



Perinatal Mortality 2005

April 2007

England, Wales and Northern Ireland

CEMACH Mission statement

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

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The recommendations contained in this report represent the view of CEMACH, which was arrived at after a careful consideration of the available evidence. It does 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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CEMACH, Chiltern Court, 188 Baker Street, London, NW1 5SD
Tel: **0207 486 1191** Fax: **0207 486 6543**
Email: info@cemach.org.uk Website: www.cemach.org.uk

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Perinatal mortality is important. It is important to the individual mother, important in relation to the health of the public, and important for planning health services. Although the perinatal mortality rate remains low, this does not mean we should be complacent. Just over 1 in 200 pregnancies end in a stillbirth and around 1 in 300 babies die in the neonatal period, a devastating event for any parent. Not all these losses are preventable, but continuous surveillance of them is critical to identify trends and problem areas. Furthermore, mortality is but the tip of an iceberg of morbidity and these data can also orientate us with regard to major morbidity problems.

Thus these reports provide critical information relevant to all of us involved in maternity care. While the data can provide not only national but also regional, and, indeed, hospital-based figures, such data often pose more questions than answers. Indeed that is one of the objectives of such reports. Full interpretation requires information such as the demographics of the population served as well as issues with regard to standards of care.

There are important messages for the health of the public which impact on planning services. For example, a clear U-shaped association between maternal age and perinatal mortality is evident in the current data. Given the steadily increasing average maternal age in the United Kingdom, maintaining perinatal mortality at current rates may be a challenge in the years ahead. As expected, and, indeed, in line with maternal mortality data, there is also a clear association with both ethnicity and social deprivation. These are issues that cannot be addressed solely through specific maternity services, but require public health initiatives.

Perinatal mortality, although important, cannot be taken in isolation. From a maternity perspective, it is critical also to study maternal mortality in an integrated way. Often there are antecedents common to both maternal and perinatal outcomes. These may be general such as age, or disease-specific, such as pre-eclampsia or antepartum haemorrhage. Artificial separation of the maternal and perinatal components does not meet the needs of our maternity services where an integrated approach is required. Further, it is also critical to examine morbidity for both mothers and babies and to probe the many questions set by perinatal mortality surveillance and mortality enquiries. In view of this, CEMACH has reorganised and has combined so that in future, perinatal mortality surveillance, maternal mortality and morbidity will come together under the direction of The National Advisory Committee for Enquiries into Maternal and Perinatal Health. The future development of a combined annual report on both maternal and perinatal mortality, along with specific projects, relating to key morbidity topics relevant to both mothers and babies, is underway. Thus, the data from the perinatal mortality surveillance reported here will act as a springboard as CEMACH enters a new era with an integrated approach, not only to maternal and perinatal mortality, but, also, to morbidity.



Professor Ian Greer

Chairman of the CEMACH National Advisory Committee for Enquiries into Maternal and Perinatal Health
Professor of Obstetric Medicine and Dean, Hull York Medical School.

Acknowledgment

The CEMACH 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 finally advocate the implementation of recommendations into NHS Trusts' practice. CEMACH cannot thank enough the many clinicians and staff who continue to provide this support for our work.

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Definitions

- Late fetal loss** An in utero death delivered between 22⁺⁰ and 23⁺⁶ weeks gestation.
- Stillbirth** A baby delivered without life after 24 completed weeks of pregnancy.
- Early neonatal death** Death of a live born baby occurring less than 7 completed days from the time of birth.
- Late neonatal death** Death of a live born baby occurring after the 7th day and before 28 completed days from the time of birth.
- Stillbirth rate** Number of stillbirths per 1000 live births and stillbirths.
- Perinatal mortality rate (UK)** Number of stillbirths and early neonatal deaths per 1000 live births and stillbirths.
- Perinatal mortality rate (WHO)** Number of late fetal losses, stillbirths and early neonatal deaths per 1000 live births and stillbirths.
- Neonatal mortality rate** Number of neonatal deaths per 1000 live births.

- 1) Total births and deaths:** In 2005 in England, Wales and Northern Ireland there were 668,681 total live births notified to the Office for National Statistics (ONS) and 7225 death notifications to CEMACH: 1193 late fetal losses, 3676 stillbirths and 2356 neonatal deaths:
 - a. Stillbirth:** The stillbirth rate [95% Confidence Intervals (CI)] was 5.5/1000 [5.3-5.6] in 2005; the mean stillbirth rate during the period 2000-2004 was 5.6/1000.
 - b. Neonatal deaths:** The neonatal mortality rate was 3.5/1000 [3.4-3.7] in 2005; the mean neonatal mortality rate during the period 2000-2004 was 3.7/1000. The early neonatal mortality rate in 2005 was 2.7 /1000 [2.6 - 2.8] and late neonatal mortality 0.8/1000, 95% CI [0.7 - 0.9].
 - c. Perinatal deaths:** The perinatal mortality was 8.2/1000 [8.0-8.4] in 2005; the mean perinatal mortality rate between 2000 and 2004 was 8.4/1000.
- 2) International comparison for stillbirth and neonatal mortality rate using the International Federation of Gynaecology and Obstetrics (FIGO) classification system (*fetus or newborn with no congenital anomalies and birth weight ≤ 1000g*):** The FIGO stillbirth rate for England, Wales and Northern Ireland was 3.1/1000 [2.8-3.5]. The neonatal mortality rate was 0.9/1000 [0.8-1.0] and the perinatal mortality rate was 3.8/1000 [3.5-4.1]. The lethal congenital anomaly rate was 1.8/1000 [1.7-1.8].
- 3) Singleton versus multiple births:** The singleton stillbirth rate was 5.1/1000 [4.9-5.2] and the neonatal mortality rate was 2.9/1000 [2.8-3.0]. The multiple stillbirth rate was 15.6/1000 [14.0-17.5] and the multiple neonatal mortality rate was 21.9/1000 [19.9-24.1]. The stillbirth rate in multiple pregnancies has declined steadily from 20.2 per 1000 in 2003 [95% CI 18.3-22.3] to 15.6 per 1000 in 2005 [95% CI 14.0-17.5], whereas the neonatal mortality rate for multiple births has increased slightly by 1.0/1000.
- 4) Geographical, NHS Trust and neonatal network variations:** There were variations in the crude mortality rate according to the region of residence in England using the new NHS Strategic Health Authorities, produced in 2006. There were also variations between NHS Trusts and between neonatal networks. Variations between Trusts should not be interpreted as direct indicators of the quality of care. Other factors may influence rates such as differences in the way data is reported from individual trusts (11% of notified neonatal deaths were between 17 and 22 weeks gestation), socio-demographic characteristics of the population or the case mix or referral pattern of an individual trust. Crude mortality for neonatal networks should not need to be adjusted for case mix, as each network should deal with all levels of complexity. Variation may, however, be linked to the socio demographic characteristics of the population served.
- 5) Maternal risk factors:**
 - a. Maternal age:** mothers aged less than 20 and above 40 had the highest rates of stillbirth (6.6 and 7.5 per 1000 respectively) and the highest rates of neonatal deaths (4.7 and 4.0 per 1000 live births respectively).
 - b. Obesity:** there was a high proportion (30%) of stillbirths or neonatal deaths amongst mothers with a body mass index > 30. These data must be interpreted with caution in the absence of available national denominator data.

-
- c. **Social deprivation:** over one third of all stillbirths and neonatal deaths were born to mothers resident in the most deprived quintile (calculated using the Index for Multiple Deprivation (IMD) score, 2004, a measure of deprivation at the small area level). Social deprivation-specific mortality rates were calculated for England using ONS data. Compared with rates in the least deprived area, mothers resident in the most deprived area had a 2 fold increase in stillbirth and neonatal mortality rates.
 - d. **Ethnicity:** ethnic-specific mortality rates were crudely estimated using information collected in England as part of the maternity record of the Hospital Episode Statistics (HES). There were significantly higher stillbirth and neonatal mortality rates for women of black ethnicity (1.9 and 2.2 times higher respectively) and Asian ethnicity (1.5 and 1.6 times higher respectively) when compared with those for women of white ethnicity.

6) Neonatal risk factors:

- a. **Birth weight:** Most deaths occurred for babies weighing < 1500g (stillbirth and neonatal mortality rates were 261/1000 and 369/1000 respectively for babies weighing <1000g).
- b. **Gestational age:** Almost three quarters (74%) of neonatal deaths and two-thirds (65%) of stillbirths were born preterm. Gestation-specific mortality rates were crudely estimated using information on gestational age collected in England as part of the maternity record of the Hospital Episode Statistics (HES). 58% of babies born at 24 weeks gestation survived the neonatal period increasing to 77% at 25 weeks' gestation. This is an increase compared to observations of a decade ago (43% and 59% respectively). Similarly, survival at 27-28 weeks' gestation was 92% an increase of 4% in comparison to national data from 1998-2000. The Epicure 2 study should provide further precise information on the neonatal survival rates of very preterm babies.

7) Causes of death:

- a. **Stillbirths:** the main identifiable causes of stillbirths were: severe/lethal congenital anomalies (16%), antepartum haemorrhage (8%) and intrapartum cause (7%). Over 50% of stillbirths remain unexplained using the current classification systems.
- b. **Neonatal deaths:** the main identifiable causes of neonatal deaths were: immaturity (48%), lethal/severe congenital anomalies (22%) and intrapartum causes (9%).

A revision of the perinatal mortality classification system used in this report will take place in 2007 and will be implemented in 2008 with the aim of enhancing the value of future CEMACH perinatal mortality surveillance reports.

- 8) **Post mortem examination:** Post-mortem examination uptake has declined from 58% of all deaths in 1993 to 39% (45% of stillbirths and 29% of neonatal deaths) in 2005. There were marked regional variations in examination uptake (27%-51%) and variations according to the cause of death. Parents declined permission in 36% of cases and medical staff did not request the examination in 19%.

- 9) Neonatal deaths of intrapartum origin at term:** The neonatal mortality rate for term babies who died from intrapartum asphyxia was 0.2/1000. Unexplained cause of death in term babies with birth weight > 2500g was by far the most represented category (55%). Explained causes mainly related to acute and mechanical conditions during labour (over one third). A pre-existing maternal disorder was present in less than 10% of cases.
- 10) Stillbirth and neonatal deaths during deliveries at home:** Out of 16737 home deliveries in England, Wales and Northern Ireland in 2005, there were 119 notified deaths. However, the vast majority of these were not planned home births: over half intended to deliver at a hospital and over one quarter were unbooked pregnancies. Four stillbirths and nine neonatal deaths occurred in planned home births and four of these were related to an intrapartum cause. The lack of national denominator data for planned home births precluded the calculation of a mortality rate.

1 Introduction



The United Kingdom has provided for many years a lead in the study of population statistics around the time of birth. The National Health Insurance Medical Research Committee, which was founded in 1913 and became the Medical Research Council, published a number of reports on the subject¹. In the 1970s, there were a number of local, regional and national studies applying the method to stillbirths and neonatal deaths². This activity developed further in the 1980s and the National Perinatal Epidemiology Unit in Oxford maintained an archive of local surveys and enquiries. In 1992, the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) was established to “improve the understanding of how the risks of deaths in late fetal life and infancy might be reduced”^{3,2}. In parallel, there has been reporting of the results of confidential enquiries into the much rarer maternal deaths. This started in 1928 and was reorganised in 1952 with the publication of triennial reports¹. This Confidential Enquiry into Maternal Deaths was merged with CESDI in 2002 to form the Confidential Enquiry into Maternal and Child Health (CEMACH).

CEMACH provides surveillance of maternal and perinatal deaths and is able to produce national, regional and Trust-specific reports from the same data system. CEMACH collects basic data on all perinatal deaths using a specific notification form, the Perinatal Death Notification (PDN) and conducts confidential enquiries and other in-depth analyses of defined subsets. This national report describes the results of CEMACH’s perinatal mortality surveillance activity for 2005.

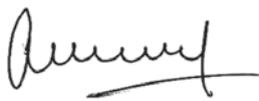
CEMACH’s first perinatal mortality surveillance report covered the years 2000-2003. In the surveillance report for 2004, CEMACH expanded this to provide an analysis of emerging issues and for the first time compared each NHS Trust’s crude mortality rates to the national average using a “funnel chart”, which allowed for the identification of “outliers”. This benchmarking of hospitals using crude analysis is a first step in the development of a fully informed comparison of NHS Trust-level perinatal mortality rates.

The surveillance report for 2005 provides a more detailed and “user-friendly” epidemiological description of national perinatal deaths, aimed at all involved directly in the care of mothers and babies. In addition to the ongoing surveillance reported in 2004, this year’s report describes more fully:

- mortality by neonatal networks
- term intrapartum deaths
- perinatal deaths and deliveries occurring at home including planned home births.

The CEMACH perinatal mortality surveillance system is an integral part of its confidential enquiry programme. Continuing and developing the enquiry's perinatal mortality surveillance serves a number of purposes relevant to its objectives:

- it will monitor changes in the rates, causes and risk factors associated with perinatal mortality
- it will help to identify topics where it may be beneficial to carry out further more detailed studies
- it can provide cases for detailed study in a full confidential enquiry and data for other studies
- it can assist hospital Trusts, neonatal networks, primary care Trusts and strategic health authorities monitor their performance.



Dr Dominique Acolet, editor

Clinical Director (Perinatal Epidemiology) CEMACH

Consultant in Neonatal Neurology, Queen Charlotte's and Chelsea Hospital, Hammersmith Hospitals NHS Trust

2 Methodology

2.1 Data sources

Since 2003, the Confidential Enquiry into Maternal and Child Health (CEMACH) has collected epidemiological and clinical information on:

- All fetuses delivering after 22 completed weeks of gestation (including legal terminations of pregnancy notifiable under the 1967/1992 Abortion Act)
- All babies with a birth weight \geq 400g if the gestation at delivery is unknown
- All registrable live births dying before 28 completed days of life.

For this purpose, CEMACH uses its Perinatal Death Notification (PDN) form. The 2005 PDN form can be seen in Appendix A.

A network of local health professionals, who are coordinated by the CEMACH regional offices, collect these data. Every maternity unit within England, Wales and Northern Ireland has a CEMACH coordinator who notifies the CEMACH regional office of any deaths within the age range collected. These data are supplemented by death notifications from child health systems and local congenital anomaly registers. This multiple source reporting leads to a very high level of ascertainment of deaths. In addition to notifying deaths, units also return denominator information, including the total number of live births and other unit-based data used in this report.

CEMACH collects mortality data by place of death but reports by mother's residence within the NHS Strategic Health Authorities (SHAs). SHAs merged in 2006 to be coterminous with CEMACH regions, except for the South East for which there are two SHAs; the 2006 SHAs have been used in this 2005 report.

2.2 Data validation and cleaning

Data are compiled centrally and cross-validated with registration data on stillbirths and neonatal deaths from the Office for National Statistics (ONS). Data cleaning is then performed in two stages at CEMACH's Central Office to ensure minimisation of errors. This process includes: a) identifying systematic errors of coding or errors in data entry and b) detecting cases that may have been duplicated within a region or across regions.

2.3 Data reporting and analysis

Data are reported on the 2005 birth cohort based on date of delivery and including deaths during the neonatal period in 2006 of babies who were born in 2005. Mortality rates displayed in the funnel plots are based on place of delivery. The response rate for questions on the PDN form varied from 67% to 100% and missing/not known responses are given for each table. Denominator data on all live births were obtained from the Office for National Statistics (ONS) for England and Wales using ONS Vital Statistics (VS) and Health Statistics Quarterly (HSQ)^{4,5}, General Registrar's Office (GRO)⁶ and Child Health System (CHS) for Northern Ireland and National Community Child Health Database, maintained by Health Solutions Wales (NCCHD) for Wales. Additional information for England was obtained from an extension to the core dataset of Hospital Episode Statistics (HES) called the "maternity tail"⁷. These data sources are referenced throughout the report. Data are presented as rates when denominators are known, and otherwise as percentages, excluding 'missing' or 'not known' values. Figures, including pie/bar charts, funnel and scatter

plots are used to illustrate relationships between data items.

