extraction	32	11.1
Caesarean section	83	28.8
Presentation at delivery		
Vertex	208	73.8
Breech	62	22.0
Compound	9	3.2
Other	3	1.1
Not known	6	..
Primary cause of death		
Major congenital anomaly	17	5.9
Hypertensive disorders of pregnancy	11	3.8
Antepartum or intrapartum haemorrhage	83	28.9
Mechanical	33	11.5
Maternal disorder	13	4.5
Infection	26	9.1
Specific fetal conditions	8	2.8
Specific placental conditions	23	8.0
IUGR	4	1.4
Associated obstetric factors	30	10.5
No antecedent or associated obstetric factors	38	13.2
Unclassified	1	0.3
Not known	1	..

[a]Percentage calculated after removing not knowns

Source: CMACE

6.2 Causes of neonatal deaths

Figure 6.2 shows the primary cause/associated factor of neonatal deaths using the maternal and fetal classification. The most common causes/associated factors of neonatal deaths were associated obstetric factors (27%), major congenital anomalies (24%) and infection (10%).

Figure 6.2
Primary cause of neonatal deaths using the CMACE maternal and fetal classification; England, Wales and Northern Ireland and the Crown Dependencies: 2009 (excluding terminations of pregnancy) N=2,115

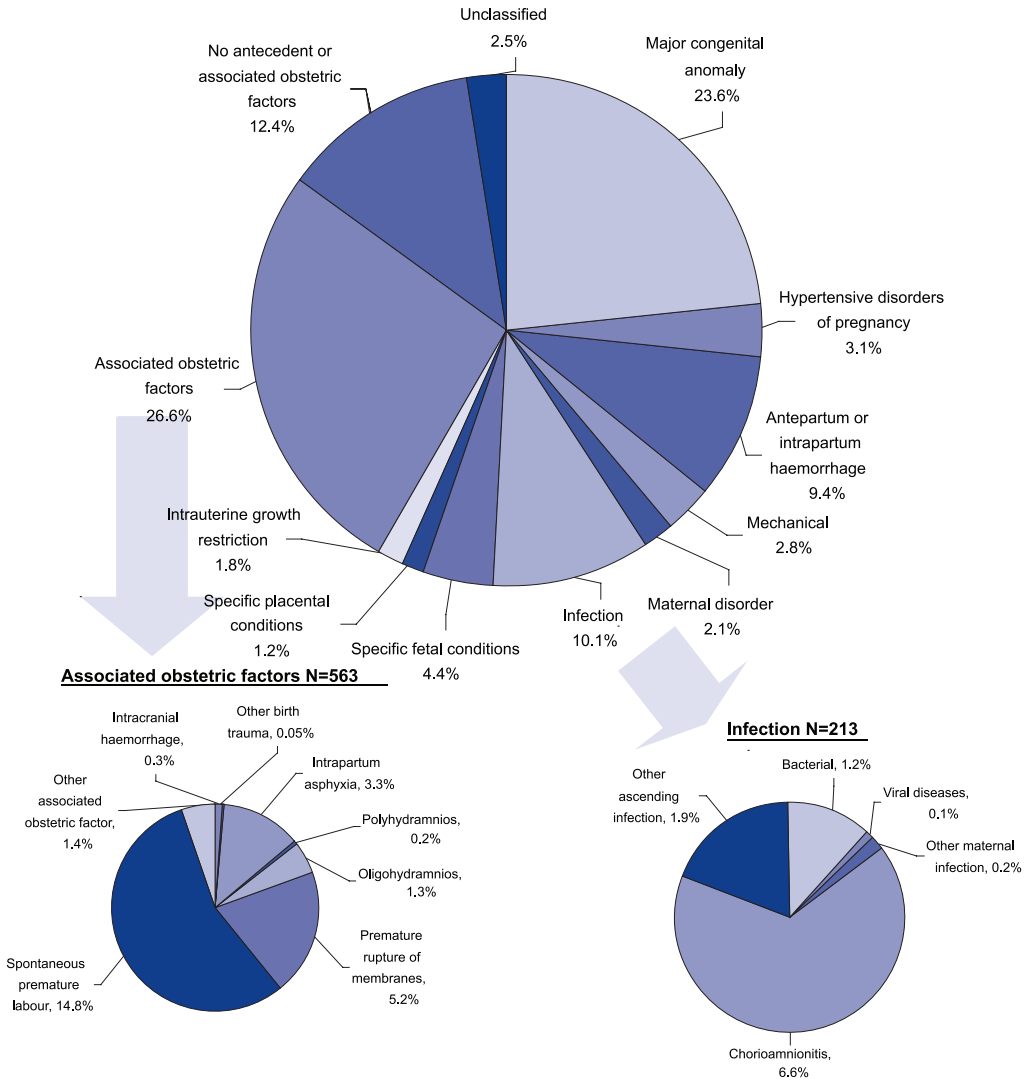


Figure 6.3 shows the primary cause/associated factor for neonatal deaths using the neonatal classification. In previous years nearly half of the neonatal deaths were due to immaturity. The CMACE classification restricts the prematurity category to only cases that are below 22 weeks' gestation. In 2009, this category had only 9% of the neonatal deaths. The major causes of neonatal death were respiratory disorders (34%), major congenital anomalies (24%) and neurological disorders (12%).

Figure 6.3
Primary cause of neonatal deaths using the CMACE neonatal classification; England, Wales and Northern Ireland and the Crown Dependencies: 2009 (excluding terminations of pregnancy) N=2,107

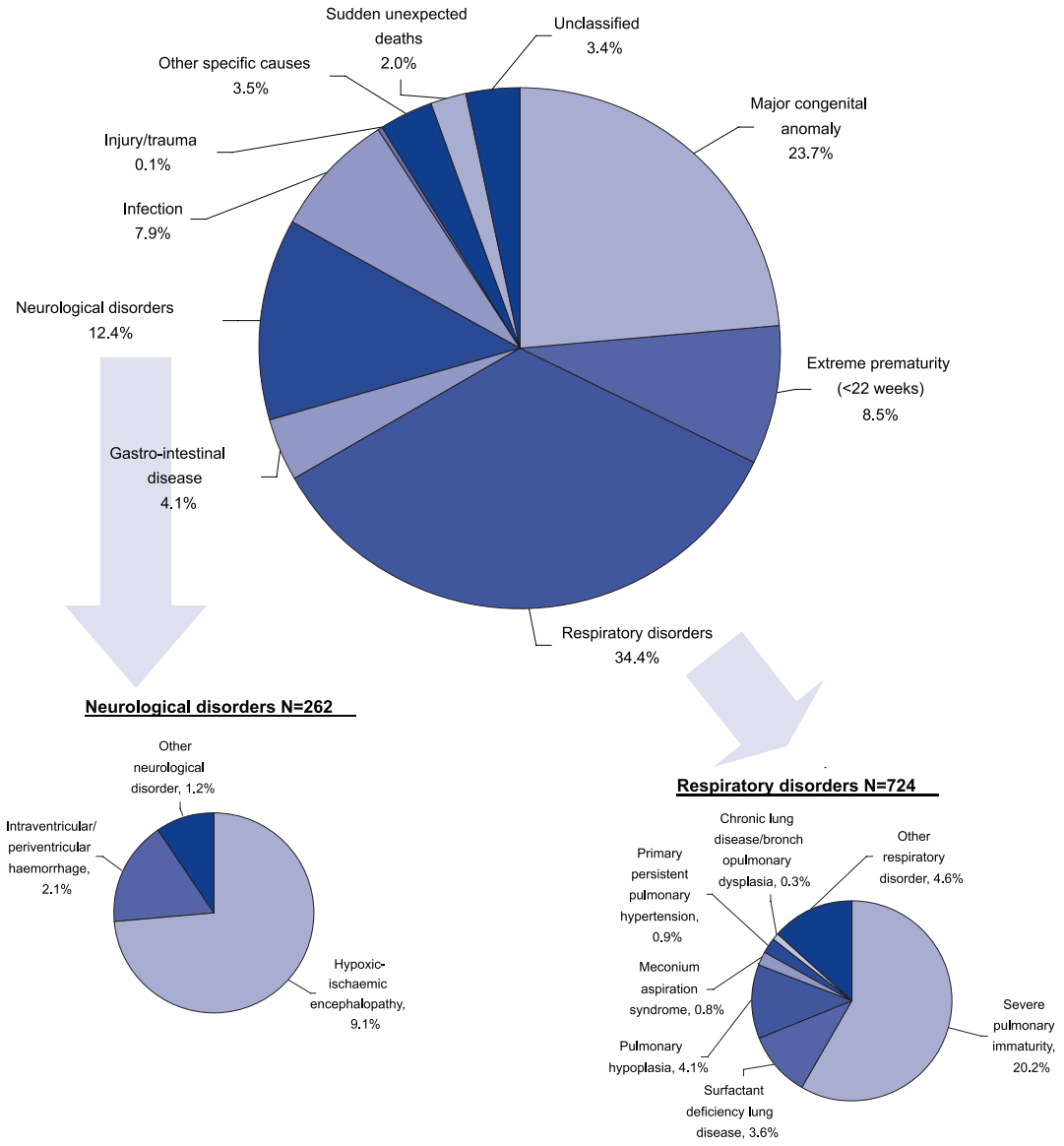


Table 6.5 shows that the most common causes/associations of early neonatal deaths were respiratory disorders (39%), major congenital anomalies (22%) and neurological disorders (13%). For late neonatal deaths the most common causes were major congenital anomaly (29%), respiratory disorders (18%) and infection (15%).

Table 6.4
Proportions of neonatal deaths by cause; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Early neonatal deaths		Late neonatal deaths		Neonatal deaths	
	Number	Percentage (%)[a]	Number	Percentage (%)[a]	Number	Percentage (%)[a]
Major congenital anomaly	358	22.1	142	29.1	500	23.7
Extreme prematurity (<22 weeks)	176	10.9	3	0.6	179	8.5
Respiratory disorders	634	39.2	90	18.4	724	34.4
Gastro-intestinal disease	19	1.2	67	13.7	86	4.1
Neurological disorders	217	13.4	45	9.2	262	12.4
Infection	92	5.7	74	15.2	166	7.9
Injury/trauma	1	0.1	2	0.4	3	0.1
Other specific causes	58	3.6	15	3.1	73	3.5
Sudden unexpected deaths	13	0.8	29	5.6	42	2.0
Unclassified	51	3.2	21	4.3	72	3.4
Not known	78	..	33	..	111	..

[a]Percentages are calculated after removing not knowns

Source: CMACE

6.2.1 Neurological disorders

Table 6.6 shows possible risk factors of neonatal deaths whose primary cause of death was a neurological disorder. Deaths from hypoxic-ischaemic encephalopathy (HIE) and intraventicular/periventricular haemorrhage were significantly related to gestational age. Seventy-one percent of deaths from HIE were term compared to 27% of all neonatal deaths, whereas 64% of neonatal deaths from intraventricular/periventricular haemorrhage occurred in very pre-term infants born less than 27 weeks' gestation, compared to 45% of all neonatal deaths.