Data were analysed using statistical computer software STATA 8. Measures of central tendency such as the mean and median were calculated for some variables and presented when appropriate. Bivariate analysis was used to explore relationships between variables and these are presented in the form of contingency tables.

2.4 Classification of stillbirths and neonatal deaths

The cause of death for stillbirths is currently classified using the Extended Wigglesworth classification⁸ supplemented by the Obstetric (Aberdeen) classification⁹ and the fetal and neonatal classification¹⁰ recorded on the PDN forms. Details of these classification systems can be found at www.cemach.org.uk/pdn_classifications.htm. The cause of neonatal deaths is classified according to the Extended Wigglesworth, supplemented by Fetal & Infant and Obstetric (Aberdeen) Classifications recorded on the PDN forms.

CEMACH regularly receive post mortem reports from hospital pathologists for all cases matching CEMACH criteria. Additionally, some regional managers have established contact with coroners who provide them with a list of perinatal cases from their system according to CEMACH reporting criteria, adding the cause of death. These reports were used to validate and confirm the cause of death suspected at the time the death was reported. Some reports were also received for cases that were not already notified to CEMACH and were used as new notifications.

2.5 Additional methodology

2.5.1 Ethnicity

Information on maternal ethnicity has been collected in England, as part of the “maternity tail” of the Hospital Episodes Statistics (HES), since 1995⁷. Coverage of maternal ethnicity remains incomplete, 75% of all birth records having a stated ethnicity for the period 2004-05⁷. Comparison of deliveries recorded on HES and census information on women with children less than one year of age suggested that if deliveries with ethnic group not stated were included with those where ethnic group was stated to be White, the distribution of deliveries in HES broadly approximated that expected from census information. Accordingly, for 2004-05, the distribution of ethnicity of maternities in England was approximately as follows: White 77.8%, Black (aggregate of Black African, Black Caribbean and Black Other) 4.6%, Asian (aggregate of Indian, Pakistani and Bangladeshi) 8.3%, Chinese 0.4% and Mixed & Other 3.4% and Not known 6% (personal communication, Information Centre for Health & Social Care, Nov. 2006). Applying these proportions to the total number of live births in England for 2005 gives an estimated breakdown of live births as shown in Table 8.

2.5.2 Deprivation

Classification of deprivation was derived from the Index of Multiple Deprivation (IMD) score 2004¹¹ and uses the overall indicator. This is based on the postcode of residence and the corresponding Super Output Area (SOA) as defined by the 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. As these scores were based on the mothers, not babies, for multiple pregnancies only first born babies were assigned a deprivation score, to avoid double counting. Rates were calculated using ONS 2005 data on all maternities by IMD deprivation quintiles in England, excluding those whose usual residence was outside England.

3 Stillbirth, Perinatal and Neonatal mortality rate 2005

3.1 Stillbirths and neonatal deaths 2005

In 2005, 7225 deaths were notified to CEMACH through maternity units in England, Wales and Northern Ireland. Of these notifications, 1193 were late fetal losses, 3676 stillbirths and 2356 neonatal deaths. The perinatal mortality rate was 8.2 per 1000 total births and the neonatal mortality rate was 3.5 (Table 1). The perinatal mortality rate was a little higher than the 2005 published rate for Scotland (7.7, 95% CI [7.02-8.51]). The neonatal mortality was identical¹².

Table 1
Summary mortality rates, England, Wales and Northern Ireland, 2005

	Number	Rate [95% CI]
Total live births	668,681	..
Late fetal loss	1,193	..
Stillbirth ^a	3,676	5.5 [5.3, 5.6]
Perinatal death (UK) ^a	5,496	8.2 [8, 8.4]
Perinatal death (WHO) ^a	6,689	9.9 [9.7, 10.1]
Neonatal death ^b	2,356	3.5 [3.4, 3.7]
Early Neonatal death	1,820	2.7 [2.6, 2.8]
Late Neonatal death	536	0.8 [0.7, 0.9]

^a Rate per 1000 total births

Sources: CEMACH PDN 2005 & 2006

^b Rate per 1000 live births

ONS 2005, NI GRO 2005

3.2 Trends in stillbirth and neonatal mortality

Table 2 shows mortality trends between 2000 and 2004. Following an increase in the stillbirth rate in 2002 (from 5.4 in 2001 to 5.7 in 2002), the rate remained unchanged in 2003 (5.8) and in 2004 (5.7). In 2005, the stillbirth rate was 5.5 per 1000 (more than one in every 200 babies born) and the perinatal mortality rate was 8.2 (Table 1). These rates were lower than in the previous three years. Nevertheless, the stillbirth rate in 2005 was similar to the rate in 1992 when the change in registration of stillbirths from 28 weeks of gestation to 24 weeks of gestation occurred¹³. The neonatal mortality rate at 3.5 per 1000 live births in 2005 was similar to that of the previous year (3.4 per 1000 live births in 2004).

Table 2
Stillbirth and neonatal death trends, England, Wales and Northern Ireland, 2000-04

	2000		2001		2002		2003		2004	
	Number	Rate [95% CI]	Number	Rate [95% CI]	Number	Rate [95% CI]	Number	Rate [95% CI]	Number	Rate [95% CI]
Total live births	625,642	..	616,322	..	617,299	..	642,899	..	662,039	..
Late fetal loss	2,668	..	2,608	..	2,674	..	2,764	..	1,102	..
Stillbirths ^a	3,366	5.4 [5.2, 5.6]	3,320	5.4 [5.2, 5.6]	3,542	5.7 [5.5, 5.9]	3,730	5.8 [5.6, 6.0]	3,791	5.7 [5.5, 5.9]
Neonatal deaths ^b	2,436	3.9 [3.7, 4.0]	2,250	3.7 [3.6, 3.9]	2,214	3.6 [3.5, 3.8]	2,350	3.7 [3.6, 3.9]	2,257	3.4 [3.3, 3.5]
Perinatal deaths (UK) ^a	5,220	8.3 [8.1, 8.5]	5,023	8.1 [7.9, 8.3]	5,257	8.5 [8.2, 8.7]	5,564	8.6 [8.4, 8.8]	5,562	8.4 [8.2, 8.6]
Perinatal death (WHO) ^a	7,888	12.5 [12.2, 12.8]	7,631	12.3 [12.0, 12.6]	7,931	12.8 [12.5, 13.1]	8,328	12.9 [12.6, 13.2]	6,664	10 [9.8, 10.2]

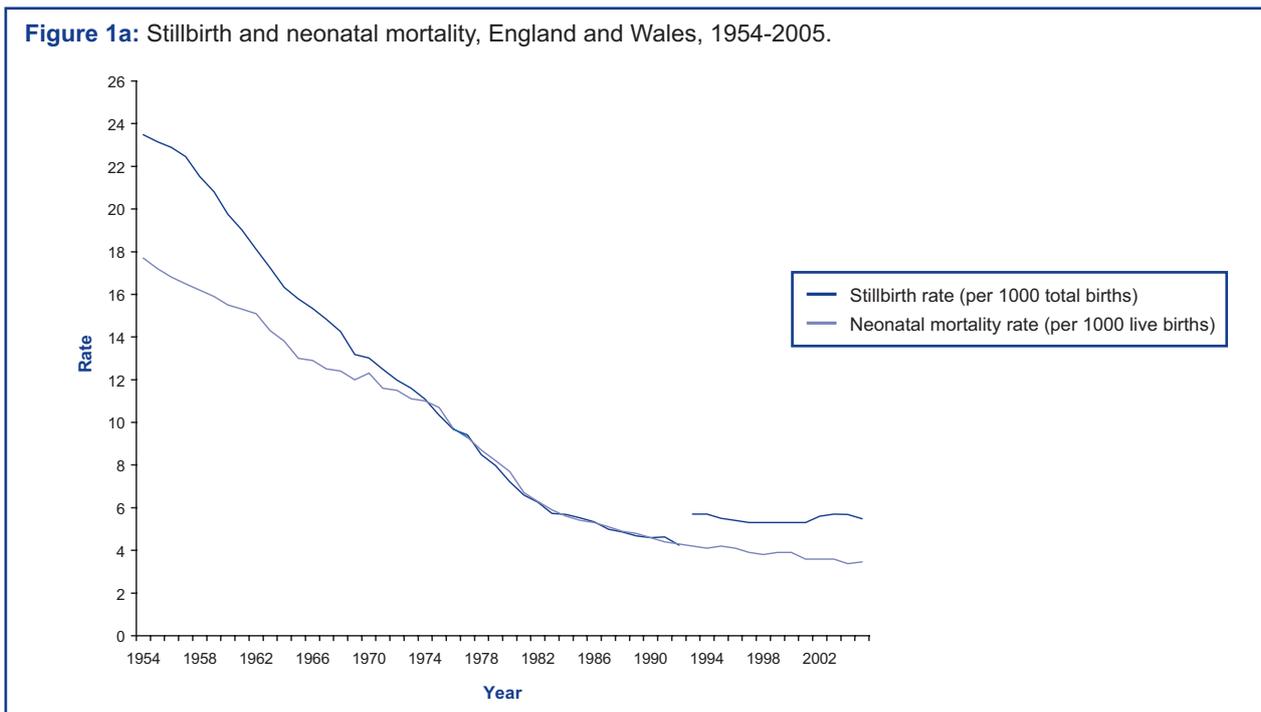
^a Rate per 1000 total births

Sources: CEMACH PDN 2000-2005

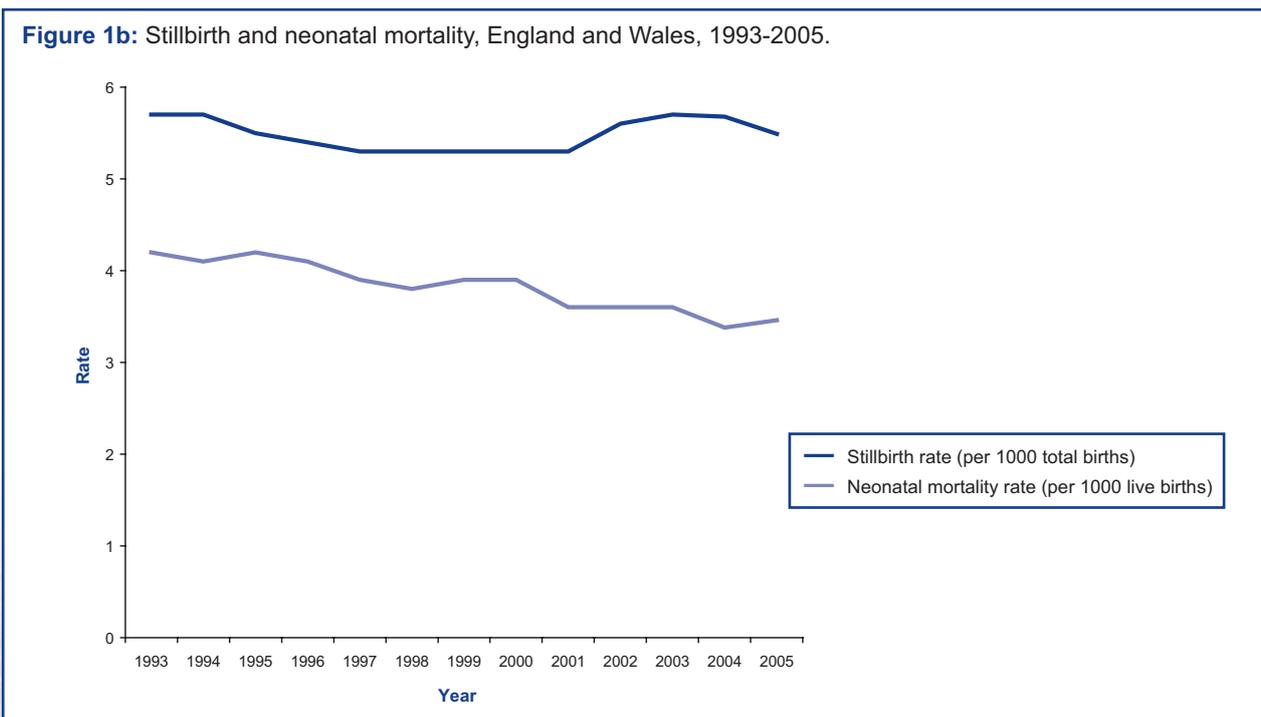
^b Rate per 1000 live births

ONS 2005, NI GRO 2005

Figure 1a shows the trend in rates of stillbirths and neonatal deaths since 1954. From 1954 until the mid 1990s, stillbirth and neonatal death rates in England and Wales fell steadily. In 1954, the stillbirth rate was 23 per 1000 total births and the neonatal mortality rate was 18 per 1000 live births. In 1997, the stillbirth rate had reduced to 5.3 per 1000 total births and the neonatal mortality rate was 3.9 per 1000 live births. Figure 1b shows that since 1992 the stillbirth rate has remained largely unchanged while the neonatal mortality rate has declined significantly (Cochran-Armitage test for linear trends $p < 0.001$). This lack of progress in reducing the stillbirth rate is a matter of public health concern.



Sources: ONS and CEMACH



Sources: ONS and CEMACH

In 2004, the Royal College of Obstetricians and Gynaecologists (RCOG) published guidance stating that a baby born without any sign of life after 24 completed weeks of pregnancy and known to have died before 24 completed weeks did not require registration as a stillbirth¹⁴. In order to examine the effect this may have on registration statistics, CEMACH collected information based on all births according to the previous definition, but additionally asked for the gestation at which death was confirmed. This allowed CEMACH to calculate stillbirth and perinatal mortality rates according to both definitions. The data showed that 81 stillbirths (i.e. delivering at 24+0 weeks gestation onwards) did not require registration under the new RCOG guidelines. This led to a decrease of 0.1 per 1000 total live births in the stillbirth rate [95% confidence intervals] from 5.5 [5.3-5.6] to 5.4 [5.2-5.5]. Interpretation of stillbirth rates over time using registration statistics need to consider the effect of this new definition.

3.3 International comparison for stillbirth and neonatal mortality rate

To produce internationally comparable stillbirth and neonatal death rates we used the International Federation of Gynaecology and Obstetrics (FIGO) classification¹⁵. This classification derives a rate for 'normally formed' fetuses and newborn babies by removing those with lethal malformations, to facilitate the evaluation of the effectiveness of perinatal care. It also derives a rate for fetuses and newborn babies weighing more than 1000g to allow international comparison¹⁵. The FIGO rates were then calculated by dividing the FIGO numbers by the total number of births in the case of stillbirths or total number of live births in the case of neonatal deaths. For 2005, the crude FIGO stillbirth rate for England and Wales was 3.1 per 1000 total births in comparison to the general stillbirth rate at 5.5 per 1000 total births. The FIGO neonatal death rate was 0.9 per 1000 live births in comparison to 3.5 per 1000 live births. The FIGO perinatal mortality rate was 3.8 per 1000 live births versus 8.2 per 1000 live births (Table 3). These figures were comparable to those cited in the 2005 report for Scotland (Table 3) although the lethal malformation rate was slightly higher than the data for Scotland¹².

Table 3

Stillbirth and neonatal mortality using FIGO classification, England, Wales and Northern Ireland, 2005

	England and Wales	Scotland
Registered births	668,681	54,678
Less than 500g		
Total	1,356	..
Stillbirth	331	17
Early neonatal deaths	399	14
Late neonatal deaths	20	1
500g or over		
Total	5,555	..
Stillbirth	3,230	274
Early neonatal deaths	1,350	113
Late neonatal deaths	493	52
Of which lethal malformation		
Total	1,190	..
Stillbirth	498	39
Early neonatal deaths	336	38
Late neonatal deaths	120	14
1000g or over		
Total	3,431	..
Stillbirth	2,380	200
Early neonatal deaths	739	70
Late neonatal deaths	292	28
Of which lethal malformation		
Total	716	..
Stillbirth	290	28
Early neonatal deaths	302	31
Late neonatal deaths	114	13
	Rate [95% CI]	Rate [95% CI]
Excluding all births <500g		
Major malformation rate ^a	1.8 [1.7, 1.8]	1.7
Stillbirth rate ^a	2.0 [1.9, 2.1]	5.0
Neonatal death rate ^b	2.8 [2.6, 2.9]	3.0
Perinatal mortality rate ^a	6.8 [6.2, 7.4]	7.1
Excluding all major malformation and other births <500g		
Stillbirth rate ^a	4.1 [3.7, 4.4]	4.3
Neonatal death rate ^b	2.1 [1.9, 2.3]	2.1
Perinatal mortality rate ^a	5.6 [5.2, 6.0]	5.7
Excluding all births <1000g		
Stillbirth rate ^a	3.6 [3.4, 3.7]	3.7
Neonatal death rate ^b	1.5 [1.5, 1.6]	1.8
Perinatal mortality rate ^a	4.6 [4.5, 4.8]	5.0
Excluding all major malformation and other births <1000g (FIGO "preventable" stillbirths & neonatal deaths)		
Stillbirth rate ^a	3.1 [2.8, 3.5]	3.2 [2.7, 3.7]
Neonatal death rate ^b	0.9 [0.8, 1.0]	1.0 [0.7, 1.3]
Perinatal mortality rate ^a	3.8 [3.5, 4.1]	3.9 [3.4, 4.4]

^a Rate per 1000 total births^b Rate per 1000 live births

Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI GRO 2005, Scottish Perinatal and Infant Mortality and Morbidity Report 2005

Note: Total number of live births has been obtained from ONS and Northern Ireland General Registrar Office.

3.4 Stillbirth and neonatal mortality in singleton and multiple births

Multiple births are at greater risk of an adverse perinatal outcome compared to singleton births¹⁶. Table 4 shows the trend of stillbirth and neonatal mortality rates by plurality between the years 2003 and 2005. The stillbirth rate in multiple pregnancies has declined steadily from 20.2 per 1000 in 2003 [95% confidence interval 18.3-22.3] to 15.6 per 1000 in 2005 [95% confidence interval 14.0-17.5]. By contrast, the 2005 neonatal death rate increased slightly for multiple births by 1.0 per 1000 live births. The stillbirth rate for multiple births was three times than for singleton births. An even greater disparity was seen for neonatal deaths, with the neonatal mortality rate for multiple births being 7.6 times that for singleton births.

Table 4

Stillbirth and neonatal deaths by multiplicity, England, Wales and Northern Ireland, 2003-2005

	2003		2004		2005	
	Number	Rate [95%CI]	Number	Rate [95%CI]	Number	Rate [95% CI]
Total live births	642,899	..	662,039	..	668,708	..
Singleton	624,228	..	642,596	..	649,105	..
Multiple	18,671	..	19,443	..	19,603	..
Stillbirth^a	3,730	5.8 [5.6, 6.0]	3,791	5.7 [5.5, 5.9]	3,676	5.5 [5.3, 5.6]
Singleton	3,331	5.3 [5.1, 5.5]	3,436	5.3 [5.1, 5.5]	3,303	5.1 [4.9, 5.2]
Multiple	384	20.2 [18.3, 22.3]	339	17.1 [15.4, 19.1]	311	15.6 [14.0, 17.5]
Unknown	15	..	16	..	62	..
Neonatal death^b	2,350	3.7 [3.6, 3.9]	2,257	3.4 [3.3, 3.6]	2,356	3.5 [3.4, 3.7]
Singleton	1,933	3.1 [3.0, 3.2]	1,841	2.9 [2.7, 3.0]	1,878	2.9 [2.8, 3.0]
Multiple	391	20.9 [18.9, 23.1]	390	20.1 [18.2, 22.2]	429	21.9 [19.9, 24.1]
Unknown	26	..	26	..	49	..

^a Rate per 1000 total births

Sources: CEMACH PDN 2005 & 2006

^b Rate per 1000 live births

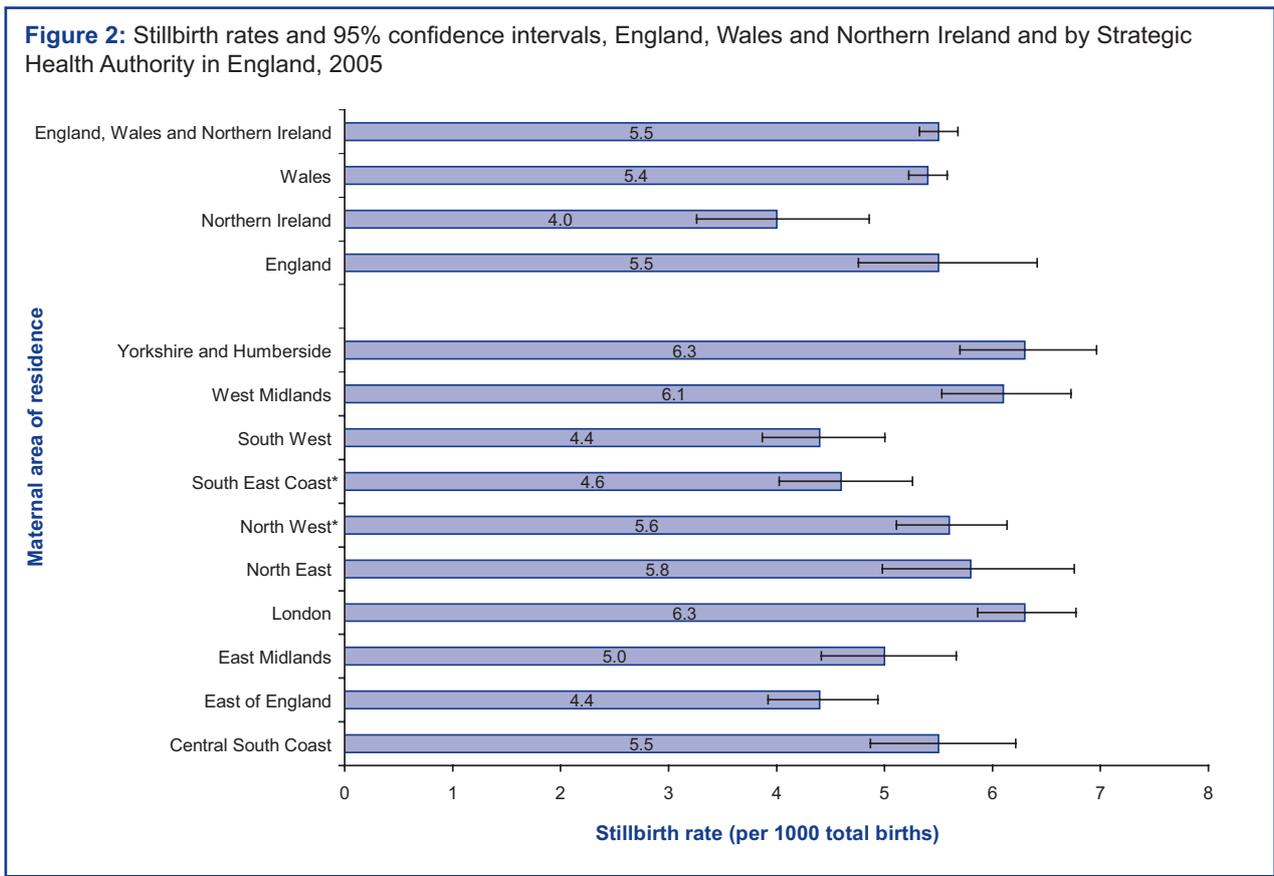
ONS 2005, NI CHS 2005

Note: Total number of live births by multiplicity has been obtained from ONS and Northern Ireland Child Health System. There are 30 cases recorded by NI Child Health System and not by NI General Registrar Office, hence the increase in number of total live births for the year 2005 when compared to earlier tables in this report.

3.5 Variation in stillbirth and neonatal mortality rates by mother’s region of residence

Using the postcode of the mother’s residential address, stillbirth and neonatal mortality rates are presented by NHS Strategic Health Authority boundaries as applied during 2006 for England (Figures 2 & 3). Data used to create these figures are shown in Appendix B.

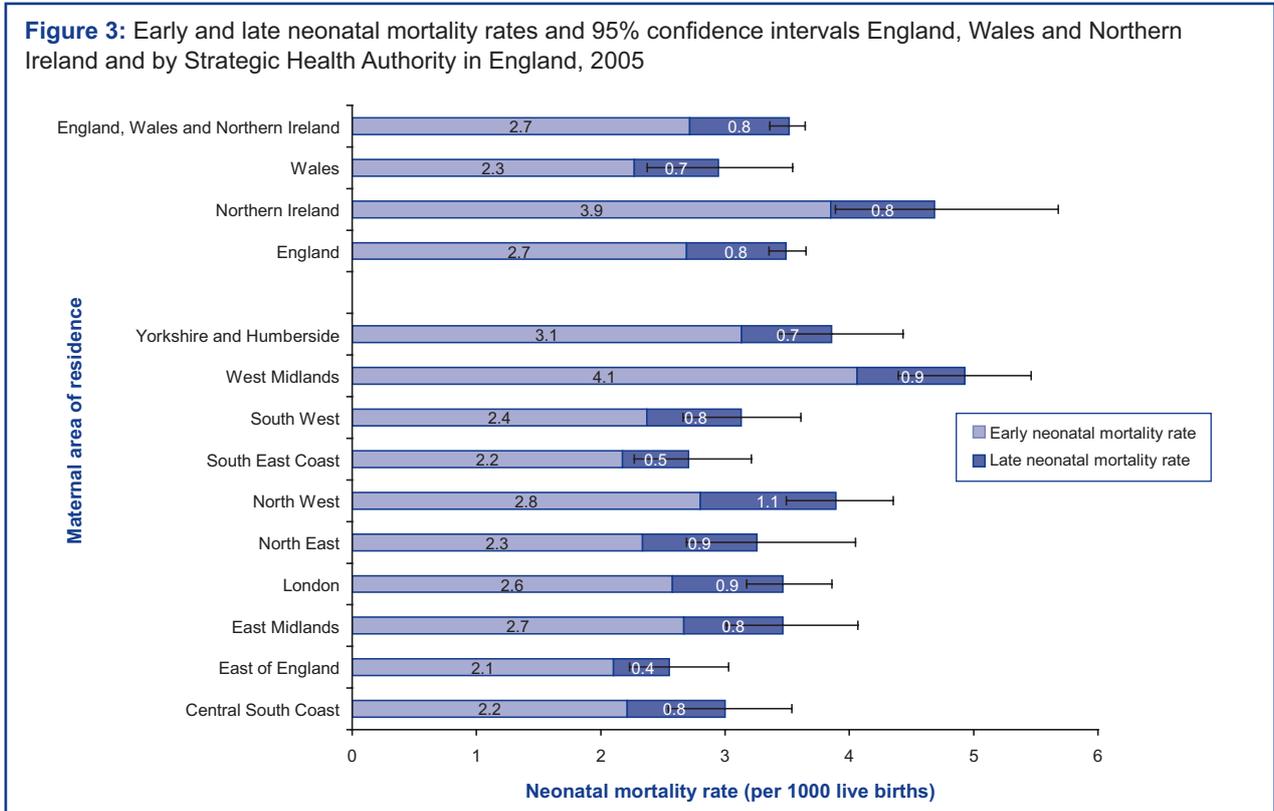
The crude stillbirth rates in London and Yorkshire and Humberside (6.3 per 1000 total births) were higher than that observed in any other part of England, Wales and Northern Ireland (Figure 2). The stillbirth rates in the East and South West of England, East Midlands and the South East Coast were lower than that of the population of England, Wales and Northern Ireland as a whole.



Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI GRO 2005

*Note: The North West region includes figures for the Isle of Man and the South East Coast includes cases from the Channel Islands.

Figure 3 shows that the highest crude neonatal mortality rate was in the West Midlands (5 per 1000) and the lowest was in the East of England (2.5 per 1000). The early neonatal death rate also ranged from 4.1 in the West Midlands to 2.1 in the East of England. The East of England also had the lowest late neonatal mortality rate at 0.4 per 1000 live births, whereas the highest late neonatal mortality rate of 1.1 per 1000 live births was in the North West.



Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI GRO 2005

These mortality rates are crude measures of mortality and have not been adjusted in any way. They should not be interpreted as direct indicators of the quality of care. Other factors may influence outcomes such as: a) differences in the way neonatal deaths are reported; b) social and demographic factors; and c) random variation¹. These issues may explain in part the high stillbirth rate in some regions known to have greater social deprivation and differences in ethnicity. The higher neonatal mortality rate in the West Midlands may be due in part to a high proportion of reporting early neonatal deaths < 22 weeks gestation¹⁸. CEMACH hopes to explore obtaining appropriate data on live births to allow adjustments for mortality by region in the future.

3.6 Stillbirth and neonatal mortality by NHS Trust and neonatal networks

3.6.1 By NHS Trust

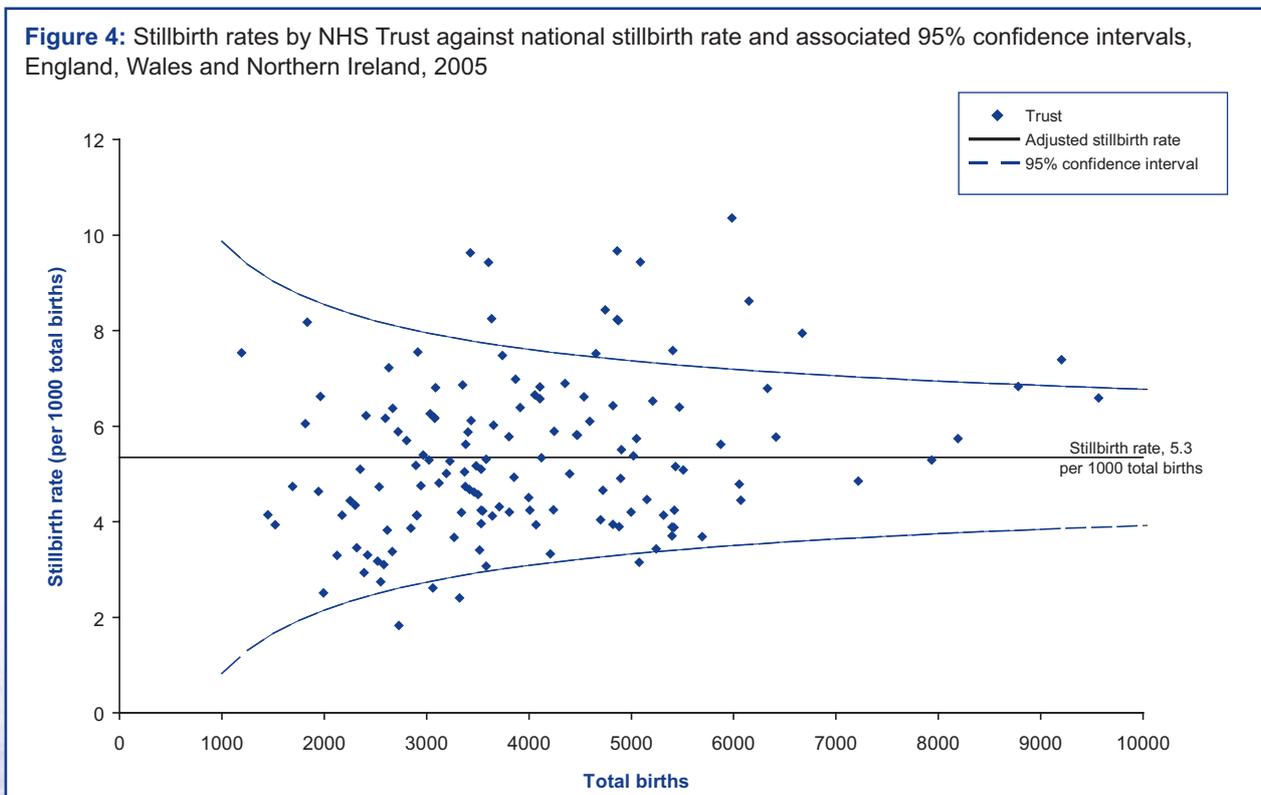
Stillbirth and neonatal mortality rates for NHS Trusts with 1000 or more live births and 5 or more deaths in 2005 are presented in Figures 4 and 5. These figures, known as funnel plots, show each individual Trust's mortality rate plotted against the total number of births in that Trust, the average mortality rate (solid line) and associated 95% confidence intervals (thin dotted lines). Each marker represents one Trust. If a Trust lies within the 95% confidence limits, it has a crude mortality rate that is statistically consistent with the average rate. If a trust or neonatal network lies outside the 95% confidence limits, then it has a crude rate that is significantly different from the average rate. The further the point is outside the confidence limits,

the more likely the rate is to be different from the national average. However, care should be taken in the interpretation of these figures as the data that are displayed are crude mortality rates. In particular, they should not be interpreted as direct indicators of quality of care. Other factors may influence rates such as differences in the way data is reported from individual trusts, socio-demographic characteristics of the population or the case mix or referral pattern of an individual trust.