Deaths from HIE and intraventricular/periventricular haemorrhage were also significantly less likely to also have had major congenital anomalies than all neonatal deaths. Five percent of deaths from HIE and no deaths from intraventricular/periventricular haemorrhage had major congenital anomalies compared with 28% of all neonatal deaths. This is probably a reflection that congenital anomalies are associated with stillbirth or with lower birth weight making a perinatal complication from an obstructed labour or intracranial haemorrhage less frequent.

Placental abruption was significantly more common in deaths from neurological disorders, particularly HIE, compared to all neonatal deaths. Abruption was recorded in the mothers of 20% of neonatal deaths from HIE and 23% of deaths from other neurological disorders, compared to only 7% of all neonatal deaths.

Table 6.5
Possible risk factors for neurological disorders; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Percentage of all neonatal deaths %	n (%)[a]		
		Hypoxic-ischaemic encephalopathy	Intraventricular/ periventricular haemorrhage	Other neurological disorder
Gestational age (completed weeks)				
<27	44.8	2 (1.0)	28 (63.6)	8 (30.8)
27-31	15.2	25 (13.0)	15 (34.1)	5 (19.2)
32-36	13.1	28 (14.6)	1 (2.3)	2 (7.7)
37+	26.9	137 (71.4)	-	11 (42.3)
Major congenital anomaly				
Yes	28.4	10 (5.2)	-	3 (11.5)
No	71.6	182 (94.8)	44 (100.0)	23 (88.5)
Intrauterine growth restriction (IUGR)				
Yes	12.7	20 (10.4)	2 (4.5)	1 (3.8)
No	87.3	172 (89.6)	42 (95.5)	25 (96.2)
Abruption				
Yes	6.5	39 (20.3)	3 (6.8)	6 (23.1)
No	93.5	153 (79.7)	41 (93.2)	20 (76.9)

[a]Percentages are calculated after removing not knowns

Source: CMACE

6.2.2 Respiratory disorders

The new classification provides much more information on respiratory disorders however there is less information for prematurity. The proportion of infants by gestational age for each main cause/associated factor for the neonatal death is detailed in Table 6.7. A large number of these cases were due to pulmonary immaturity associated with prematurity. A relatively small number of term infants died from or had a death associated with a respiratory condition.

Table 6.6
Percentage by gestational age of infants with a respiratory condition as the main cause/association for neonatal death; England, Wales, Northern Ireland and the Crown Dependencies: 2009

Respiratory disorders	Percentage of primary cause n (%)[a]				
	<27	27-31	32-36	37+	Not known
Severe pulmonary immaturity	393 (92.7)	29 (6.8)	1 (0.2)	1 (0.2)	2
Surfactant deficiency lung disease	51 (68.0)	18 (24.0)	5 (6.7)	1 (1.3)	-
Pulmonary hypoplasia	24 (27.9)	37 (43.0)	18 (20.9)	7 (8.1)	-
Meconium aspiration syndrome	-	-	-	16 (100)	-
Primary persistent pulmonary hypertension	6 (33.3)	3 (16.7)	2 (11.1)	7 (38.9)	-
Chronic lung disease/bronchopulmonary dysplasia	4 (66.7)	2 (33.3)	-	-	-
Other (includes pulmonary haemorrhage)	43 (44.8)	31 (32.3)	5 (5.2)	17 (17.7)	1
All respiratory disorder deaths	521 (72.3)	120 (16.6)	31 (4.3)	49 (6.8)	3

[a]Percentages are calculated after removing not knowns

Source: CMACE

6.2.3 Intrapartum related neonatal deaths

In 2009, there were 232 intrapartum related neonatal deaths which accounts for 10.5% of the total.

Of the 232 intrapartum related neonatal deaths, 139 (59.9%) were delivered at term (≥37 weeks) and 215 (92.7%) had no major congenital anomaly either causing or associated with the death. There were 134 intrapartum related neonatal deaths that delivered at term with no signs of a major congenital anomaly, accounting for 6.0% of neonatal deaths. Of the intrapartum related neonatal deaths, 39 presented in breech position, with 21 of these being born vaginally and 17 by caesarean section. In one case the mode of delivery is unrecorded. Of these 39 breech intrapartum stillbirths, only nine were at term and four were ascribed to anoxia.

Table 6.7
Possible risk factors among the stillbirths alive at onset of care in labour; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	Number	Percentage (%)[a]
Gestational age		
<32	66	28.4
32-36	27	11.6
37+	139	59.9
Major congenital anomaly		
Yes	17	7.3
No	215	92.7
Mode of delivery		
Spontaneous vaginal	78	34.1
Ventouse	16	7.0
Forceps	10	4.4
Assisted breech/breech extraction	9	3.9
Caesarean section	116	50.7
Not known	3	..
Presentation at delivery		
Vertex	171	79.2
Breech	39	18.1
Compound	3	1.4
Other	3	1.4
Not known	16	..
Primary cause of death		
Major congenital anomaly	6	2.6
Extreme prematurity	5	2.2
Respiratory disorders	54	23.5
Gastro-intestinal disease	4	1.7
Neurological disorder	132	57.4
Infection	6	2.6
Injury/trauma	-	-
Other specific causes	13	5.7
Sudden unexpected deaths	4	1.7
Unclassified	6	2.6
Not known	2	..

[a]Percentages are calculated after removing not knowns

Source: CMACE

6.3 Post mortem examinations

In 2009, 44% of stillbirths, 38% of perinatal deaths and 25% of neonatal deaths were offered and consent was given for a hospital post mortem to be performed. This compares to hospital post mortems performed for 46% of stillbirths and 25% of neonatal deaths in 2008. Details of hospital post mortem results were received by CMACE for 36% of stillbirths, 31% of perinatal deaths and 18% of neonatal deaths which help in coding the cases for cause of death. Hospital post mortems were not carried out in the remaining cases due either to them not being offered or consent not being given.

Table 6.8
Percentage of hospital post mortem examinations among stillbirths, perinatal and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	n (%)		
	Stillbirths N=3,812	**Perinatal deaths N=5,639**	**Neonatal deaths N=2,348**
PM offered and consent given for full PM	1,554 (40.8)	1,994 (35.4)	529 (22.5)
PM offered and consent given for limited PM	122 (3.2)	155 (2.7)	48 (2.0)
MRI	18 (0.5)	21 (0.4)	3 (0.1)
X-Ray	42 (1.1)	51 (0.9)	9 (0.4)
Other	90 (2.4)	113 (2.0)	37 (1.6)
PM offered and consent given for full PM and details received at CMACE	1,292 (33.9)	1,608 (28.5)	379 (16.1)
PM offered and consent given for limited PM and details received at CMACE	90 (2.4)	110 (2.0)	33 (1.4)
MRI	15 (0.4)	17 (0.3)	2 (0.1)
X-Ray	26 (0.7)	32 (0.6)	6 (0.3)
Other	75 (2.0)	92 (1.6)	29 (1.2)
PM offered and consent not given	1,771 (46.5)	2,717 (48.2)	1,159 (49.4)
PM offered and not known if consent was given	31 (0.8)	43 (0.8)	22 (0.9)
PM not offered	217 (5.7)	516 (9.2)	425 (18.1)
Not known if PM was offered	117 (3.1)	214 (3.8)	165 (7.0)

Source: CMACE

In less than one percent of stillbirths the case was referred to the coroner, as in 5% of perinatal deaths and 14% of neonatal deaths. Details of whether the coroner's post mortem was carried and/or the results of the post mortem were received by CMACE for less than one percent of stillbirths, 2% of perinatal deaths and 7% of neonatal deaths.

Table 6.9
Percentage of coroner's post mortem examinations among stillbirths, perinatal and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	n (%)		
	Stillbirths N=3,812	**Perinatal deaths N=5,639**	**Neonatal deaths N=2,348**
Case referred to the coroner	27 (0.7)	255 (4.5)	316 (13.5)
Case referred to the coroner and PM performed and/or details received at CMACE	10 (0.3)	114 (2.0)	159 (6.8)
Case not referred to the coroner	3,242 (85.0)	4,527 (80.3)	1,605 (68.4)
Not known if referred to the coroner	543 (14.2)	857 (15.2)	427 (18.2)

Source: CMACE

Figures 6.4 and 6.5 show the trends in post mortem uptake for stillbirths from 2000 to 2009. The percentage of post mortems performed for stillbirths has decreased over the 10 years from 55% in 2000 to 45% in 2009 ($p<0.001$). But the decrease appears to have occurred mainly in the years 2000-2002 in the wake of the organ retention issue. Subsequently, stillbirth autopsy rates have remained relatively steady at approximately 45%. Stillbirths are outside the jurisdiction of coroners but a coroner's investigation and autopsy may sometimes be required to establish the cause of death when there is the possibility that the baby was alive at birth. A common circumstance for this is an untended (and usually unexpected) home birth although sometimes the timing of death is not always certain even in hospital.

There was a reduction in the number of cases where a post mortem examination was not offered to parents of stillborn infants, from 11% to 3% ($p<0.001$), but there was an increase in the proportion of parents who did not consent for a post mortem, from 33% to 51% ($p<0.001$).

Figure 6.4
Trend in post mortem uptake for stillbirths; England, Wales, Northern Ireland and the Crown Dependencies: 2000-2009