Regarding the way data is reported from individual trusts, we found that 11% of the notified neonatal deaths had a gestation between 17 and 22 weeks. Adjustments for these cases will be carried out in the future and would allow a reduction in the variation between regions¹⁸ and would be a better evaluation of neonatal care.

From 2005, CEMACH collected data on the intended as well as the actual place of delivery and place of death. Future regional reports and individual Trust reports will use these new data. These reports will therefore start to address the question of case mix by adjusting for transfer of mothers and babies between hospitals due to medical or other reasons. In addition, from 2006 onwards, CEMACH will present Trust mortality data by type of provider such as level of neonatal unit. This will allow organisations to compare their mortality rates with other organisations with similar facilities. Regarding, for example, neonatal mortality, the UK neonatal staffing study²¹ reported that “crude mortality rates were significantly higher in high volume neonatal units but that following risk-adjustment, the observed mortality by patient volume was not significantly different to that expected given the illness severity of their populations”. It is one of the aims of the annual CEMACH mortality surveillance system to follow these principles to give feedback to individual Trusts in the context of their region and network.

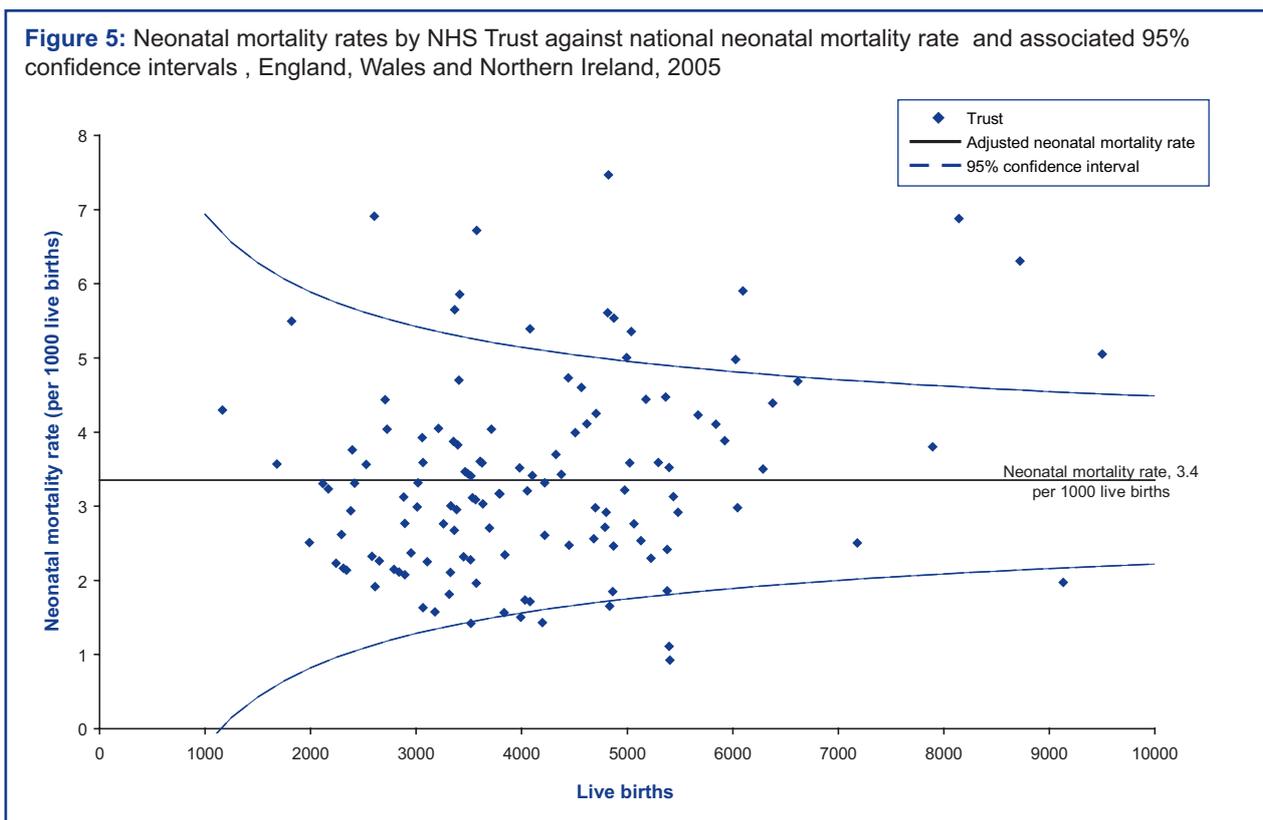
Case mix or chance do not entirely explain variations in outcome²². Information about clinical variables that can predict the severity of the illness of each individual baby may be required to determine the expected number of deaths at each unit for future comparisons.



Sources: CEMACH PDN 2005

Note: Due to the high variance in rates calculated using events numbering less than five, data presented in the graph are for trusts with 1000 or more live births and 5 or more deaths in 2005. The national stillbirth rate has been adjusted accordingly.

Figure 5: Neonatal mortality rates by NHS Trust against national neonatal mortality rate and associated 95% confidence intervals, England, Wales and Northern Ireland, 2005

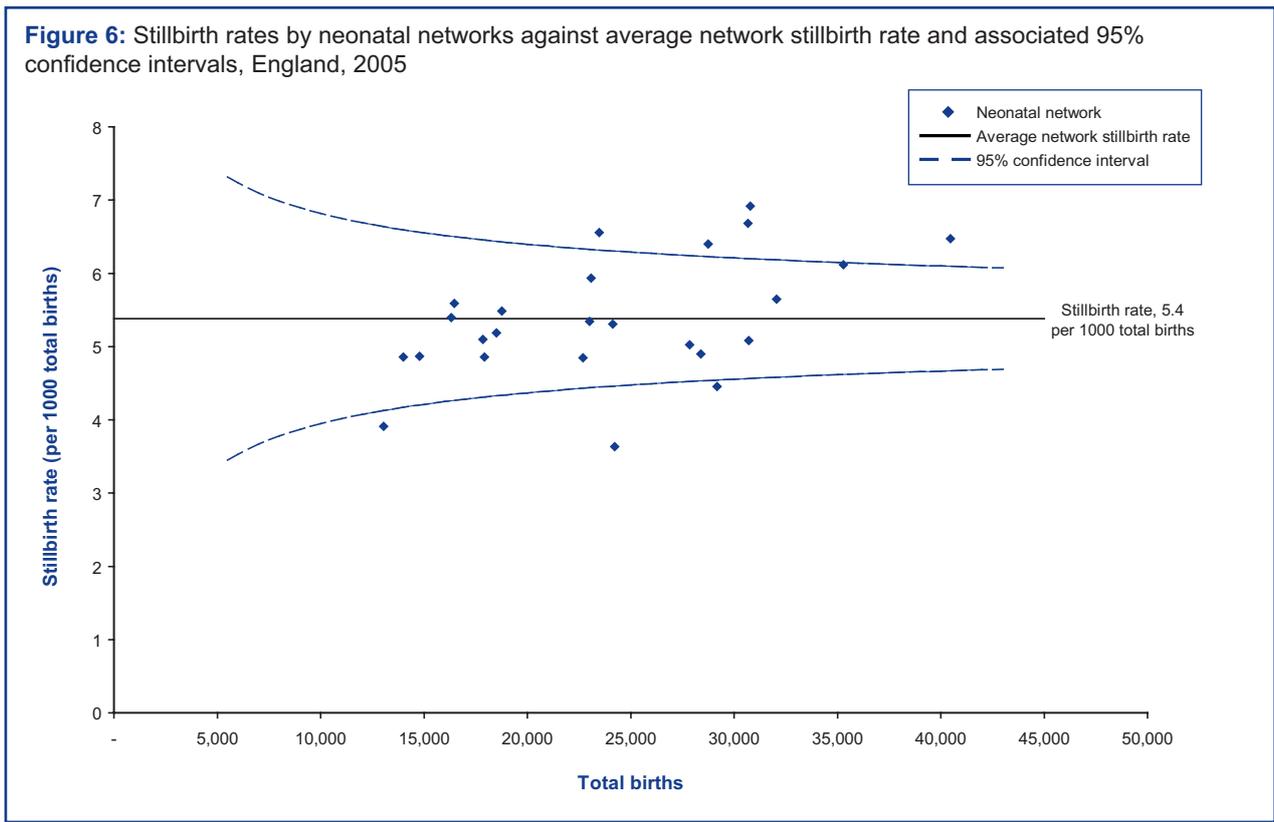


Sources: CEMACH PDN 2005 & 2006

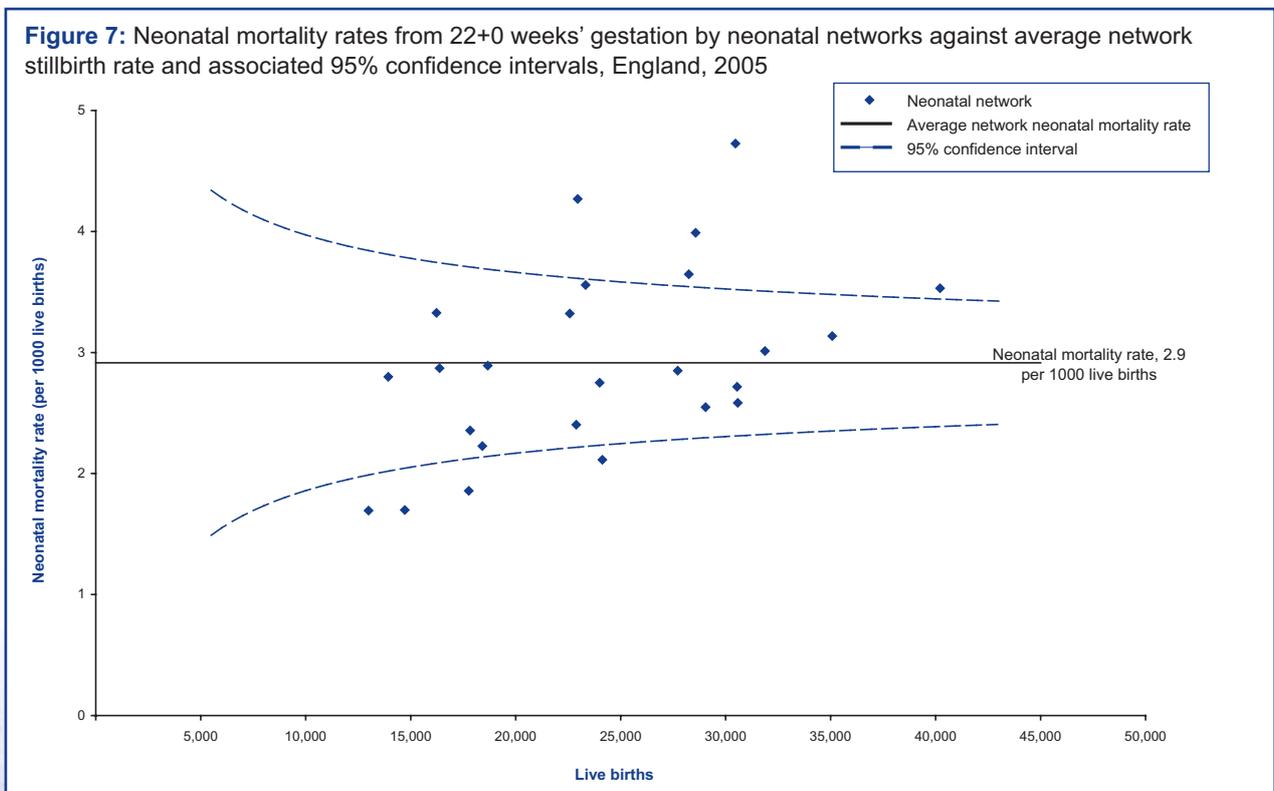
Note: Due to the high variance in rates calculated using events numbering less than five, data presented in the graph are for trusts with 1000 or more live births and 5 or more deaths occurring in the Trust during 2005. The national neonatal mortality rate has been adjusted accordingly.

3.6.2 By neonatal networks in England

The UK neonatal staffing study 2000²¹ indicated that “infants in the UK have an equal chance of survival irrespective of the type of unit in which they were born”. The study also concluded that “transfer arrangements suggest that hierarchical networks of care are already operating where infants are transferred to other larger or even tertiary units according to their illness severity”. However, a national project by the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) that looked at standards of care of premature babies at 27 and 28 weeks’ gestation, highlighted deficiencies in the organisation of national perinatal services^{23, 24}, including problems related to transfer arrangements. Managed clinical neonatal networks with different types of neonatal units, working together to deliver perinatal care to a defined geographical area with a shared referral pattern were implemented recently in England. These networks are still in their infancy and have never been audited before. Mortality by neonatal networks in England is reported for the first time as a baseline for future surveillance (Figures 6 and 7). Neonatal deaths notifications of < 22 weeks’ gestation have been removed to allow comparison between regions with different methods of reporting¹⁸. There were variations in crude perinatal mortality rates between the 25 neonatal networks recently established in England. Crude mortality for neonatal networks should not need to be adjusted for case mix, as each network should deal with all levels of complexity. Variation may, however, be linked to the socio demographic characteristics of the population served¹⁹.



Sources: CEMACH PDN 2005 & 2006



Sources: CEMACH PDN 2005 & 2006

Note: Data presented in figure 7 are for all neonatal deaths with gestational age of 22 weeks or more.

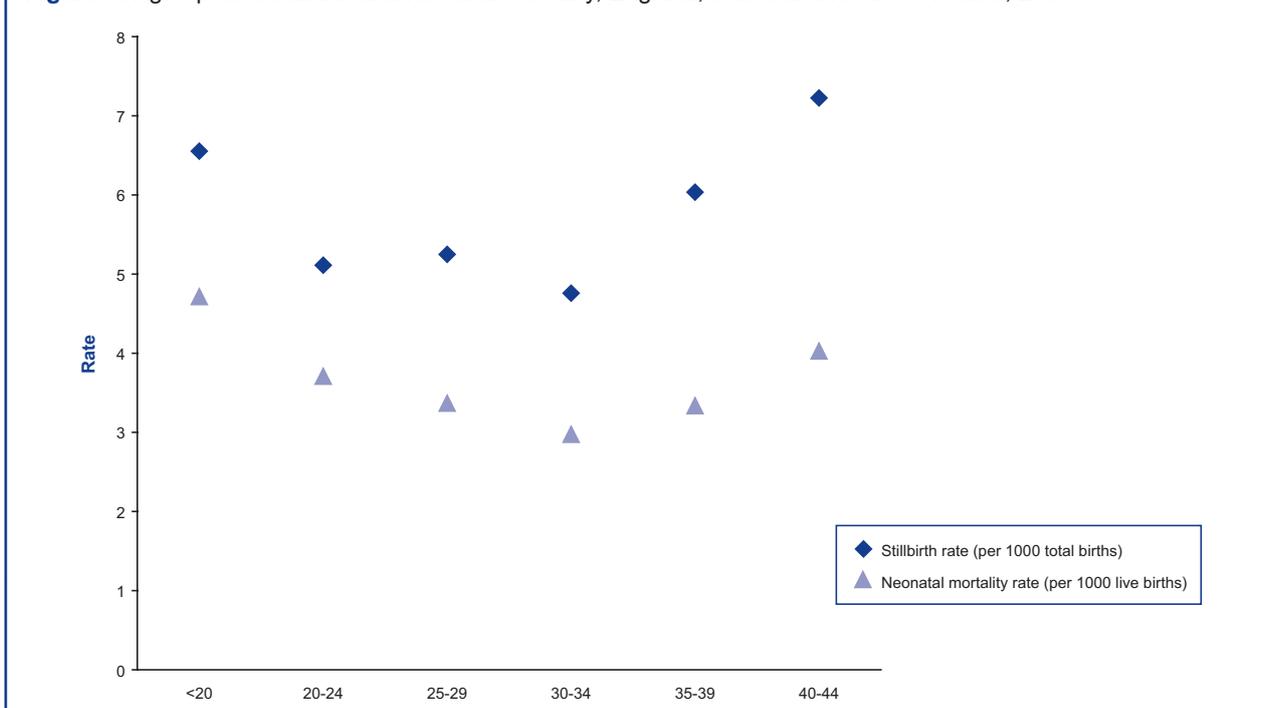
4 Maternal and neonatal risk factors for stillbirths and neonatal deaths

4.1 Maternal risk factors

4.1.1 Maternal age

During 2005, the youngest mother with a perinatal death was aged 12 and the oldest was 49. The median maternal age was 29, interquartile range IQR [24-34]. The effect of maternal age on perinatal deaths is described by a U-shaped curve with highest deaths rate in very young and older mothers, although the highest neonatal mortality rate is for babies with mothers in their teens²⁵ (Figure 8). The percentage of livebirths in mothers over 40 years old almost doubled from 1.8% in 1995 to 3.4% in 2005. Given the steadily increasing average maternal age in the UK maintaining perinatal mortality at current rates may be a challenge in the years ahead. Appendix C shows that mothers aged less than 20 and above 40 had the highest rates of stillbirth (6.6 and 7.2 per 1000 total births respectively) and the highest rates of neonatal deaths (4.7 and 4.0 per 1000 live births respectively). The lowest stillbirth and neonatal mortality rates were observed in the 30 to 34 years category (3 per 1000 total births) (Figure 8 and Appendix C). These are nevertheless crude data that are not adjusted for factors that may influence these results such as the possible effect of social deprivation for very young mothers.

Figure 8: Age-specific stillbirth and neonatal mortality, England, Wales and Northern Ireland, 2005



Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI CHS 2005

4.1.2 Maternal body mass index (BMI)

The Health Survey for England Department of Health report, “Forecasting obesity in 2010” <http://www.dh.gov.uk/PublicationsAndStatistics/PublishedSurvey/HealthSurveyForEngland/fs/en> observed that 23% of women over the age of 16 were obese (BMI > 30) in 2003. In CEMACH’s 2005 data, the proportion of mothers (excluding missing values) having a stillbirth or a neonatal death who were obese was similar and around 30% (Table 5). Unfortunately, there are no national denominator data available for mortality amongst obese pregnant women that would allow information that is more definitive. Nevertheless, these findings are in keeping with the increasing incidence of maternal obesity (9.9% to 16% between 1990 and 2004) described in Middlesbrough, UK²⁶.

Table 5

Percentage distribution of stillbirths and neonatal deaths by mother’s BMI, England, Wales and Northern Ireland, 2005

Body Mass Index categories	Late fetal loss		Stillbirths		Neonatal deaths	
	Number	%	Number	%	Number	%
Total	1,193	100.0	3,676	100.0	2,356	100.0
<18.5	35	4.0	58	2.2	48	3.5
18.5-24.9	411	47.5	1,044	39.8	599	44.1
25-29.9	222	25.6	724	27.6	296	21.8
30+	198	22.9	798	30.4	415	30.6
Missing	327	..	1,052	..	998	..

Sources: CEMACH 2005 & 2006

4.1.3 Social deprivation

The relationship between perinatal deaths and social deprivation was explored by the application of the Index of Multiple Deprivation (IMD) score 2004¹¹, a measure of deprivation at the small area level (see Methodology chapter, section 2.5.2). Over one third of all stillbirths and neonatal deaths were born to mothers resident in the most deprived quintile (compared with the expected 20%). Social deprivation-specific mortality rates were calculated for England using maternity denominators from ONS. Stillbirth and neonatal mortality rates for mothers resident in the most deprived area were 1.8 and 2.2 times higher when compared with rates in the least deprived area (Table 6). This appears to substantiate previous work showing that deprivation is associated with adverse perinatal outcome²⁷. For future reports, CEMACH proposes looking at individual level occupation and social class data by linkage with registration data collected by the ONS for England and Wales and the Northern Ireland GRO.

Table 6
Stillbirths and neonatal mortality rates by quintiles of deprivation, England, 2005

	Live births		Stillbirths		Neonatal deaths		
		Number	Rate ^a	Rate ratio ^c [95% CI]	Number	Rate ^b	Rate ratio ^c [95% CI]
Total	607,090	3,064	..	..	1,726	..	..
1 (least deprived)	167,684	345	3.5	..	171	1.7	..
2	129,918	421	4.2	1.2 [1, 1.4]	224	2.2	1.3 [1.1, 1.6]
3	109,868	531	4.8	1.4 [1.2, 1.6]	277	2.5	1.5 [1.2, 1.8]
4	100,815	714	5.5	1.6 [1.4, 1.8]	404	3.1	1.8 [1.5, 2.2]
5 (most deprived)	98,805	1,040	6.2	1.8 [1.6, 2]	640	3.8	2.2 [1.9, 2.6]
Missing	..	13	..	..	10	..	..

^a Rate per 1000 total births

Sources: CEMACH PDN 2005 & 2006

^b Rate per 1000 live births

ONS 2005

^c Rate ratio using least deprived as baseline

Note: second or subsequent deaths from pregnancies with multiple losses excluded from this table.

4.1.4 Ethnicity

CEMACH collected self-reported maternal ethnicity in order to explore the association between ethnicity and perinatal death. The breakdown of maternal ethnicity for all reported stillbirths and neonatal deaths is shown in Table 7.

	Stillbirths		Early neonatal deaths		Late neonatal deaths	
	Number	%	Number	%	Number	%
Total	3,676	100.0	1,820	100.0	536	100.0
White	2,560	72.1	1,303	75.1	355	71.1
Black African	219	6.2	82	4.7	19	3.8
Black Caribbean	89	2.5	58	3.3	25	5.0
Black other	27	0.8	9	0.5	4	0.8
Indian	143	4.0	63	3.6	16	3.2
Pakistani	262	7.4	114	6.6	38	7.6
Bangladeshi	58	1.6	13	0.7	6	1.2
Chinese	11	0.3	8	0.5	3	0.6
Mixed	45	1.3	22	1.3	5	1.0
Other	139	3.9	63	3.6	28	5.6
Not known	65	..	61	..	22	..
Missing	58	..	24	..	15	..

Sources: CEMACH PDN 2005 & 2006

The calculation of ethnic-specific mortality rates is hindered by the fact that neither registration statistics for England and Wales nor those for Northern Ireland collect information on maternal ethnicity. We have attempted to estimate rates using the information on maternal ethnicity collected in England as part of the maternity tail of the Hospital Episodes Statistics (HSE)⁷ as described in the Methodology chapter. There are limitations with doing this, for example, coverage of maternal ethnicity on HES is incomplete with only 75% of all birth records having a stated ethnicity for the period 2004-05 (Department of Health, NHS Maternity Statistics, England, 2004-2005). The resulting rates should therefore be considered as an approximation only. Within the limits of the methodology used, estimated maternal ethnic-specific mortality rates (Table 8) show significantly higher stillbirth rates and neonatal mortality rates for women of Black ethnicity (1.9 and 2.2 times higher respectively), Asian ethnicity (1.5 and 1.6 times higher respectively) when compared with those for women of White ethnicity.

Table 8
Stillbirth and neonatal mortality rates by ethnicity, England, 2005

	Live births		Stillbirths		Neonatal deaths		
	Number	Number	Rate ^b	Rate Ratio ^d [95% CI]	Number	Rate ^c	Rate Ratio ^d [95% CI]
Total	613,028	3,390	..	..	2,149	..	..
White	476,900 ^a	2,302	4.8	..	1,476	3.1	..
Black	28,200 ^a	331	11.6	1.9 [1.7, 2.1]	192	6.8	2.2 [1.9, 2.6]
Black Caribbean	7,200 ^a	89	12.2	2 [1.6, 2.5]	82	11.4	3.6 [2.9, 4.5]
Black African	15,600 ^a	215	13.6	2.3 [2, 2.6]	99	6.3	2 [1.6, 2.5]
Any other black	5,500 ^a	27	4.9	0.8 [0.5, 1.2]	11	2.0	0.6 [0.3, 1.1]
Asian	50,800 ^a	455	8.9	1.5 [1.4, 1.7]	246	4.8	1.6 [1.4, 1.8]
Indian	14,400 ^a	140	9.6	1.6 [1.3, 1.9]	77	5.3	1.7 [1.4, 2.1]
Pakistani	21,100 ^a	257	12.0	2 [1.8, 2.3]	150	7.1	2.3 [1.9, 2.7]
Bangladeshi	8,200 ^a	58	7.0	1.2 [0.9, 1.6]	19	2.3	0.7 [0.4, 1.1]
Chinese	2,400 ^a	10	4.1	0.7 [0.4, 1.3]	10	4.2	1.3 [0.7, 2.4]
Other & mixed origin	18,400 ^a	177	9.5	1.6 [1.4, 1.9]	119	6.5	2.1 [1.7, 2.5]
Not known	36,500 ^a	58	..	..	69	..	..
Missing	..	57	..	..	37	..	..

^a Estimated distribution according to maternity HES

^b Rate per 1000 total births

^c Rate per 1000 live births

^d Rate ratio using White ethnicity as baseline

Sources: CEMACH PDN 2005 & 2006
Maternity HES 2004-2005, ONS 2005

4.2 Neonatal risk factors

4.2.1 Baby's birth weight

Table 9 shows the distribution of all live births, stillbirths and neonatal deaths according to birth weight for England, Wales and Northern Ireland. Over two-thirds of all stillbirths and nearly 75% of all neonatal deaths had a birth weight of less than 2500g compared with only 7.5% of all live births in England, Wales and Northern Ireland. The neonatal mortality rate for babies with birth weight <1500g was 174 per 1000 live births and 369 per 1000 live births for babies <1000g; this was comparable to data previously published by the ONS in 2001 (173 and 361 respectively)¹.

Table 9

Birth weight specific stillbirth and neonatal mortality rates, England, Wales and Northern Ireland, 2005

Birth weight (g)	Live births	Number		Rate	
	Number	Stillbirths	Neonatal deaths	Stillbirth ^a	Neonatal death ^b
Total	668,497	3,676	2,356	5.5	3.5
<1000	3,337	1,181	1,231	261	369
1000-1499	4,956	459	208	85	42
1500-1999	10,194	379	135	36	13
2000-2499	31,616	409	152	13	4.8
2500-2999	112,391	435	196	3.9	1.7
3000-3499	237,681	408	180	1.7	0.8
3500-3999	191,545	198	116	1.0	0.6
4000+	74,533	92	44	1.2	0.6
Not known	2,241	115	94	..	..

^a Rate per 1000 total births

Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI CHS 2005

^b Rate per 1000 live births

Table 10 shows the mortality rates for singleton and multiple births in each birth weight category.

Table 10 Birth weight specific mortality rates for singleton and multiple births, England, Wales and Northern Ireland, 2005										
Birth weight (g)	Number						Rate			
	Livebirths		Stillbirths		Neonatal deaths		Stillbirth ^a		Neonatal death ^b	
	s	m	s	m	s	m	s	m	s	m
Total	649,105	19,603	3,303	373	1,878	478	5.1	18.7	2.9	24.4
<1000	2,616	734	1,016	165	902	326	280	184	345	444
1000-1499	3,603	1,366	418	40	164	44	104	28	46	32
1500-1999	7,196	3,012	351	28	112	23	47	9.2	16	7.6
2000-2499	25,861	5,772	377	32	143	9	14	5.5	5.5	1.6
2500-2999	106,196	6,226	425	8	184	10	4.0	1.3	1.7	1.6
3000-3499	235,606	2,149	402	6	178	1	1.7	2.8	0.8	0.5
3500-3999	191,329	252	194	3	112	1	1.0	11.8	0.6	4.0
4000+	74,529	17	92	-	44	-	1.2	-	0.6	-
Not known	2,169	75	28	29	39	15	..	..	..	..
Missing	..	-	-	62	-	49	..	..	..	..

s=singleton

m=multiple

^a Rate per 1000 total births

^b Rate per 1000 live births

Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI CHS 2005

4.2.2 Gestational age

As expected, death rates decrease dramatically with increasing gestational age and just under three-quarters (74%) of neonatal deaths and two-thirds (65%) of stillbirths were born preterm (Tables 11 and 12). To calculate the rates in Tables 11 and 12 below we used estimates of deliveries by gestational week produced by The Information Centre, Community Health Statistics, which produces statistical bulletins with information derived from the Maternity Hospital Episode Statistics (HES)⁷. To calculate estimates, HES uses percentages that are based on records with data. These are grossed up to the known total number of deliveries registered in the year.

From these tables the survival rate at the lower end of gestation for comparison with previous national studies can be derived. Estimated rates for <24 weeks' gestation have not been calculated because of the imprecision of the estimation. 58% of babies born at 24 weeks' gestation survived the neonatal period increasing to 77% at 25 weeks' gestation, a marked increase compared to observations of a decade ago (respectively 43% and 59%)²⁸. Similarly, survival at 27-28 weeks' gestation was 92%. This has increased by 4% in comparison to national data from 1998-2000²³. Within the limitations of these estimated gestation-specific mortality rates at the lowest gestational ages, these data suggest an improvement in survival of very premature babies over recent years in UK. The 2006 Epicure2 data collection will give precise outcome data under 27 weeks' gestation in England.

Table 11

Estimated gestation-specific stillbirth and neonatal mortality rates, England, Wales and Northern Ireland, 2005

Gestation (weeks)	Number			Rate	
	Live births ^a	Stillbirths	Neonatal deaths	Stillbirth ^b	Neonatal death ^c
Total	638,504	3,676	2,356	5.7	3.7
<24	600	-	655	-	..
24	600	324	254	351	423
25	600	246	139	291	232
26	800	215	124	212	155
27	900	204	73	185	81
28	1,000	166	80	142	80
29	1,200	141	50	105	42
30	1,400	147	46	95	33
31	1,900	125	51	62	27
32	2,600	145	43	53	17
33	3,600	153	44	41	12
34	5,900	149	53	25	9.0
35	9,000	184	53	20	5.9
36	17,000	205	71	12	4.2
37	35,900	218	79	6.0	2.2
38	87,600	238	123	2.7	1.4
39	136,900	236	116	1.7	0.8
40	181,900	246	123	1.4	0.7
41	121,300	214	97	1.8	0.8
42	23,300	26	16	1.1	0.7
>42	4,500	3	2	0.7	0.4
Not known	200	91	64	..	..

^a Number of live births by gestation is an estimate for England, Wales and Northern Ireland obtained from Maternity HES, NCCHD and NI CHS. This explains the inflated stillbirth and neonatal rates in this table.