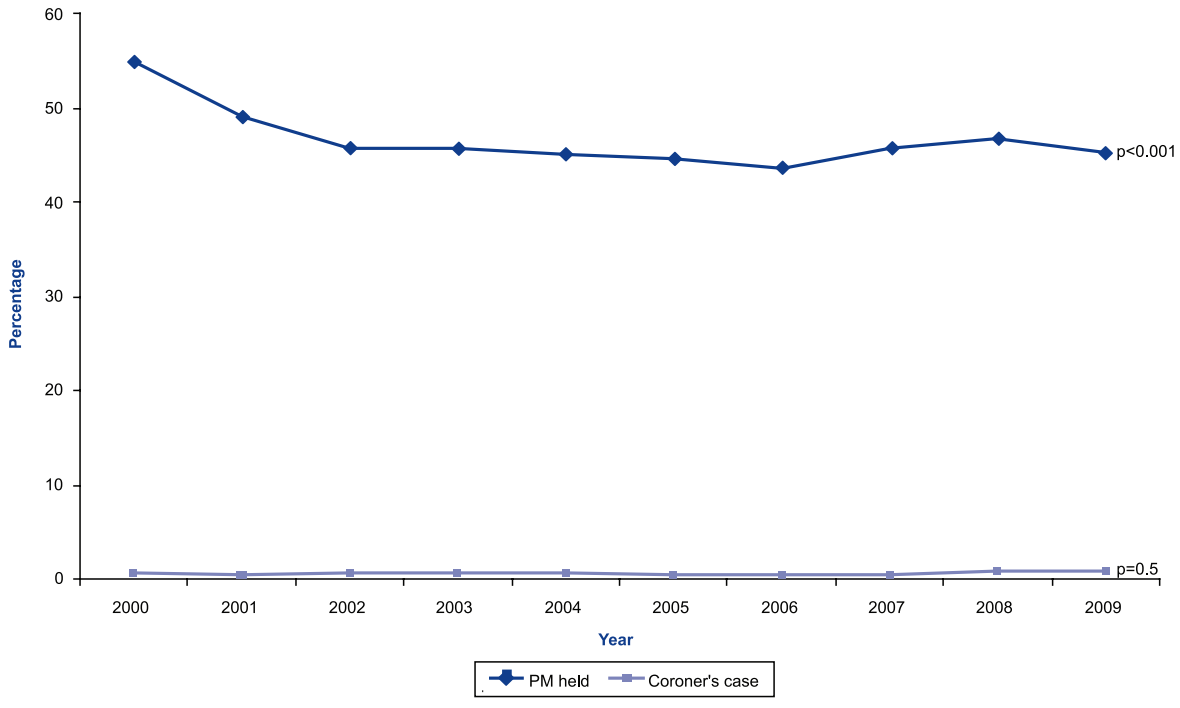
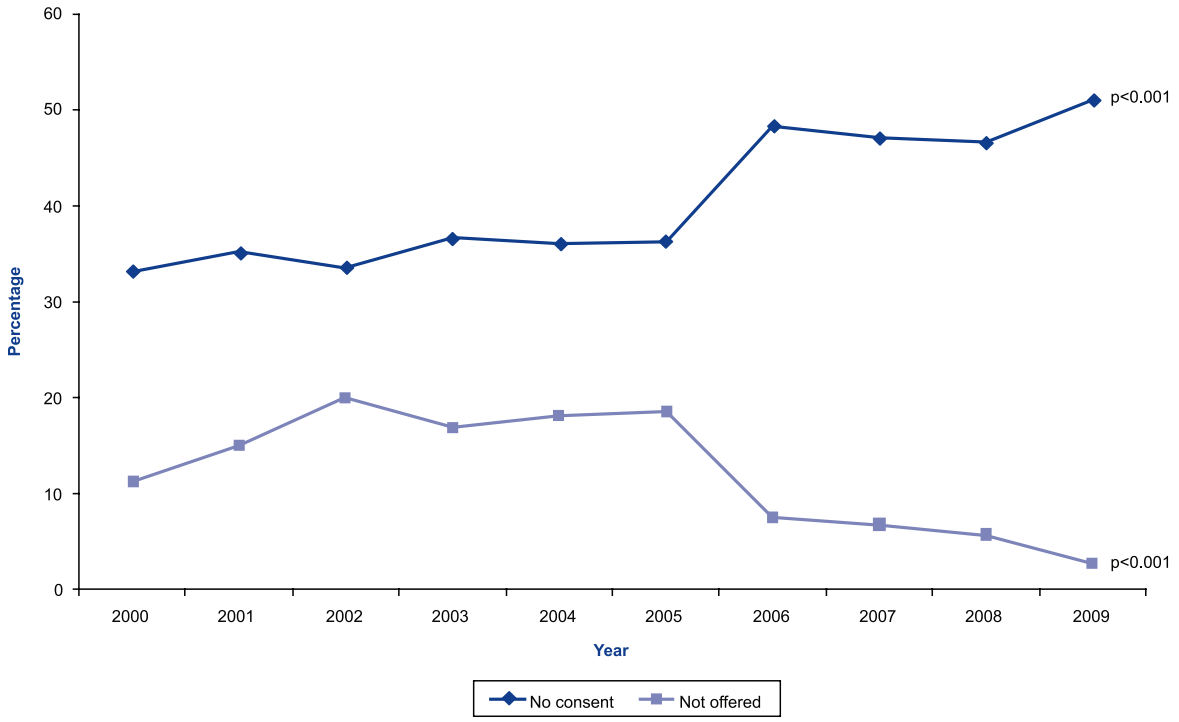


Figure 6.5
Trend in reasons why post mortems were not held for stillbirths; England, Wales, Northern Ireland and the Crown Dependencies: 2000-2009



Figures 6.6 and 6.7 show the trends in post mortem uptake for neonatal deaths from 2000 to 2009. Over the last 10 years, the percentage of hospital consent post mortems performed after neonatal death has decreased, from 29% in 2000 to 18% in 2009 ($p<0.001$). Again, much of this drop occurred in the first three years of the decade. However, there was an increase and notable change in the percentage of neonatal deaths referred to the coroner, 8% in 2000 to 17% in 2009 ($p<0.001$). Most of this increase is likely to be hospital death referrals. The cause(s) of this rise is largely speculative. Possibilities include a greater willingness of coroners to investigate hospital practice and neonatologists being more cautious about signing a death certificate when the cause of death is less than certain and/or management has been less than optimum.

Like stillbirths, there was a reduction in the number of parents of neonatal deaths who were offered post mortem examination, from 23% to 13% ($p<0.001$), together with an increase in parents who did not consent to a post mortem, from 41% to 52% ($p<0.001$).

Figure 6.6
Trend in post mortem uptake for neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2000-2009

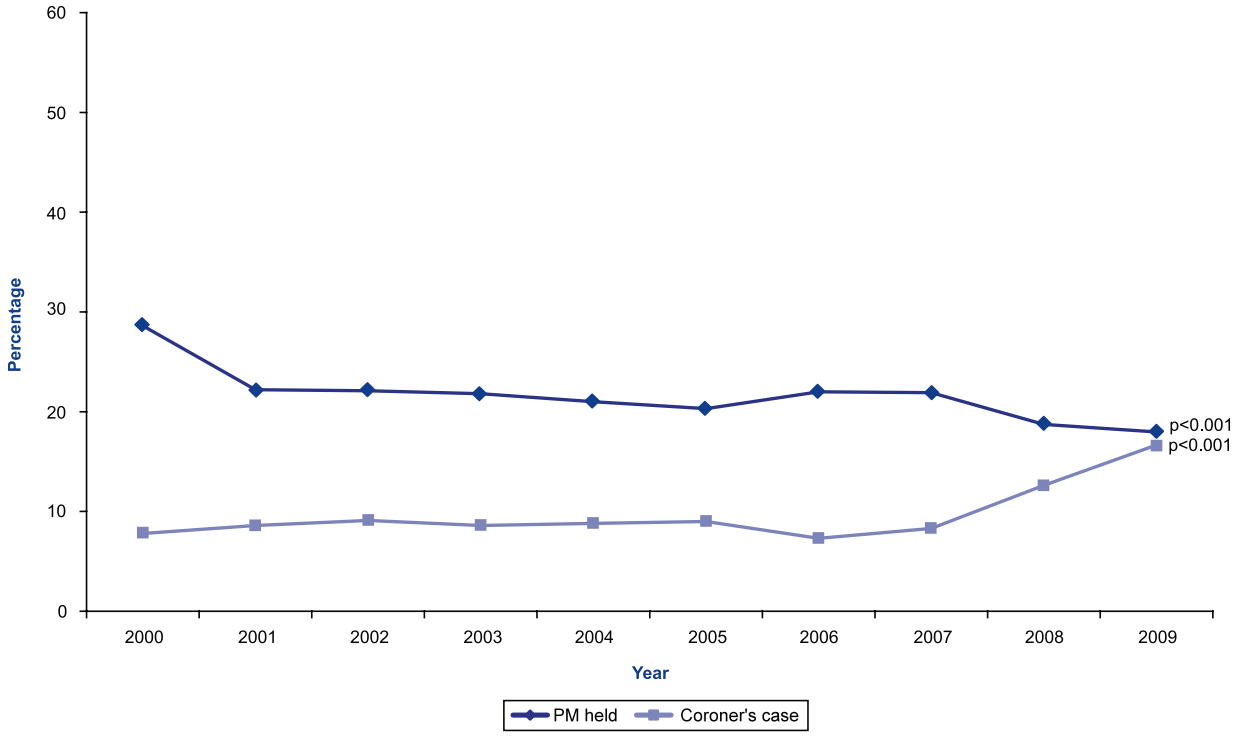
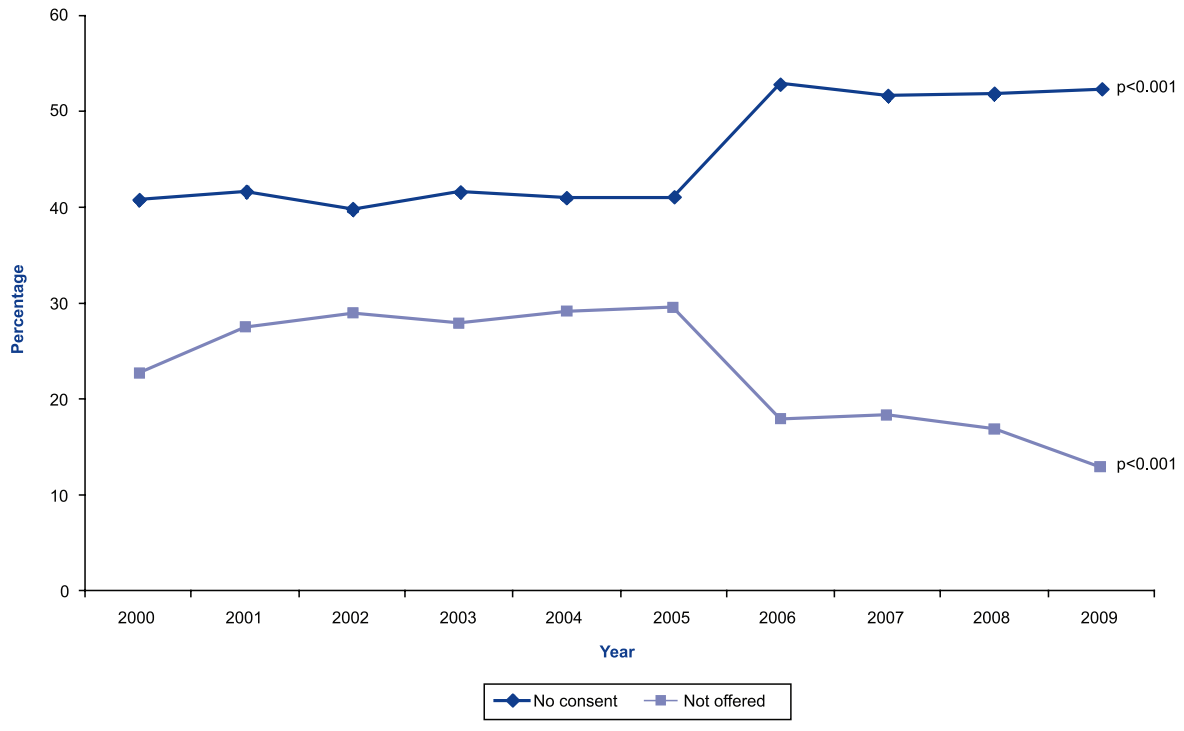


Figure 6.7
Trend in reasons why post mortems were not held for neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2000-2009



6.4 Placental examinations

This is the second year CMACE has reported data on whether the placenta was sent for histology. If it was sent, the details of the examination are obtained. The details can contribute to coding for the cause of death.

In 78% of stillbirths the placenta was sent for histology, in 71% of perinatal deaths and 51% of neonatal deaths, compared to 80% of stillbirths and 46% of neonatal deaths in 2008. Details of the placental histology were received by CMACE for 39% of stillbirths and 19% of neonatal deaths.

Table 6.10
Percentage of placental histology among stillbirths, perinatal and neonatal deaths; England, Wales, Northern Ireland and the Crown Dependencies: 2009

	n (%)		
	Stillbirths N=3,812	**Perinatal deaths N=5,639**	**Neonatal deaths N=2,348**
Placenta sent for histology	2,983 (78.3)	4,025 (71.4)	1,194 (50.9)
Placenta sent for histology and details received at CMACE	1,489 (39.1)	1,884 (33.4)	443 (18.9)
Placenta not sent for histology	501 (13.1)	995 (17.6)	715 (30.5)
Not known if placenta was sent for histology	328 (8.6)	619 (11.0)	439 (18.7)

Source: CMACE

Chapter 7 Focus on singleton and twin births

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This chapter analyses trends in the perinatal mortality rates for twin births compared to singletons from 2000 to 2009. Information is also presented on higher order multiples but in general due to small numbers, trends in these cases are not clear and therefore not commented on in this chapter.

The perinatal mortality rate in twins has decreased from 33.6 per 1,000 total births in 2000 to 24.6 per 1,000 total births in 2009 ($p<0.001$).

Although twin births constituted just 3% of all births in 2009 in comparison to singletons (97%), they are at substantially higher risk of complications: stillbirth rates were increased 3 to 4 fold in twins, and early neonatal death rates were 6 to 8 times that of singletons. In the UK, the perinatal mortality rate for twin births was 3.6 times that of singleton births in 2009 (24.6 versus 6.8 per 1,000 total births). Despite constituting a small percentage of overall births, twins pregnancies consume a relatively large proportion of NHS resources before, during labour and after birth[22 23 24], with extra costs being particularly related to prematurity,[25 26] growth restriction[26] and twin specific complications.

Further analysis of the excess mortality and morbidity for twins will help identify areas for improvement and focus resources to produce continued improvement in their perinatal care and therefore outcomes.

7.1 Rates and rate ratios

The perinatal mortality rate in twins has decreased from 33.6 per 1,000 total births in 2000 to 24.6 per 1,000 total births in 2009 ($p<0.001$). This compares to the reduction in the mortality rate for singletons from 7.5 per 1,000 total births in 2000 to 6.8 per 1,000 total births in 2009 ($p<0.001$). The perinatal mortality rate is a composite marker with contributions from both obstetric (stillbirth rate) and neonatal care (neonatal mortality rate).

Stillbirth rates in twin births have decreased from 16.7 per 1,000 total births in 2000 to 12.1 per 1,000 total births in 2009 ($p<0.001$, Table 7.1). Similarly, the neonatal mortality rate in twin births has decreased from 21.5 per 1,000 live births in 2000 to 16.4 per 1,000 live births in 2009 ($p<0.001$, Table 7.2).

We have used rate ratios to compare the rate of reduction of stillbirth rates and neonatal mortality for twin births with those for singleton births (Tables 7.1 and 7.2) for each year from 2000 to 2009. For example, a rate ratio of 3.6 for stillbirth in twins in the year 2003 means that stillbirth occurred 3.6 times as often per 1,000 total births in twin deliveries than in singleton deliveries for the same year. Analysis of the trend from 2000 to 2009 reveals that there was a significant reduction in the stillbirth rate ratio for twins from 3.4 to 2.5. However there was no corresponding change in the neonatal mortality rate ratio over the same period (Figure 7.1).

Table 7.1
Stillbirth rates of singleton and multiple births and rate ratios; United Kingdom: 2000-2009.

Year	Singletons	Twins		Triplet and higher order multiples	
	Rate [95% CI][a]	Rate [95% CI][a]	Rate ratios[b] [95% CI]	Rate [95% CI][a]	Rate ratios[b] [95% CI]
2000	5.0 [4.8, 5.2]	16.7 [15.0, 18.7]	3.4 [3.0, 3.8]	23.8 [15.5, 36.5]	4.8 [3.1, 7.3]
2001	5.0 [4.8, 5.2]	17.4 [15.6, 19.4]	3.5 [3.1, 3.9]	40.3 [28.2, 57.7]	8.1 [5.7, 11.5]
2002	5.2 [5.1, 5.4]	17.8 [16.0, 19.8]	3.4 [3.0, 3.8]	51.0 [35.9, 72.5]	9.7 [6.9, 13.7]
2003	5.3 [5.1, 5.5]	19.1 [17.3, 21.1]	3.6 [3.3, 4.0]	62.2 [42.7, 90.7]	11.8 [8.2, 17.0]
2004	5.3 [5.2, 5.5]	16.1 [14.5, 18.0]	3.0 [2.7, 3.4]	47.6 [31.9, 71.0]	8.9 [6.0, 13.2]
2005	5.0 [4.8, 5.2]	13.1 [11.7, 14.8]	2.6 [2.3, 3.0]	32.8 [20.1, 53.5]	6.6 [4.0, 10.6]
2006	4.9 [4.7, 5.0]	12.2 [10.8, 13.7]	2.5 [2.2, 2.8]	19.0 [9.9, 36.6]	3.9 [2.0, 7.5]
2007	4.9 [4.8, 5.1]	12.2 [10.9, 13.7]	2.5 [2.2, 2.8]	15.2 [7.2, 31.9]	3.1 [1.5, 6.4]
2008	4.8 [4.6, 4.9]	11.2 [9.9, 12.6]	2.4 [2.1, 2.7]	27.9 [17.1, 45.5]	5.9 [3.6, 9.5]
2009	4.8 [4.7, 5.0]	12.1 [10.8, 13.5]	2.5 [2.2, 2.8]	20.9 [11.6, 37.8]	4.3 [2.4, 7.8]

[a]Rate per 1,000 total births
[b]Rate ratios are calculated using singletons as the reference group

Sources: CMACE, ONS, NI CHS, GROS and SSBID Survey

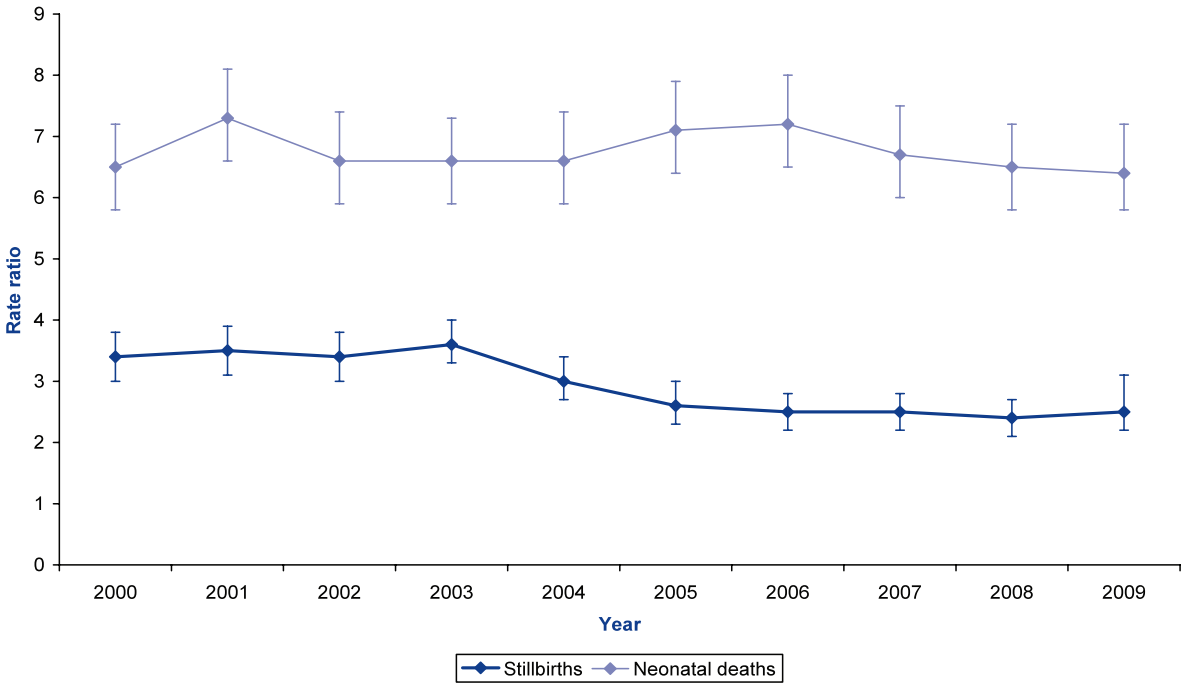
Table 7.2
Neonatal mortality rates of singleton and multiple births and rate ratios; United Kingdom: 2000-2009.

Year	Singletons	Twins		Triplet and higher order multiples	
	Rate [95% CI][a]	Rate [95% CI][a]	Rate ratios[b] [95% CI]	Rate [95% CI][a]	Rate ratios[b] [95% CI]
2000	3.3 [3.2, 3.4]	21.5 [19.5, 23.7]	6.5 [5.8, 7.2]	58.1 [44.0, 76.6]	17.6 [13.4, 23.1]
2001	3.1 [2.9, 3.2]	22.4 [20.3, 24.6]	7.3 [6.6, 8.1]	53.2 [38.7, 73.1]	17.4 [12.7, 23.8]
2002	3.0 [2.9, 3.1]	19.8 [17.9, 21.9]	6.6 [5.9, 7.4]	34.7 [22.4, 53.7]	11.5 [7.5, 17.7]
2003	3.0 [2.9, 3.2]	19.9 [18.1, 22.0]	6.6 [5.9, 7.3]	93.4 [67.9, 128.3]	30.7 [22.6, 41.7]
2004	2.8 [2.7, 3.0]	18.8 [17.1, 20.8]	6.6 [5.9, 7.4]	68.8 [48.9, 96.7]	24.2 [17.4, 33.7]
2005	2.9 [2.8, 3.0]	20.6 [18.8, 22.7]	7.1 [6.4, 7.9]	63.6 [44.4, 90.9]	21.9 [15.4, 31.0]
2006	2.6 [2.5, 2.7]	18.7 [17.0, 20.6]	7.2 [6.5, 8.0]	79.7 [57.8, 110.1]	30.6 [22.4, 41.8]
2007	2.7 [2.6, 2.8]	18.0 [16.3, 19.8]	6.7 [6.0, 7.5]	39.6 [25.0, 62.9]	14.8 [9.4, 23.3]
2008	2.6 [2.5, 2.7]	17.0 [15.4, 18.8]	6.5 [5.8, 7.2]	53.8 [37.6, 76.9]	20.4 [14.4, 29.0]
2009	2.6 [2.5, 2.7]	16.4 [14.9, 18.0]	6.3 [5.7, 7.1]	48.5 [32.8, 71.8]	18.8 [12.8, 27.6]

[a]Rate per 1,000 live births
[b]Rate ratios are calculated using singletons as the reference group

Sources: CMACE, ONS, NI CHS, GROS and SSBID Survey

Figure 7.1
Stillbirth and neonatal mortality rate ratios for twins in comparison to singleton births; United Kingdom: 2000-2009.