^b Rate per 1000 total births

^c Rate per 1000 live births

Sources: CEMACH PDN 2005 & 2006 HES 2004-05, NNHD 2005, NI CHS 2005

Table 12

Estimated gestation-specific stillbirth and neonatal mortality rates by gestational age groups for England, Wales and Northern Ireland, 2005

	Number			Rate	
	Live births ^a	Stillbirths	Neonatal deaths	Stillbirth ^b	Neonatal death ^c
Total	638,504	3,676	2,356	5.7	3.7
<24	600	-	655	-	..
24-27	2,900	989	590	254	203
28-31	5,500	579	227	95	41
32-36	38,100	836	264	21	6.9
37-41	563,600	1,152	538	2.0	1.0
42+	27,800	29	18	1.0	0.6
Not known	200	91	64	..	..

^a Number of live births by gestation is an estimate for England, Wales and Northern Ireland obtained from Maternity HES, NCCHD and NI CHS. This explains the inflated in total stillbirth and neonatal rates in this table.

^b Rate per 1000 total births

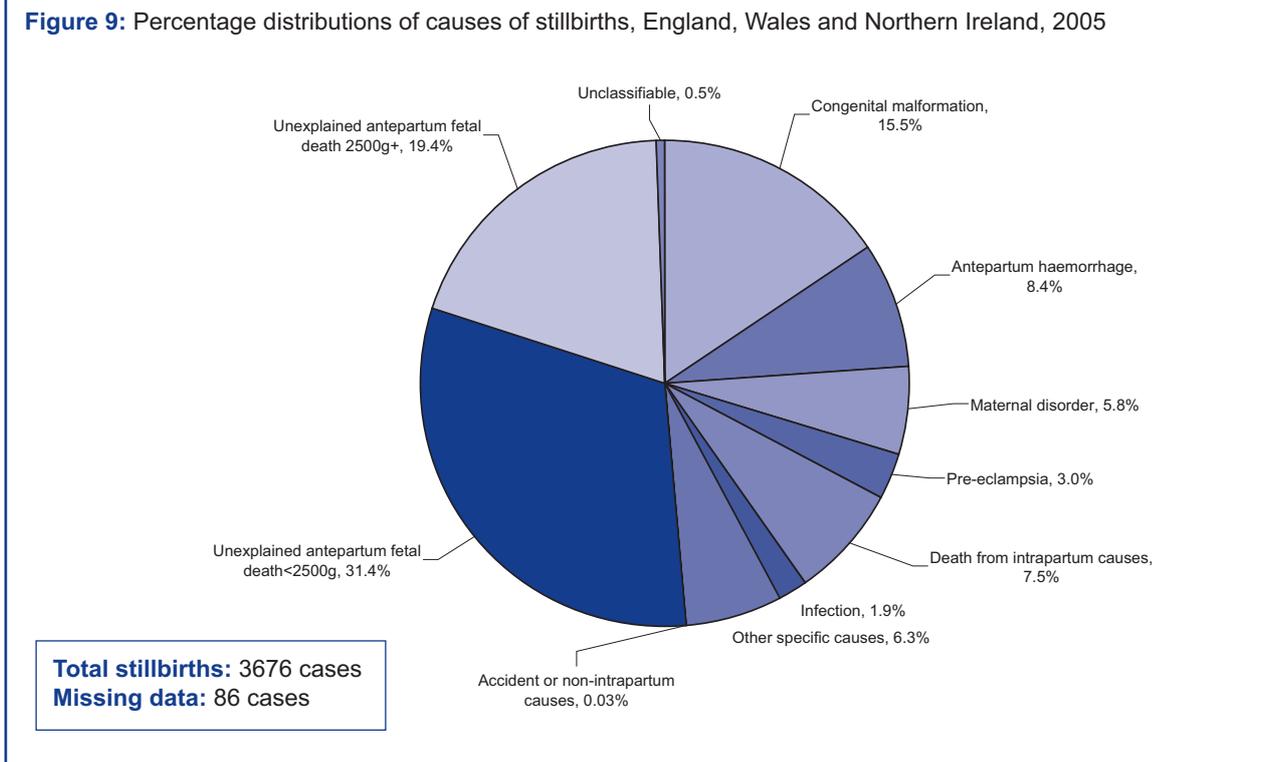
^c Rate per 1000 live births

Sources: CEMACH PDN 2005 & 2006
HES 2004-05, NCCHD 2005, NI CHS 2005

5 Cause of Death for Stillbirths and Neonatal deaths

5.1 Causes of stillbirths

Figure 9 shows the cause of death of all stillbirths. The largest identifiable groups are deaths due to: a) severe/lethal congenital anomalies (accounting for 16% of all stillbirths); b) antepartum haemorrhage (8%) and c) intrapartum causes (8%). Over 50% of stillbirths remain unexplained using the current classification systems. The corresponding cause-specific rates can be seen in Table 13.



Sources: CEMACH PDN 2005 & 2006

Table 13

Cause-specific stillbirth rates, England, Wales and Northern Ireland, 2005

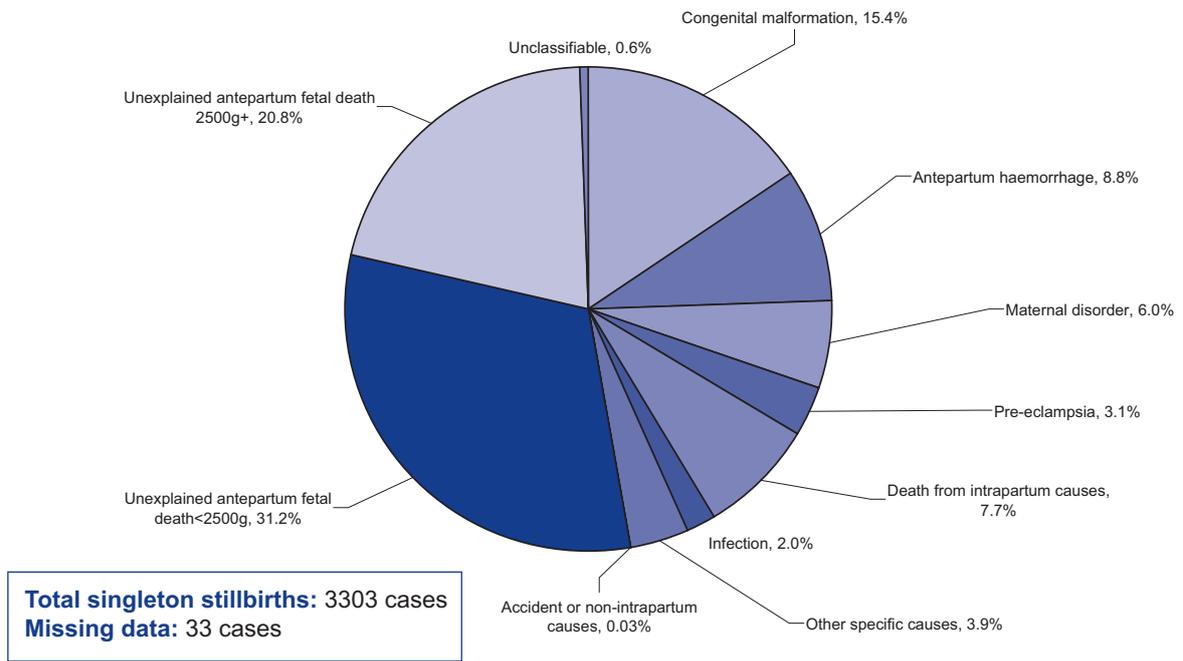
	Numbers			Rate ^a	
	Antepartum	Intrapartum	Timing unknown	Antepartum	Intrapartum
Total	3,179	320	91	4.7	0.5
Congenital malformation	485	35	38	0.7	0.1
Antepartum haemorrhage	299	-	1	0.4	-
Maternal disorder	206	-	1	0.3	-
Pre-eclampsia	106	1	-	0.2	0.0
Death from intrapartum causes	-	260	8	-	0.4
Infection	50	14	5	0.1	0.0
Other specific causes	208	9	10	0.3	0.0
Accident or non-intrapartum causes	1	-	-	0.0	-
Unexplained antepartum fetal death <2500g	1,123	-	6	1.7	-
Unexplained antepartum fetal death 2500g+	682	1	6	1.0	0.0
Unclassifiable	11	-	12	0.0	-
Not known	8	-	4	..	..

^a Rate per 1000 total births

Sources: CEMACH PDN 2005, 2006, ONS 2005, NI GRO 2005

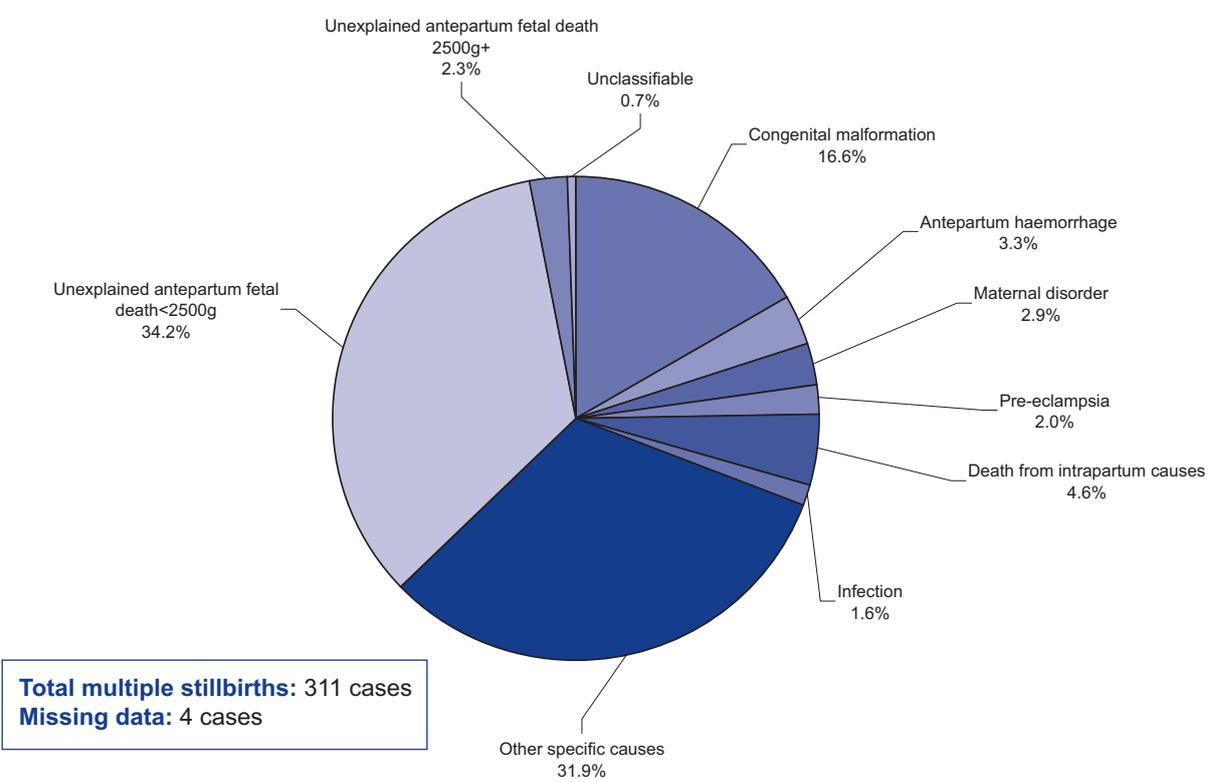
Figures 10 and 11 show the percentage distribution of causes of stillbirths according to singleton and multiple births. The two salient differences between singleton and multiple are: a) a reduction in unexplained antepartum fetal deaths above 2500g from 21% in singleton stillbirths to 2% in multiple stillbirths and b) an increase in “other specific causes” from 4% to 32%.

Figure 10: Percentage distributions of causes of singleton stillbirths, England, Wales and Northern Ireland, 2005



Sources: CEMACH PDN 2005 & 2006

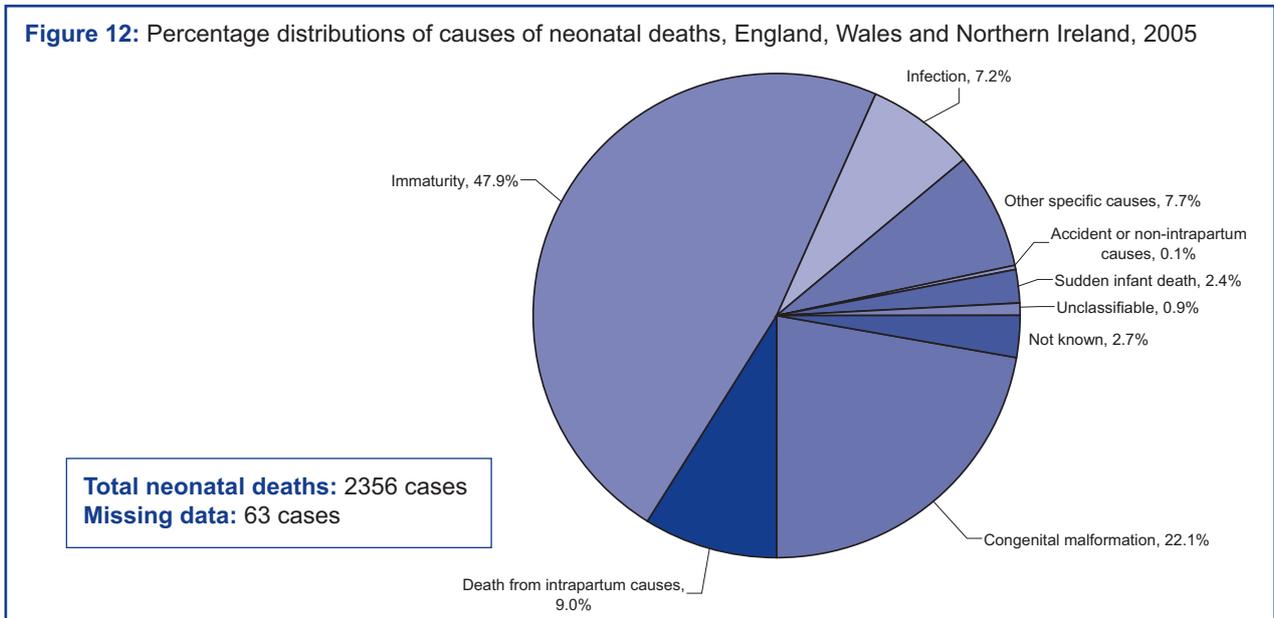
Figure 11: Percentage distributions of causes of multiple stillbirths, England, Wales and Northern Ireland, 2005



Sources: CEMACH PDN 2005 & 2006

5.2 Causes of neonatal deaths

For 2005, the largest proportions of neonatal deaths were classified as: a) death due to immaturity (48%); b) lethal/severe congenital anomalies (22%) and c) death due to intrapartum causes (9%) (Figure 12). Cause-specific rates for all neonatal deaths are detailed in Table 14.