There are a number of possible explanations for this finding which is likely to be multi-factorial. It is likely that there have been improvements in obstetric practice over this time period with intrauterine transfusion and laser therapies for twin to twin transfusion syndrome being the most apparent of these. Similarly, improvements in neonatal care are also likely to have had a beneficial impact but these appear not to have produced specific improvements for twins. Alternatively, as studies have demonstrated that much of the increased risk is due to prematurity and growth restriction, it is possible that earlier obstetric intervention in twin pregnancy is reducing stillbirth but increasing the chance of neonatal death. Another possibility is that important characteristics of the women and babies have changed over time, perhaps as a result of changing utilisation of subfertility treatment.

Unfortunately these questions cannot be answered by the CMACE dataset as the data on babies who survive is obtained via ONS from birth certificates which do not include gestational age, nor detail on treatment for subfertility. It is hoped that alternative sources of this data such as the Neonatal Audit Programme will be available in the near future to study this in more detail. The following section provides some of the detail that is available.

7.2 Gestation and birth weight

Table 7.3 presents the trends in median and inter-quartile range (IQR) for gestational age and birth weight for stillbirths categorised by singleton and twin deliveries. Stillborn twins had a similar gestational age distribution compared to singletons but significantly lower birth weights (Table 7.3).

Table 7.3
Median and range of gestation and birth weight among the stillbirths; England, Wales and Northern Ireland: 2000-2009.

Year	Median (IQR) gestation		Median (IQR) birth weight	
	Singleton	Twin	Singleton	Twin
2000	33 (27-38)	33 (28-37)	1820 (840-2825)	782 (360-1580)
2001	33 (27-38)	32 (27-36)	1779 (820-2790)	899 (469-1640)
2002	33 (27-38)	33 (27-37)	1763 (800-2780)	843 (444-1590)
2003	33 (27-38)	33 (28-37)	1740 (814-2859)	845 (340-1559)
2004	33 (27-38)	32 (27-36)	1750 (810-2850)	700 (330-1550)
2005	33 (27-38)	32 (27-35)	1820 (846-2845)	849 (540-1725)
2006	33 (27-38)	32 (27-35)	1800 (860-2800)	940 (540-1670)
2007	33 (28-38)	32 (28-36)	1830 (870-2860)	1105 (600-1830)
2008	34 (28-38)	32 (28-35)	1820 (860-2870)	1080 (590-1700)
2009	34 (28-38)	32 (28-35)	1860 (870-2880)	1000 (555-1705)

Source: CMACE

Trends in median and inter-quartile range (IQR) for gestation and birth weight for neonatal deaths are presented in Table 7.4. Twins that died in the neonatal period aren't born at significantly earlier gestation or of a lower birth weight when compared to singletons.

This trend has not changed from 2000 to 2009. This could be a reflection of an inherent risk of mortality purely from being a twin but may also reflect contribution of other co-morbidities more prevalent in twins compared to singleton births.

Table 7.4
Median and range of gestation and birth weight among the neonatal deaths; England, Wales and Northern Ireland: 2000-2009

Year	Median (IQR) gestation		Median (IQR) birth weight	
	Singleton	Twin	Singleton	Twin
2000	28 (24-37)	24 (23-28)	1050 (620-2710)	670 (530-980)
2001	28 (24-38)	25 (23-28)	1100 (610-2730)	689 (540-1005)
2002	28 (24-37)	25 (23-28)	1089 (590-2710)	680 (514-1060)
2003	28 (23-37)	24 (23-28)	1035 (584-2660)	650 (492-1011)
2004	28 (23-38)	25 (23-28)	1080 (595-2785)	730 (500-1091)
2005	28 (23-38)	24 (23-28)	1025 (580-2642)	657 (490-903)
2006	27 (23-37)	24 (23-27)	1000 (595-2600)	651 (510-915)
2007	29 (23-38)	24 (23-27)	1200 (600-2700)	660 (520-920)
2008	28 (23-37)	24 (23-27)	1070 (580-2700)	660 (500-990)
2009	28 (23-38)	24 (23-27)	1180 (590-2720)	660 (530-1020)

Source: CMACE

7.3 Cause of death

Documented primary causes for stillbirth were diverse for twin births. Figures 7.2 and 7.3 provide a representation of relative frequency of the primary causes of singleton and twin stillbirths respectively. Disappointingly, the most common category was 'no antecedent or associated obstetric factor'. Specific fetal conditions (21%) and major congenital anomalies (11%) were more common primary causes of stillbirth in twins compared to singletons: 2% and 9% respectively. Twin specific fetal conditions including twin to twin transfusion syndrome were a major cause of stillbirth in twins (18% of all twin births).

Understanding the underlying primary causes of neonatal deaths is key to devising strategies to reduce mortality both in singletons and twins. Further research needs to be undertaken to determine the relative contribution of feto-maternal and neonatal contributions to neonatal mortality.

Figures 7.4 and 7.5 provide a breakdown of primary causes of neonatal deaths, in singletons and twins respectively, using the CMACE maternal and fetal classification. Associated obstetric factors and major congenital anomalies constitute, by far, the largest relative categories, both in singletons and twins. Major congenital anomaly as the primary cause of death is less common in twin neonatal deaths and stillbirths (13% and 11%) compared to singletons (27% and 9%). This may reflect improved recognition of abnormalities in twins and/or higher rates of termination of pregnancy in twin pregnancy.

Infection and antepartum or intrapartum haemorrhage are the other main contributors. The key to achieving further reductions in mortality and morbidity lies in developing guidance to target modifiable obstetric variables in a cost effective way.

Figure 7.2
Primary cause of singleton stillbirths using the CMACE maternal and fetal classification; England, Wales and Northern Ireland: 2009 (excluding terminations of pregnancy) N=3,071

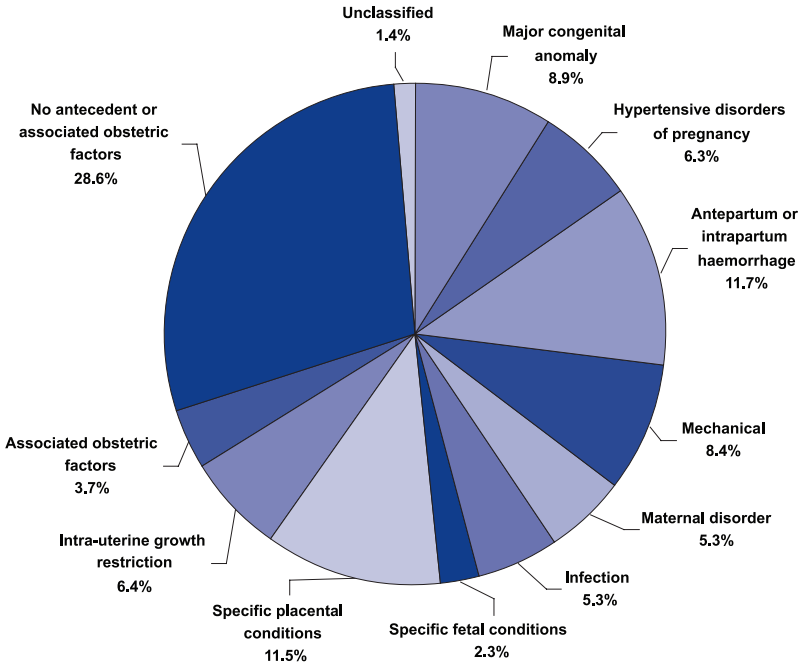


Figure 7.3
Primary cause of twin stillbirths using the CMACE maternal and fetal classification; England, Wales and Northern Ireland: 2009 (excluding terminations of pregnancy) N=246

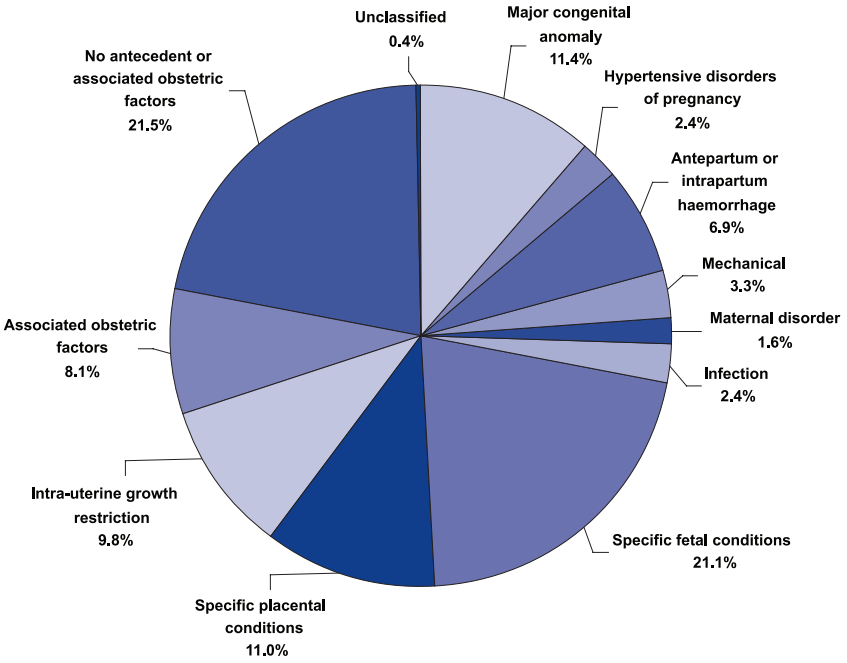


Figure 7.4
Primary cause of singleton neonatal deaths using the CMACE maternal and fetal classification; England, Wales and Northern Ireland: 2009 (excluding terminations of pregnancy) N=1,679

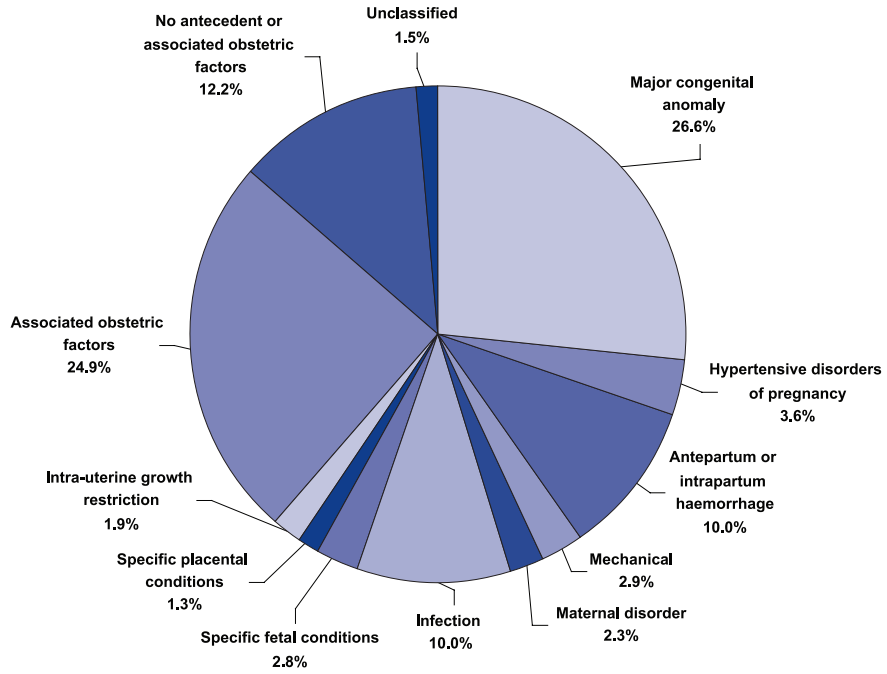
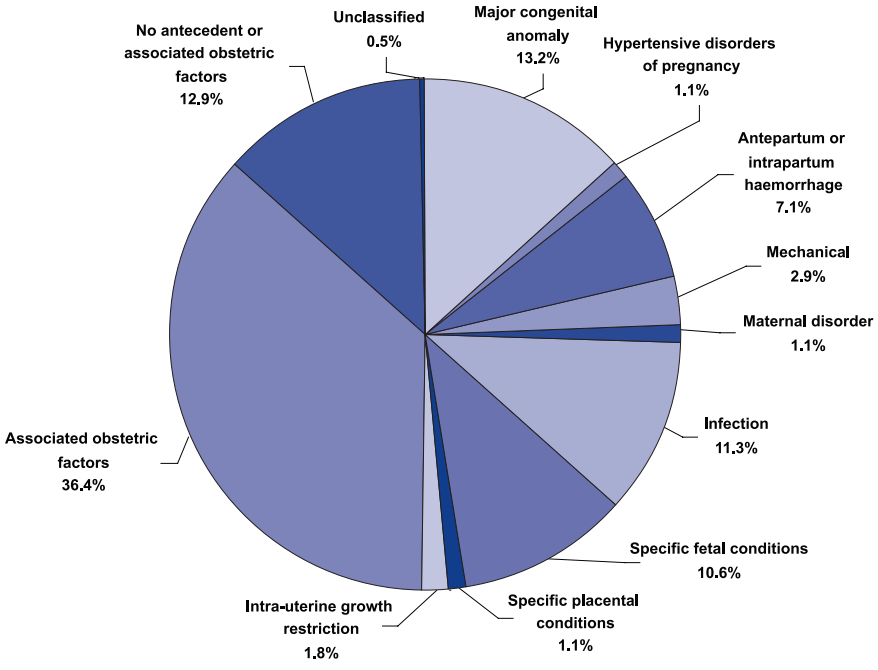


Figure 7.5
Primary cause of twin neonatal deaths using the CMACE maternal and fetal classification; England, Wales and Northern Ireland: 2009 (excluding terminations of pregnancy) N=379



Similarly it is important to appreciate the spectrum of neonatal conditions that contribute to neonatal mortality both in singletons and twins. Understanding the contributions of various pathologies could help to focus efforts and resources to achieve better survival.

Figures 7.6 and 7.7 give a breakdown of the frequency of the primary causes of neonatal deaths, in singletons and twins respectively, using the CMACE neonatal classification. Not surprisingly, respiratory pathology is the most common cause for mortality in both singleton and twins, the higher rate in twins probably reflecting the lower median gestational age of twins.

Congenital anomaly was a much less common cause of death in twin births compared to singleton deliveries, reflecting the higher incidence of all the other causes of neonatal death in twins.

Figure 7.6
Primary cause of singleton neonatal deaths using the CMACE neonatal classification; England, Wales and Northern Ireland: 2009 (excluding terminations of pregnancy) N=1,672

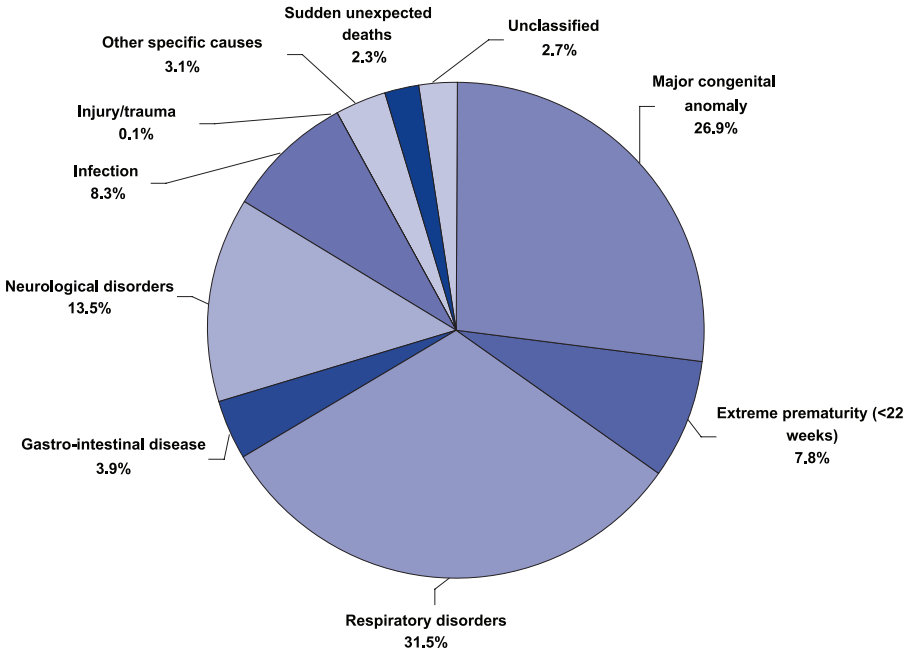
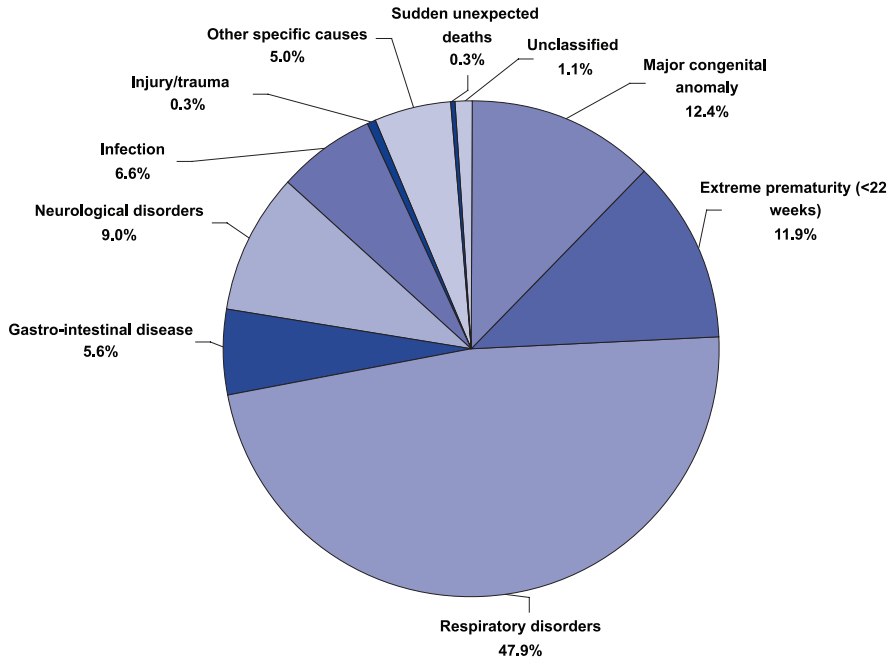


Figure 7.7
Primary cause of twin neonatal deaths using the CMACE neonatal classification; England, Wales and Northern Ireland: 2009 (excluding terminations of pregnancy) N=378



Although CMACE collects information on cause of death in singleton and twins, detailed analysis of the relative frequency of various causes of death between singletons and twins are limited by non-availability of morbidity data in the CMACE dataset as it is not possible to correct for risk. It is hoped that future datasets such as that being collected by the Neonatal Audit Programme will assess the contribution of gestational age and birth weight and determine whether being a twin itself remains an important risk factor for neonatal deaths.

In summary, although there have been significant improvements in the perinatal mortality rate for twins, this appears to be primarily from a reduction in the stillbirth rate which has improved faster than the singleton stillbirth rate. Neonatal mortality appears to have been improved at the same rate in both twin and singleton deliveries. This observed decrease in the relative stillbirth rate of twins may be due to improved antenatal and delivery care but it may be that twins are being delivered more prematurely increasing their risk of neonatal death. More research needs to be undertaken to identify causes for these observed trends so that strategies can be devised to achieve further reductions in perinatal mortality. There is a need to improve the collection of data on mortality and morbidity to enable new research utilising risk correction or logistic regression methodology.

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Index of tables

The following symbols have been used in the tables:

.. Not available/not applicable

- Nil

0.0 Negligible

Index of figures

Appendix A Contributors to Perinatal Mortality Surveillance

CMACE Regional Managers responsible for data collection

East Midlands & Yorkshire and the Humber	**Sue Wood (until November 2009)**
East of England	**Carol Hay**
London and South East	**Rachel Thomas**
North East	**Marjorie Renwick (until October 2009)** **Mary Bythell (from October 2009)**
North West	**Julie Maddocks**
Northern Ireland	**Angela Bell (until December 2009)** **Jacquie McCall (from December 2009)** **Heather Reid (from December 2009)**
South West and Wessex	**Rosie Thompson**

CMACE Regional Assistants involved in data collection

East Midlands & Yorkshire and the Humber	**Daniel Beever** **Clare Wade**	**Administrative Assistant** **Assistant Regional Manager**
East of England	**Helen Doyle**	**Regional Assistant**
London and South East	**Shahida Akhtar** **Sanila Gill** **David Kimani** **Melanie Workman**	**Assistant Regional Manager** **Administrative Assistant** **Projects Assistant** **Administrative Assistant**
North East	**Nicola Miller**	**Midwife**
North West	**Aqsa Aziz** **Emily Liddiard**	**Administrative Assistant** **Administrative Assistant**
Northern Ireland	**Malcolm Buchanan** **Terry Falconer** **Joanne Gluck**	**Administrator** **Project Manager** **Clinical Research Midwife**
South West and Wessex	**Jo Coffee**	**Regional Assistant**

For Office use only: PDN CODE FOR CASE ☐☐0 9☐☐☐☐

SURNAME _____

PLACE OF DEATH _____

DATE OF DELIVERY ☐☐ / ☐☐ / ☐☐

CEMACH

Confidential Enquiry into Maternal and Child Health

Improving the health of mothers, babies and children

PERINATAL DEATH NOTIFICATION FORM

2009

CHOOSE Type of Case *(TICK)*

☐ **STILLBIRTH:** *A baby delivered without life **after** 23+6 weeks of pregnancy i.e. no signs of life at birth and where no heartbeat was ever detected.*

If the birth occurred unattended and there was no lung aeration seen at Post Mortem (PM) and no other circumstantial evidence of life at birth, it should be assumed that the baby was stillborn.