Sources: CEMACH PDN 2005 & 2006

Table 14

Cause-specific neonatal mortality rates, England, Wales and Northern Ireland, 2005

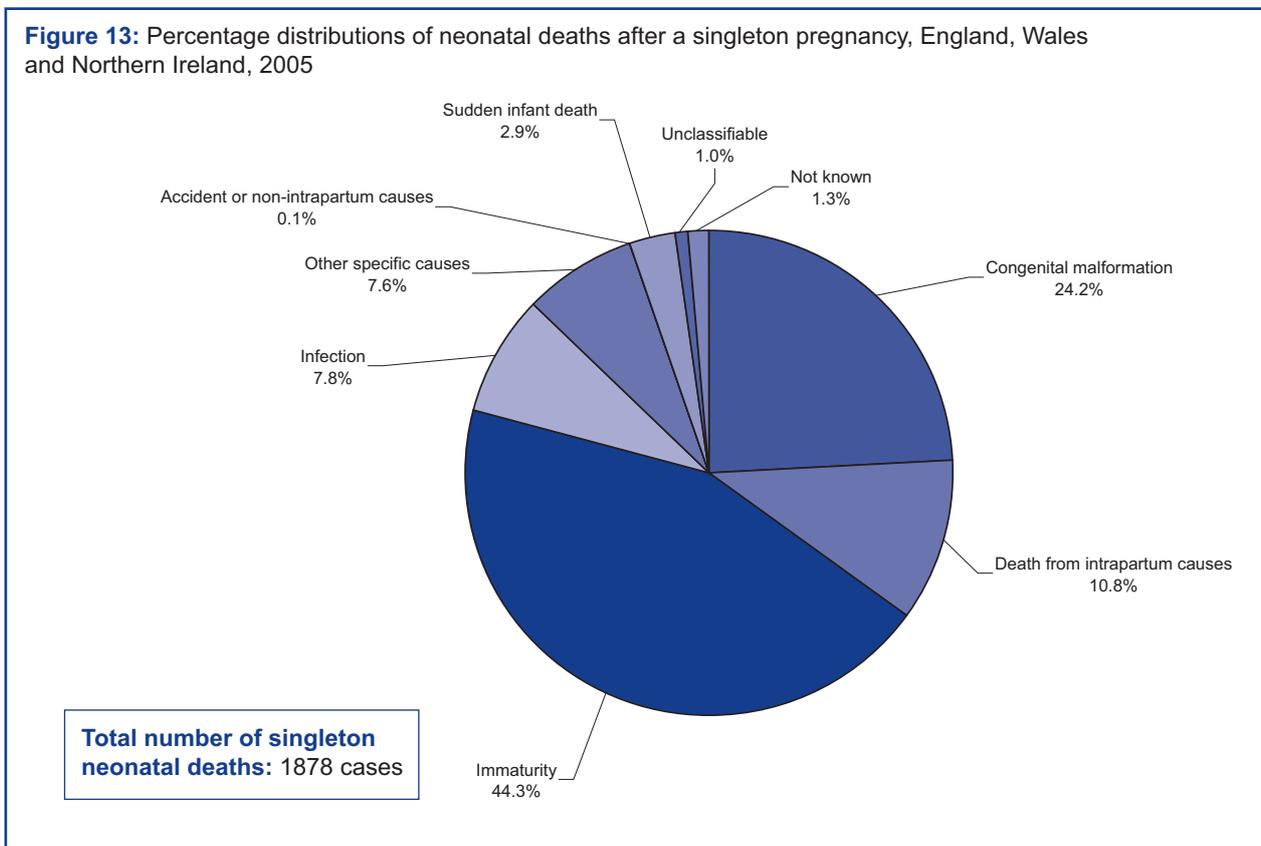
	Number			Rate ^a		
	Early Neonatal death	Late Neonatal death	All Neonatal deaths	Early Neonatal death	Late Neonatal death	All Neonatal deaths
Total	1,820	536	2,356	2.7	0.8	3.5
Congenital malformation	395	126	521	0.6	0.2	0.8
Death from intrapartum causes	182	29	211	0.3	0.0	0.3
Immaturity	948	181	1,129	1.4	0.3	1.7
Infection	91	79	170	0.1	0.1	0.3
Other specific causes	131	51	182	0.2	0.1	0.3
Accident or non-intrapartum causes	1	2	3	0.0	0.0	0.0
Sudden infant death	21	35	56	0.0	0.1	0.1
Unclassifiable	12	9	21	0.0	0.0	0.0
Not known	39	24	63	0.1	0.0	0.1

^a Rate per 1000 live births

Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI GRO 2005

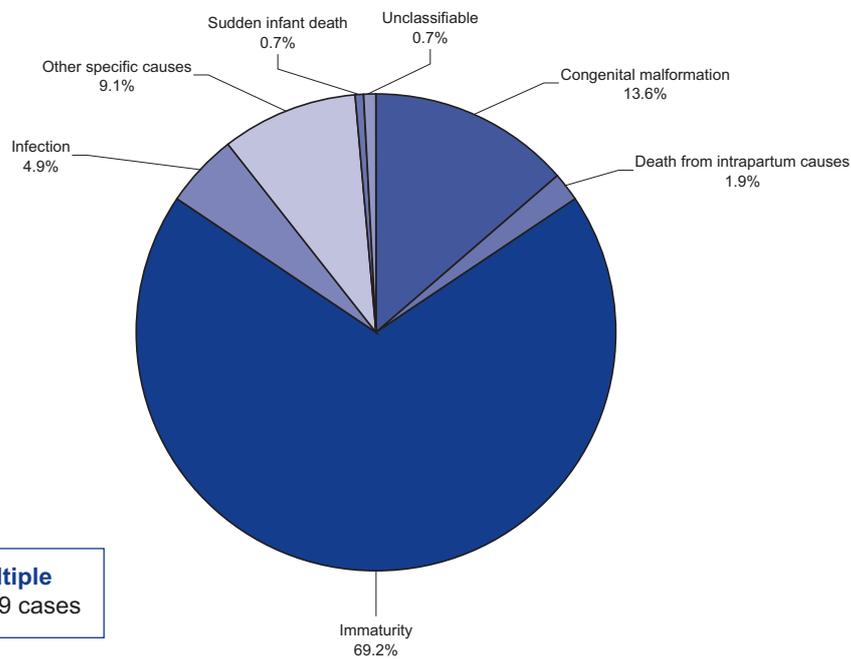
Sixty-six of the 2235 neonatal deaths notified in England and Wales followed legal termination (predominantly on account of congenital anomalies) of the pregnancy i.e. born showing signs of life and dying during the neonatal period. Sixteen were born at 22 weeks' gestation or later and death occurred between 1 and 270 minutes after birth (median: 66 minutes). The remaining 50 fetuses were born before 22 weeks' gestation and death occurred between 0 and 615 minutes after birth (median: 55 minutes).

The causes of neonatal deaths are shown in Figure 13 (singleton births) and Figure 14 (multiple births). The two main differences between singleton and multiple births are: a) a marked increase in causes classified as immaturity from 44% in neonatal deaths following a singleton birth to 69% following multiple pregnancy - an observation that is in agreement with the report for Scotland 2005¹² - and b) fewer congenital anomalies and deaths due to intrapartum causes in birth following singleton compared with multiple pregnancies.



Sources: CEMACH PDN 2005 & 2006

Figure 14: Percentage distributions of causes of neonatal deaths after a multiple pregnancy, England, Wales and Northern Ireland, 2005



Total number of multiple neonatal deaths: 429 cases

Sources: CEMACH PDN 2005 & 2006

5.3 Post mortem examination

5.3.1 Post mortem examination uptake

CEMACH collected information about whether a post mortem was held or was being arranged for each perinatal death notification. Post mortem reports were then obtained by the CEMACH regional offices to confirm the cause of death. Overall proportions of post mortem performed for all deaths, by Strategic Health Authority (SHA) of maternal residence in England, Wales and Northern Ireland, 2005 are shown in Table 15. They range from 27% in the North West to 51% in the Central South Coast.

Table 15

Percentage distribution of post mortem examinations performed by maternal region of residence, England (using new SHA), Wales and Northern Ireland, 2005

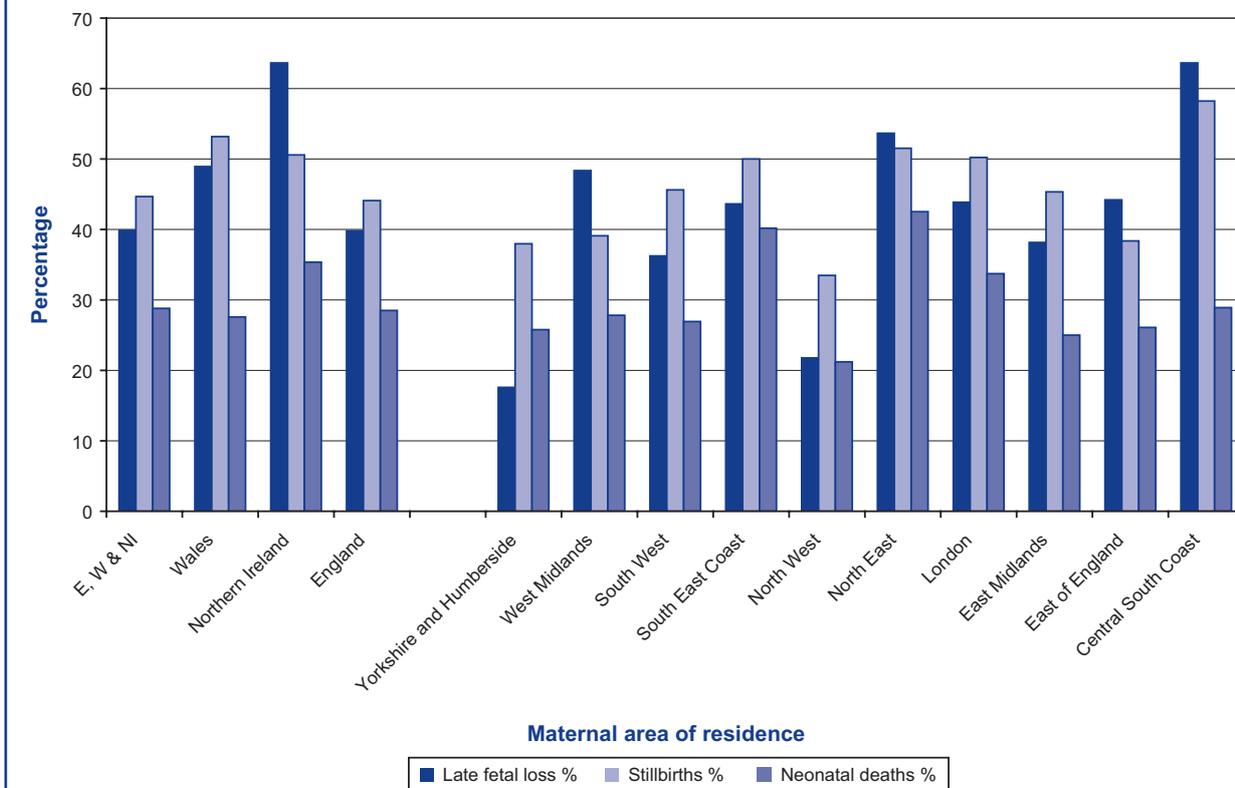
	Total notifications	Postmortems performed	%
E, W & NI	7,225	2,680	38.8
Wales	326	139	45.3
Northern Ireland	222	93	44.7
England	6,622	2,437	38.4
Yorkshire and Humberside	710	216	31.3
West Midlands	819	289	35.7
South West	481	170	37.5
South East Coast	456	199	45.7
North West	924	252	27.4
North East	298	143	49.1
London	1,415	561	44.5
East Midlands	493	183	37.3
East of England	550	193	35.7
Central South Coast	476	231	50.9
Not known and or missing or elsewhere	55	11	22.0

Sources; CEMACH PDN 2005 & 2006

Note: Percentages are calculated from total records excluding those that were classified as not known or missing.

Data for post mortem examinations performed according to the type of death (late fetal loss, stillbirths or neonatal deaths) and by SHA of maternal residence in England, Wales and Northern Ireland in 2005 are displayed in Figure 15, which shows that autopsy uptake for neonatal deaths is consistently lower than for stillbirths and late fetal losses in all regions except Yorkshire and Humberside.

Figure 15: Percentage distribution of post mortem examinations performed for all types of deaths by region of residence, England (using new SHA), Wales and Northern Ireland, 2005



Sources: CEMACH PDN 2005 & 2006

The proportion of post mortem examinations performed for late fetal loss, stillbirths and neonatal deaths, by maternal SHA of residence in England, Wales and Northern Ireland is shown in detail in Table 16. Overall, a post mortem examination was performed in 39% of all deaths (45% of stillbirths and 29% of neonatal deaths). This uptake is lower than described in the 2005 report for Scotland (47% overall)¹². These figures also represent for the first time a slight increase compared with the previous year, when the examination was performed after 38% of perinatal deaths (43% stillbirths and 27% neonatal deaths)²⁹. The data nevertheless confirm that post-mortem examination uptake has declined from 58% of all deaths in 1993 to 39% (45% of stillbirths and 29% of neonatal deaths) in 2005. This confirms the overall decline in national perinatal autopsy uptake reported over the years by CEMACH^{30, 31} and other recent publications³².

Table 16

Percentage distribution of post mortem examinations performed by cause of death and maternal region of residence, England (using new SHA), Wales and Northern Ireland, 2005

	Late fetal loss			Stillbirths			Neonatal deaths		
	Total	PM performed	%	Total	PM performed	%	Total	PM performed	%
E, W & NI	1,193	479	41.2	3,676	1,577	44.7	2,356	637	28.8
Wales	53	23	48.9	177	92	53.2	96	24	27.6
Northern Ireland	24	14	63.6	91	44	50.6	107	35	35.4
England	1,093	429	39.9	3,390	1,433	44.1	2,139	575	28.5
Yorkshire and Humberside	92	16	17.6	384	142	38.0	234	58	25.8
West Midlands	91	44	48.4	403	156	39.1	325	89	27.8
South West	84	29	36.3	232	99	45.6	165	42	26.9
South East Coast	114	48	43.6	215	104	50.0	127	47	40.2
North West	147	32	21.8	459	153	33.5	318	67	21.2
North East	41	22	53.7	165	84	51.5	92	37	42.5
London	275	118	43.9	738	329	50.2	402	114	33.7
East Midlands	76	29	38.2	247	112	45.3	170	42	25.0
East of England	96	42	44.2	289	109	38.4	165	42	26.1
Central South Coast	77	49	63.6	258	145	58.2	141	37	28.9
Not known and or missing or elsewhere	23	13	68.4	18	8	47.1	14	3	30.0

Source: CEMACH PDN 2005 & 2006

5.3.2 Staff and parents' attitudes to post mortem examination

CEMACH also collected information on whether: a) a post mortem was not requested, b) was requested but parental consent was not given, or c) parental consent was given but the autopsy was not performed (Tables 17 and 18). Parents or guardians declined permission in 36% (1272/3530) of cases. A further 19% (666/3530) were not requested by medical staff with the remaining 0.4% (15/3530) not being performed even though consent was obtained. Recent data suggest that the lack of a perinatal pathologist remains the main reason for clinicians not requesting a post mortem³².

To further explore why post mortem examination is not requested by medical staff, the proportion of post mortem performed by cause of death for stillbirths and neonatal deaths in England, Wales and Northern Ireland in 2005 is also shown in Tables 17 and 18. Table 17 shows that the highest percentages of post mortem held were for stillbirths related to infection (69%) followed by a maternal disorder (56%). Lowest post mortem uptake was found in cases of antepartum haemorrhage (25%) and intrapartum causes (34%). Table 18 shows that the highest percentages of post mortem were for neonatal deaths related to accident or non-intrapartum deaths (100%) and sudden infant deaths (98%) which are mostly ordered by a coroner, and cases categorised as unclassifiable (59%). Paediatricians were less likely to request a post mortem in congenital anomaly cases (33%), while parents were more likely to refuse a post mortem in cases classified as "immaturity" (51%).

Table 17

Distribution of post mortem examinations by cause of stillbirths, England, Wales and Northern Ireland, 2005

	Postmortem held		Not requested		Requested but consent not given		Parental consent given but PM not performed	
	Number	%	Number	%	Number	%	Number	%
Total	1,577	44.7	666	18.9	1,272	36.0	15	0.4
Congenital malformation	248	44.5	128	23.0	177	31.8	4	0.7
Antepartum haemorrhage	74	25.3	79	27.1	139	47.6	-	-
Maternal disorder	113	55.7	35	17.2	55	27.1	-	-
Pre-eclampsia	45	43.3	20	19.2	38	36.5	1	1.0
Death from intrapartum causes	90	34.1	47	17.8	126	47.7	1	0.4
Infection	48	68.6	6	8.6	16	22.9	-	-
Other specific causes	89	40.3	58	26.2	74	33.5	-	-
Accident or non-intrapartum causes	-	-	1	100.0	-	-	-	-
Unexplained antepartum fetal death <2500g	538	48.5	175	15.8	393	35.4	4	0.4
Unexplained antepartum fetal death 2500g+	317	47.0	104	15.4	248	36.8	5	0.7
Unclassifiable	10	41.7	11	45.8	3	12.5	-	-
Not known	5	..	2	..	3	..	-	..