In all cases where there is evidence that the fetus has died prior to the 24th week of pregnancy, the death **should not** be notified as a stillbirth. Where there is any doubt about the gestational age at which the fetus died, the default position would be to notify as a stillbirth.

OR

☐ **EARLY NEONATAL DEATH:** *Death, following live birth at ANY GESTATION, of a baby before the age of 7 completed days.*

OR

☐ **LATE NEONATAL DEATH:** *Death of a baby occurring from the 7th day of life and before the age of 28 completed days.*

Brief Instructions and Guidance

1. **Fill in the form using the information available in the maternity case notes and discharge summary.**
2. **Guidance for completing Sections 9 & 10 on Cause of Death is found on the folder enclosing this form.**
3. **There are no "not known" codes as all the information should be contained in the notes. *If you do not know the answer to a question please indicate this in Section 12.***
4. **Please complete all dates in the format DD/MM/YY, and all times using the 24hr clock e.g. 17:45.**
5. **Please DO NOT wait for the PM details to complete and return this form.**

For Office Use Only: PDN CODE FOR CASE ☐☐09☐☐☐☐

SECTION 1. WOMAN'S DETAILS

1.1 NHS number: ☐☐☐ ☐☐☐ ☐☐☐☐

1.2 Surname: _____ **First name:** _____

1.3 Hospital number: ☐☐☐☐☐☐☐☐☐☐

1.4 Usual residential address at time of delivery/birth: _____

_____

1.5 Postcode: ☐☐☐☐ ☐☐☐

1.6 Woman's date of birth: D D / M M / Y Y **or estimated age** ☐☐

1.7 Ethnic group:

White: ☐ *British* ☐ *Irish* ☐ *Any other White background, specify* _____

Mixed: ☐ *White & Black Caribbean* ☐ *White & Black African* ☐ *White & Asian* ☐ *Any other mixed*

Asian or Asian British: ☐ *Indian* ☐ *Pakistani* ☐ *Bangladeshi* ☐ *Any other Asian*

Black or Black British: ☐ *Caribbean* ☐ *African* ☐ *Any other Black background*

Other ethnic groups: ☐ *Chinese* ☐ *Any other, specify* _____

Not stated: ☐

1.8 Was the woman in paid employment at booking? ☐ **YES** ☐ **NO**

If yes, what is her occupation? *(Transcribe exactly what is in notes)* _____

1.9 Was the woman's partner in paid employment at booking? ☐ **YES** ☐ **NO** ☐ **NOT KNOWN**

If yes, what is the partner's occupation? *(Transcribe exactly what is in notes)* _____

1.10 Height at booking (cm): ☐☐☐.☐☐

1.11 Weight at booking (kg): ☐☐☐.☐☐

If weight is unavailable, was there evidence that the woman was too heavy for hospital scales? ☐ **YES** ☐ **NO**

1.12 Body Mass Index at booking (BMI): ☐☐

1.13 Smoking status: ☐ *Never* ☐ *Gave up prior to pregnancy* ☐ *Gave up in pregnancy* ☐ *Current*

1.14 Was this woman known to abuse alcohol? ☐ **YES** ☐ **NO**

1.15 Was this woman known to be a substance user? ☐ **YES** ☐ **NO**

SECTION 2. PREVIOUS PREGNANCIES

2.1 Did the woman have any previous pregnancies? *If yes, complete questions 2.2-2.4* ☐ **YES** ☐ **NO**

2.2 No. of completed pregnancies ≥24 weeks (all live & stillbirths): ☐☐

2.3 No. of pregnancies <24 weeks: ☐☐

2.4 Were there any previous pregnancy problems? *If yes,* *tick all that apply below* ☐ **YES** ☐ **NO**

☐ *Three or more miscarriages* ☐ *Pre-term birth or mid trimester loss* ☐ *Stillbirth*

☐ *Neonatal death* ☐ *Baby with congenital anomaly* ☐ *Infant requiring intensive care*

☐ *Previous caesarean section* ☐ *Placenta praevia* ☐ *Placental abruption*

☐ *Pre-eclampsia (hypertension & proteinuria)* ☐ *Post-partum haemorrhage requiring transfusion*

☐ *Other, specify* _____

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SECTION 3. PREVIOUS MEDICAL HISTORY

3.1 Were there any pre-existing medical problems? *If yes, tick all that apply below* ☐ **YES** ☐ **NO**

- ☐ *Cardiac disease (congenital or acquired)*
- ☐ *Endocrine disorders e.g. hypo or hyperthyroidism*
- ☐ *Haematological disorders e.g. sickle cell disease*
- ☐ *Inflammatory disorders e.g. inflammatory bowel disease*
- ☐ *Diabetes*
- ☐ *Epilepsy*
- ☐ *Renal disease*
- ☐ *Psychiatric disorders*
- ☐ *Drug or substance abuse*
- ☐ *Other, specify* _____

SECTION 4. THIS PREGNANCY

4.1 Final Estimated Date of Delivery (EDD): D D/M M/Y Y
Use best estimate *(ultrasound scan or date of last menstrual period)*
based on a 40 week gestation. Or the final date agreed in the notes.

4.2 Was this a multiple pregnancy at the onset of pregnancy? ☐ **YES** ☐ **NO**

4.3 Date of first booking appointment: D D/M M/Y Y ☐ **NOT BOOKED**

4.4 Intended place of delivery at booking:
☐ **UNDECIDED** Name of unit/place _____
Please specify the type of unit
☐ Obstetric unit ☐ Alongside midwifery unit ☐ Freestanding midwifery unit ☐ Home ☐ Other

4.5 What was the intended type of delivery care at booking?
☐ Obstetric led care ☐ Midwifery led care

SECTION 5. DELIVERY

5.1 Onset of labour:
☐ Spontaneous ☐ Induced ☐ Never in labour

5.2 Intended place of delivery at onset of labour:
Name of unit/place _____
Please specify type of unit
☐ Obstetric unit ☐ Alongside midwifery unit ☐ Freestanding midwifery unit ☐ Home ☐ Other

5.3 What was the intended type of delivery at onset of labour?
☐ Obstetric led care ☐ Midwifery led care

5.4 Actual place of delivery:
Name of unit/place _____
Please specify type of unit
☐ Obstetric unit ☐ Alongside midwifery unit ☐ Freestanding midwifery unit ☐ Home ☐ Other

5.5 What was the type of care at delivery?
☐ Obstetric led care ☐ Midwifery led care

5.6 Date & time of delivery/birth: **Date:** D D/M M/Y Y **Time:** H H:M M

5.7 What was the presentation at *delivery*?
☐ *Vertex* ☐ *Breech* ☐ *Compound (includes transverse and shoulder presentations)* ☐ *Brow* ☐ *Face*

5.8 What was the FINAL mode of delivery?
☐ *Spontaneous vaginal* ☐ *Ventouse* ☐ *Lift-out forceps* ☐ *Mid cavity forceps* ☐ *Rotational forceps*
☐ *Assisted breech* ☐ *Breech extraction* ☐ *Pre-labour caesarean section* ☐ *Caesarean section after onset of labour*

CAESAREAN SECTIONS ONLY *(non-Caesarean Sections go to Section 6)*

5.9 Was a caesarean section planned prior to labour? ☐ **YES** ☐ **NO**

5.10 What was the type of caesarean section?
☐ *Elective* - *At a time to suit woman or maternity team*
☐ *Urgent* - *Maternal or fetal compromise which is not immediately life threatening*
☐ *Scheduled* - *Needing early delivery but no maternal or fetal compromise*
☐ *Emergency* - *Immediate threat to life of woman or fetus*

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SECTION 6. ALL BABY OUTCOMES

6.1 **Baby's surname:** _____ **First name:** _____

6.2 **Baby's NHS number:** ☐☐☐ ☐☐☐ ☐☐☐☐

6.3 **Sex of fetus/baby:** ☐ *Male* ☐ *Female* ☐ *Indeterminate*

6.4 **Number of fetuses/babies this delivery:** *(all identifiable including papyraceous)* ☐

6.5 **Birth order of this fetus/baby:** *(0=singleton)* ☐

6.6 **Birth weight (kg):** ☐.☐☐☐

6.7 **Gestation at delivery:** ☐☐ *weeks +* ☐ *days*

6.8 **Was this a termination of pregnancy?** ☐ **YES** ☐ **NO**

6.9 **Was the death due to an intrapartum related event?** ☐ **YES** ☐ **NO**
If yes, complete questions 6.10-6.12

6.10 **Was a local Hospital/Trust review of this case undertaken?** ☐ **YES** ☐ **NO**

6.11 **If no, please state why not:**

6.12 **If yes, what method was used?**
☐ *Root cause analysis* ☐ *Hospital/Trust review* ☐ *Clinical governance review*
☐ *Other, please specify* _____

SECTION 7. STILLBIRTHS (if not stillbirth go to section 8)

7.1 **What gestation was death confirmed?**
(confirmed by ultrasound, pathological report or when baby born dead) ☐☐ *weeks +* ☐ *days*
If known, what date was death confirmed? D D / M M / Y Y

7.2 **Was the baby alive at *onset of care* in labour?**

☐ **YES** ☐ **NO** ☐ **NEVER IN LABOUR** ☐ **UNATTENDED** ☐ **NOT KNOWN**

SECTION 8. NEONATAL DEATHS (if not neonatal go to section 9)

8.1 **Was spontaneous respiratory activity absent or ineffective at 5mins?** ☐ **YES** ☐ **NO**
If a baby is receiving any artificial ventilation at 5 mins assumption is absent/ineffective activity, a 0 Apgar score indicates absent activity.

8.2 **Was the heart rate persistently <100? (i.e. heart rate never rose above 100 before death)**
☐ Persistently <100 ☐ Rose above 100

8.3 **Was the baby admitted to a neonatal unit?** *(includes SCBU and ICU)* ☐ **YES** ☐ **NO**

8.4 **Place of death:**
Name of unit/place _____
This is where the baby actually died, e.g. 'name of unit', 'at home', 'in transit'. This includes babies who are brought to hospital, but are either declared dead on arrival or show no subsequent signs of life, despite attempted resuscitation.

8.5 **Date & time of death:** **Date:** D D / M M / Y Y **Time:** H H : M M

8.6 **Was the baby transferred to another unit after birth?** ☐ **YES** ☐ **NO**

8.7 **Please briefly describe the obstetric and neonatal factors contributing to and associated with the death:**

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SECTION 9. ASSOCIATED FACTORS & CAUSE OF DEATH - STILLBIRTH and NEONATES

9.1 Which condition, indicated in 9.2 as being present, was the MAIN condition causing or associated with the death? *(NB 'non-MAIN' conditions are best described as the 'Other clinically relevant maternal or fetal conditions/factors that were associated with but not necessarily causing the death'). Please list the MAIN condition:*

9.2 Please TICK ALL the maternal or fetal conditions that arose during pregnancy or were associated with death - *PLEASE REFER TO SEPARATE CAUSE OF DEATH GUIDANCE ON THE ENCLOSING FOLDER.*

9.2.1 MAJOR CONGENITAL ANOMALY:

☐ *Central nervous system* ☐ *Cardiovascular system* ☐ *Respiratory system* ☐ *Gastro-intestinal system*
☐ *Musculo-skeletal anomalies* ☐ *Multiple anomalies* ☐ *Chromosomal disorders* ☐ *Metabolic diseases*
☐ *Urinary tract* ☐ *Other, specify* _____

9.2.2 HYPERTENSIVE DISORDERS OF PREGNANCY:

☐ *Pregnancy induced hypertension* ☐ *Pre-eclampsia toxaemia* ☐ *HELLP syndrome* ☐ *Eclampsia*

9.2.3 ANTEPARTUM or INTRAPARTUM HAEMORRHAGE:

☐ *Praevia* ☐ *Abruption* ☐ *Cause uncertain*

9.2.4 MECHANICAL:

Cord compression: ☐ *Prolapse cord* ☐ *Cord around neck* ☐ *Other cord entanglement or knot*
Uterine rupture: ☐ *Before labour* ☐ *During labour*
Mal-presentation: ☐ *Breech* ☐ *Face* ☐ *Compound*
☐ *Other, please specify* _____

9.2.5 MATERNAL DISORDER:

☐ *Pre-existing hypertensive disease* ☐ *Diabetes* ☐ *Endocrine diseases* ☐ *Thrombophilias*
☐ *Cholestasis* ☐ *Drug misuse* ☐ *Uterine anomalies*
☐ *Other, please specify* _____

9.2.6 INFECTION:

Maternal infection: ☐ *Bacterial* ☐ *Syphilis* ☐ *Viral diseases*
☐ *Protozoal* ☐ *Other, specify* _____
☐ *Specify organism if known* _____
Ascending infection: ☐ *Chorioamnionitis* ☐ *Other, specify* _____

9.2.7 SPECIFIC FETAL CONDITIONS:

☐ *Twin-twin transfusion* ☐ *Feto-maternal haemorrhage* ☐ *Non-immune hydrops* ☐ *Iso-immunusation*
☐ *Other,specify* _____

9.2.8 SPECIFIC PLACENTAL CONDITIONS:

☐ *Placental infarction* ☐ *Massive perivillous fibrin deposition* ☐ *Vasa praevia* ☐ *Velamentous insertion*
☐ *Other, specify* _____

9.2.9 INTRA-UTERINE GROWTH RESTRICTION: ☐

9.2.10 ASSOCIATED OBSTETRIC FACTORS:

Birth trauma: ☐ *Intracranial haemorrhage* ☐ *Birth injury to scalp* ☐ *Other, specify* _____
Intrapartum asphyxia: ☐
Other: ☐ *Polyhydramnios* ☐ *Oligohydramnios* ☐ *Premature rupture of membranes*
☐ *Spontaneous premature labour* ☐ *Other, specify* _____

9.2.11 NO ANTECEDENT OR ASSOCIATED OBSTETRIC FACTORS: ☐

9.2.12 UNCLASSIFIED: (Use this category as sparingly as possible) ☐

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SECTION 10. CAUSE OF DEATH - NEONATES ONLY (Stillbirths go to Section 11)

10.1 Which condition, indicated in 10.2 as being present, was the MAIN condition causing or associated with the death? *(NB 'non-MAIN' conditions are best described as the 'Other clinically relevant conditions/factors that were associated with but not necessarily causing the death'). Please list the MAIN condition:*

10.2 Please TICK ALL the neonatal conditions causing and associated with death - *PLEASE REFER TO SEPARATE CAUSE OF DEATH GUIDANCE ON THE ENCLOSING FOLDER*

10.2.1 MAJOR CONGENITAL ANOMALY:

☐ *Central nervous system* ☐ *Cardiovascular system* ☐ *Respiratory system* ☐ *Gastro-intestinal system*

☐ *Musculo-skeletal anomalies* ☐ *Multiple anomalies* ☐ *Chromosomal disorders* ☐ *Metabolic disease*

☐ *Urinary tract* ☐ *Other, specify* _____

10.2.2 EXTREME PREMATURITY (only less than 21[+6] weeks): ☐

10.2.3 RESPIRATORY DISORDERS:

☐ *Severe pulmonary immaturity* ☐ *Surfactant deficiency lung disease* ☐ *Pulmonary hypoplasia* ☐ *Meconium aspiration syndrome*

☐ *Primary persistent pulmonary hypertension* ☐ *Chronic lung disease/Bronchopulmonary dysplasia (BPD)*

☐ *Other (includes pulmonary haemorrhage), specify* _____

10.2.4 GASTRO-INTESTINAL DISEASE:

☐ *Necrotising enterocolitis (NEC)* ☐ *Other, specify* _____

10.2.5 NEUROLOGICAL DISORDER:

☐ *Hypoxic-ischaemic encephalopathy (HIE)* ☐ *Intraventricular/Periventricular haemorrhage*

☐ *Other, specify* _____

10.2.6 INFECTION:

☐ *Generalised (sepsis)* ☐ *Pneumonia* ☐ *Meningitis* ☐ *Other, specify* _____

10.2.7 INJURY/TRAUMA (postnatal): ☐

Specify _____

10.2.8 OTHER SPECIFIC CAUSES:

☐ *Malignancies/Tumours* ☐ *Specific conditions* _____

10.2.9 SUDDEN UNEXPECTED DEATHS:

☐ *SIDS* ☐ *Infant deaths – cause unascertained*

10.2.10 UNCLASSIFIED (Use this category as sparingly as possible): ☐

SECTION 11. POST MORTEM *(Please do not wait for post mortem results before sending in this form)*

11.1 Was a Post Mortem offered? ☐ **YES** ☐ **NO**

11.2 Was consent given for a Post Mortem? ☐ **YES, FULL** ☐ **YES, LIMITED** ☐ **NO CONSENT**

11.2.1 If PM was limited what was consent given for?

☐ *MRI* ☐ *X-Ray* ☐ *Other, specify* _____

11.3 Was the placenta sent for histology? ☐ **YES** ☐ **NO**

11.4 Was this a Coroners' Case? ☐ **YES** ☐ **NO**

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SECTION 12. ANY OTHER RELEVANT DETAILS

SECTION 13. DETAILS OF PERSON WHO COMPLETED THE FORM *(personal information is not passed to central office)*

Name:

Positions:

Addresses:

Tel number/email address:

Date of notification: D D / M M / Y Y

SECTION 14. REGIONAL OFFICE USE ONLY

Please code the causes of death that were given and the clinically derived single main cause of death
(Refer to the coding sheet)

14.1 Cause of Death: Associated Maternal & Fetal Factors and Cause of Death - STILLBIRTH & NEONATES (section 9)

14.1.1 *Single* Main Cause

14.1.2 Other Cause(s) (no more than 3):

14.2 Cause of Death: Associated Neonatal Factors & Cause of Death – NEONATES ONLY (section 10)

14.2.1 *Single* Main Cause

14.2.2 Other Cause(s) (no more than 3):

14.3 Maternal death: ☐ YES ☐ NO

14.4 Was a copy of the Post Mortem report received? ☐ YES ☐ NO

If yes, was it a limited Post Mortem? ☐ MRI SCAN ☐ X-RAY ☐ OTHER LIMITED ☐ NO

If yes, was it a Coroners' Post Mortem? ☐ YES ☐ NO

14.5 Was a copy of the placental histology report received? ☐ YES ☐ NO

14.6 Was cause of death coding completed using a Placental Histology or Post Mortem?

☐ PLACENTAL HISTOLOGY ☐ POST MORTEM ☐ NO

Appendix C

Table C1
Adjusted live births, total births, stillbirths and neonatal death by nation; United Kingdom and the Crown Dependencies: 2009

	Live births[a]	Total births[a]	Stillbirths[a]	Early neonatal deaths[a]	Late neonatal deaths[a]
England	670,790	673,930	3,140	1,364	470
Northern Ireland	24,896	25,013	117	71	15
Scotland	58,836	59,150	314	119	45
Wales	34,930	35,086	156	76	25
Crown Dependencies	2,674	2,681	7	10	2

[a]Adjusted by removing terminations of pregnancy and babies born at less than 22 weeks' gestation

Sources: CMACE, ONS, NISRA, GRO and SSBID Survey

Appendix D

Table D1
Adjusted live births, total births, stillbirths and neonatal deaths by SHA; England: 2009

	Live births[a]	Total births[a]	Stillbirths[a]	Early neonatal deaths[a]	Late neonatal deaths[a]
East Midlands	53,720	54,002	282	113	35
East of England	71,295	71,603	308	130	44
London	129,216	129,834	618	275	93
North East	29,769	29,895	126	59	19
North West	87,506	87,910	404	174	69
South Central	51,962	52,180	218	95	25
South East Coast	51,677	51,875	198	85	28
South West	58,319	58,583	264	90	30
West Midlands	70,990	71,361	371	198	70
Yorkshire and the Humber	66,336	66,687	351	145	145

[a]Adjusted by removing termination of pregnancy and babies born at less than 22 weeks' gestation

Source: CMACE, ONS

Appendix E

Table E1
Adjusted live births, total births, stillbirths and neonatal deaths by Network; England: 2009

	Live births[a]	Total births[a]	Stillbirths[a]	Neonatal deaths[a]
Beds and Herts	19,671	19,759	88	55
Central	33,228	33,401	173	87
Central South Coast	30,658	30,786	128	59
Cheshire and Merseyside	29,579	29,707	128	88
Essex	19,782	19,860	78	22
Greater Manchester	37,383	37,552	169	104
Kent and Medway	20,781	20,878	97	31
Lancashire and South Cumbria	17,829	17,928	99	55
Norfolk, Suffolk and Cambridgeshire	28,959	29,087	128	68
North Central London	19,093	19,183	90	44
North East London and North Middlesex	32,477	32,653	176	97
North Trent	25,803	25,929	126	61
North West London	32,319	32,449	130	105
Northern	34,564	34,709	145	94
South Central North	29,484	29,612	128	76
South East London	27,040	27,198	158	92
South West London	20,702	20,790	88	53
South West Peninsula	17,365	17,441	76	32
Southern West Midlands	32,489	32,669	180	132
Staffordshire, Shropshire and Black Country	25,310	25,448	138	72
Surrey and Sussex	29,658	29,757	99	52
Trent	25,186	25,305	119	71
Western	32,031	32,180	149	70
Yorkshire	43,788	44,027	239	137

[a]Adjusted by removing termination of pregnancy and babies born at less than 22 weeks' gestation

Sources:CMACE

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