Sources: CEMACH PDN 2005 & 2006

Note: Percentages are calculated from total records excluding those that were classified as not known or missing.

Table 18

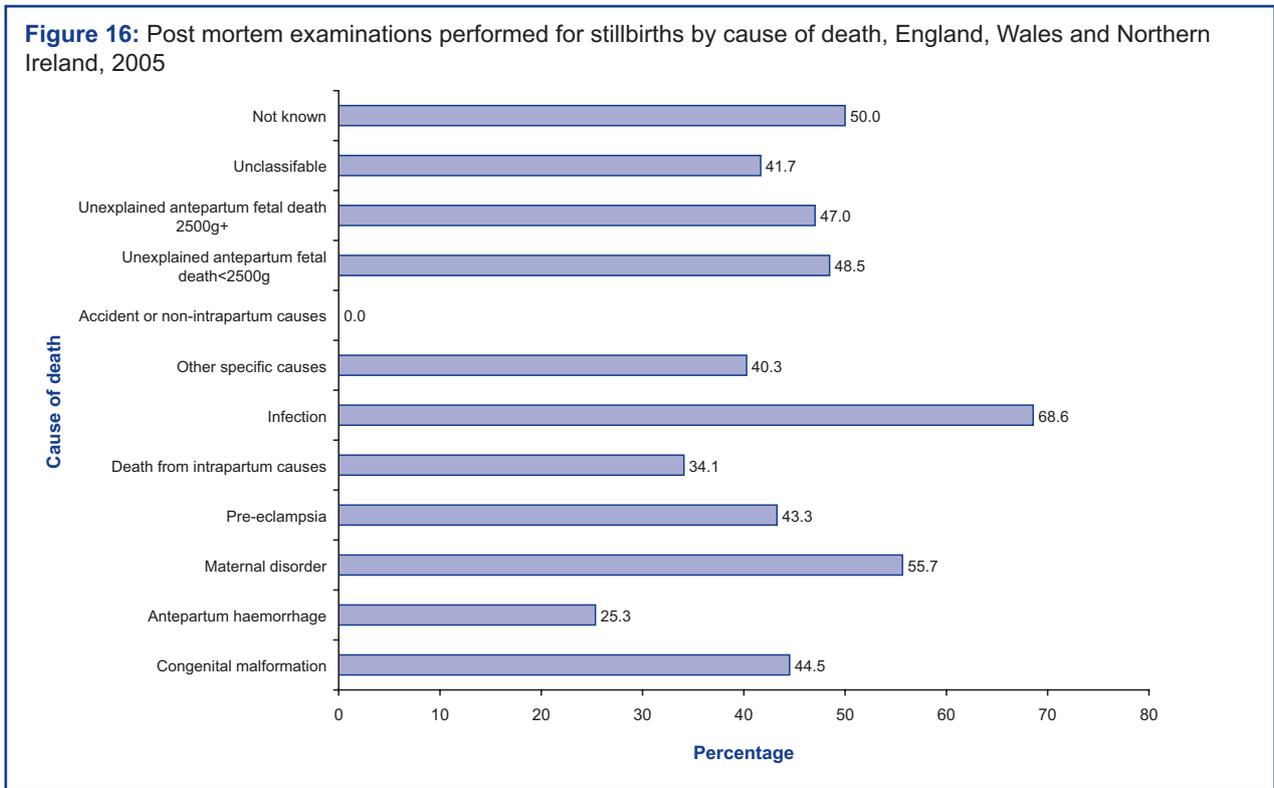
Distribution of post mortem examinations by cause of neonatal deaths, England, Wales and Northern Ireland, 2005

	Postmortem held		Not requested		Requested but consent not given		Parental consent given but PM not performed	
	Number	%	Number	%	Number	%	Number	%
Total	637	28.8	655	29.6	909	41.1	11	0.5
Congenital malformation	171	34.3	166	33.3	159	31.9	2	0.4
Death from intrapartum causes	80	39.8	39	19.4	80	39.8	2	1.0
Immaturity	159	14.7	366	33.9	550	51.0	4	0.4
Infection	79	47.9	36	21.8	48	29.1	2	1.2
Other specific causes	69	39.2	41	23.3	65	36.9	1	0.6
Accident or non-intrapartum causes	3	100.0	-	-	-	-	-	-
Sudden infant death	53	98.1	1	1.9	-	-	-	-
Unclassifiable	10	58.8	2	11.8	5	29.4	-	-
Not known	13	..	4	..	2	..	-	..

Sources: CEMACH PDN 2005 & 2006

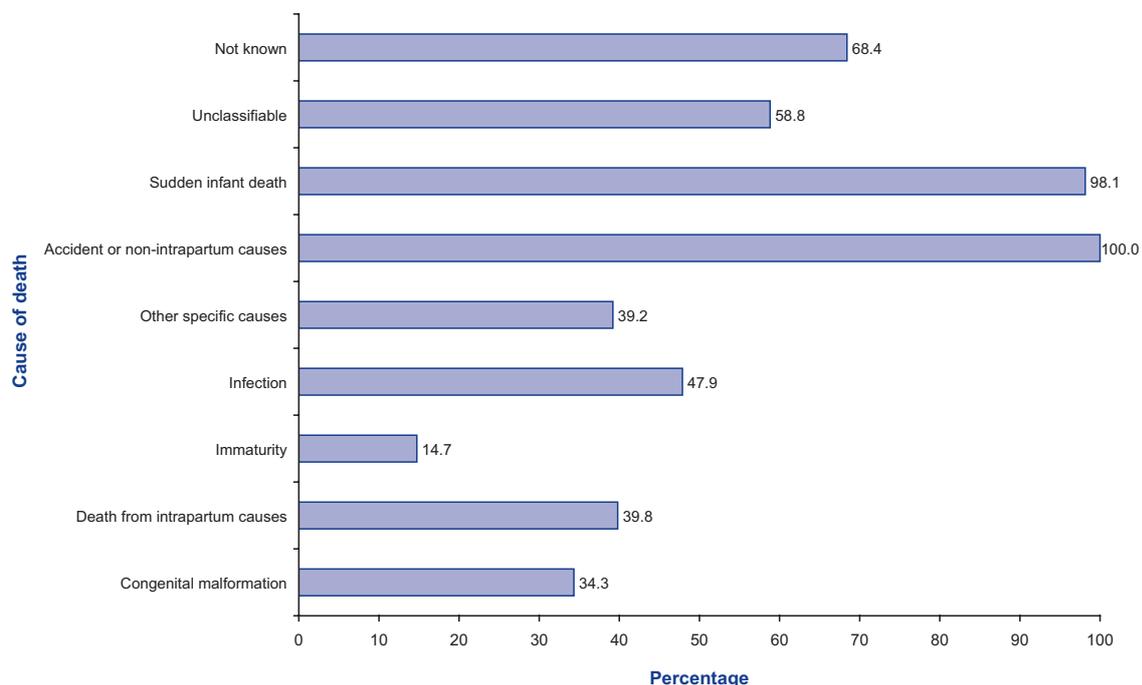
Note: Percentages are calculated from total records excluding those that were classified as not known or missing.

Figures 16 and 17 display the post mortem performed by cause of death. These figures display a pattern of post mortem examination uptake that may reflect to some extent the perception of the clinician as to the likely value of the autopsy in providing the cause of death. For instance, when neonatologists feel confident about congenital heart disease as cause of death, an autopsy will be perceived either by themselves or by parents as unlikely to alter the cause of death. Similarly, for stillbirths, in the context of abruption, the autopsy may be perceived rightly or wrongly as having little value. Decisions to request post mortem examinations based on the perceived value of autopsy in a given case may be questioned in many cases (unexplained stillbirths, deaths from intrapartum causes). These data suggest nevertheless that clinical perception of the value of an autopsy in a given case needs to be taken into consideration together with the lack of the perinatal service factor mentioned above to explain these data.



Sources: GEMACH PDN 2005 & 2006

Figure 17: Post mortem examinations performed for neonatal deaths by cause of death, England, Wales and Northern Ireland, 2005



Sources: CEMACH PDN 2005 & 2006

Although requesting a post mortem examination may be perceived as difficult when parents have just lost a baby, it is useful for ascertaining the cause of death more precisely and helps parents to plan future pregnancies. A previous UK study found that clinico-pathological classification was altered after post mortem in 13% of cases, new information was obtained in 26% and cause of death was disclosed in 19%³³. Perinatal pathology has been described in UK as a service “in crisis with problems related to pathologist recruitment and lack of public confidence following recent publicity over organ retention”³⁴. While these issues are being addressed, the post mortem uptake has declined. The fact that in a quarter of deaths post mortem examination was not requested by medical staff should be explored further. Those few cases where consent was given but post mortem was not performed are of special concern. Post mortem examination will always remain a distressing choice for parents³⁵: in one third of deaths, parents withheld their consent. Nevertheless, it is important for a clinician to explain to parents the potential advantages of this investigation.

5.4 Classification system for stillbirths and neonatal deaths

Using the current classification system, just over 50% of stillbirths were classified as ‘unexplained’ and 48% of neonatal deaths were classified as due to ‘immaturity’. Other classification systems may result in a lower proportion of stillbirths classified as unexplained^{36, 37}. The Australia and New Zealand Antecedent Classification of Perinatal Mortality classifies 32% of stillbirths as ‘unexplained’ using obstetric antecedents and uses supplementary codes for important factors contributing to neonatal deaths³⁸. The lack of consistency between many classification systems also leads to difficulties in allowing valid comparison of data¹².

The lack of precision of the causes of deaths resulting from the use of the current perinatal mortality classification systems also reduces the value of CEMACH perinatal mortality surveillance reports to clinicians, epidemiologists and those responsible for planning services.

A revision of the classification system may enhance the value of future CEMACH perinatal mortality surveillance reports. Additional knowledge about factors associated with perinatal mortality, even though not directly causal, could lead to the identification of potentially promising areas for targeted clinical research into the causes of stillbirths and neonatal deaths. The ultimate aim is for better information to indicate interventions that might reduce perinatal mortality. For this reason, a Perinatal Mortality Classification Review Advisory Group (PMCRAG) was established by CEMACH to review its classification of perinatal deaths. PMCRAG will involve parties from all the key professional disciplines required to bring an authoritative perspective on the perinatal mortality classification system (such as midwifery, neonatology, obstetrics, pathology and public health). The ONS is participating as member. The Stillbirths and Neonatal Deaths Society (SANDS), a leading UK charity supporting bereaved parents, provide a lay perspective. The aim is that the recommendations from this review will be piloted during 2007 and implemented in 2008.

6 Focus issues

Part of the purpose of CEMACH's perinatal mortality surveillance is to identify clinically relevant topics, where it may be beneficial to carry out further more detailed studies. This chapter of the report focuses on neonatal deaths of intrapartum origin at term and perinatal deaths during deliveries at home.

6.1 Neonatal deaths of intrapartum origin at term

6.1.1 Background

The incidence of intrapartum stillbirths and of severe neonatal encephalopathy of hypoxic origin that often leads to a neonatal death has not changed over the period 1993-2001 in two English regions (Trent and Northern region)³⁹. Intrapartum-related neonatal deaths remain the third most important identifiable cause of neonatal deaths^{29, 30}. Previous national and regional confidential enquiries have reported substandard care present in as many as 75% of these cases^{40, 41}, although their reliability was limited by the absence of case-controls. The contribution and therefore the possible prevention of intrapartum events leading to an hypoxic insult are controversial^{42, 43}. To explore further the contribution of intrapartum events to neonatal deaths in term babies in this report, a descriptive analysis and a classification of these deaths were performed using the Aberdeen Obstetric system⁹.

6.1.2 Results

The proportion of all neonatal deaths dying from intrapartum causes was identified using category 3 of the Extended Wigglesworth classification (deaths from intrapartum "asphyxia", "anoxia" or "trauma")⁸. As shown earlier in this report, this was 9% (211/2356). One hundred and forty two out of these 211 neonatal deaths were born at term. One hundred and twenty eight out of these 142 cases were further classified as "intrapartum asphyxia" by the Fetal and Neonatal classification system⁹. The neonatal death rate for all term newborns who died from intrapartum asphyxia was 0.2 (128/668681) per 1000 live births. This rate was similar to the rate for babies dying because of moderate and severe hypoxic-ischaemic encephalopathy (0.2 per 1000 (140/704130 births)) reported for the Trent 12 years cohort³⁹. The proportion of early neonatal deaths in this group was 88%. Table 19 shows that these 128 term infants' deaths represented 61% (128/211) of the total of neonatal deaths from intrapartum causes for all gestational ages and that they mainly occurred in babies born between 38 and 41 weeks' gestation.

Table 19

Neonatal deaths of intrapartum causes in term infants by week of gestation, England, Wales and Northern Ireland, 2005

Gestational age (weeks)	Live births	Early Neonatal death		Late Neonatal death		Neonatal deaths	
		Number	Rate ^a	Number	Rate ^a	Number	Rate ^a
<37	47,000	56	1.2	13	0.3	69	1.5
37	36,000	8	0.2	-	-	8	0.2
38	88,000	19	0.2	2	0.0	21	0.2
39	137,000	24	0.2	4	0.0	28	0.2
40	182,000	33	0.2	2	0.0	35	0.2
41	121,000	37	0.3	6	0.0	43	0.4
42	23,000	5	0.2	1	0.0	6	0.3
>42	4,500	-	-	1	0.2	1	0.2

^a Rate per 1000 live births

Sources: CEMACH PDN 2005 & 2006, HES 2004-2005, NI CHS 2005

Note: Number of live births by gestation is an estimate for England, Wales and Northern Ireland obtained from Maternity HES, NCCHD and NI CHS.

These 128 neonatal deaths were further categorised according to the Aberdeen Obstetric classification⁹ to describe the causes of death in more detail from an obstetric perspective (Table 20). An unexplained cause was by far the most common category (55%). Catastrophic event at delivery was the second most common condition: placental abruption (12%), cord prolapse and cord compression (6%). A breech presentation occurred in 6% of these neonatal deaths and there was a dystocic presentation or a ruptured uterus in 2%. A pre-existent maternal disorder was present in nearly 8% of cases.

Table 20

Causes of term neonatal deaths of intrapartum origin, England, Wales and Northern Ireland, 2005

Aberdeen obstetric classification	Early Neonatal death		Late Neonatal death		Neonatal deaths	
	Number	%	Number	%	Number	%
Total	113	100.0	15	100.0	128	100.0
Congenital anomaly						
Neural tube defects	-	-	-	-	-	-
Other anomalies	-	-	-	-	-	-
Isoimmunisation	-	-	-	-	-	-
Due to Rhesus antigen	-	-	-	-	-	-
Pre-eclampsia						
Without	2	1.8	-	-	2	1.6
Antepartum Haemorrhage (APH)						
With placenta praevia	-	-	1	6.7	1	0.8
With placental abruption	14	12.4	1	6.7	15	11.7
APH of uncertain origin	3	2.7	-	-	3	2.3
Mechanical						
Cord prolapse or compression with vertex or face presentation	7	6.2	1	6.7	8	6.3
Other vertex or face presentation	3	2.7	-	-	3	2.3
Breech presentation	6	5.3	2	13.3	8	6.3
Oblique or compound presentation, uterine rupture	3	2.7	-	-	3	2.3
Maternal disorder						
Maternal hypertensive disease	1	0.9	-	-	1	0.8
Other maternal disease	5	4.4	1	6.7	6	4.7
Maternal infection	2	1.8	1	6.7	3	2.3
Miscellaneous						
Specific fetal conditions	3	2.7	-	-	3	2.3
Unexplained						
Equal or greater than 2.5 kg	62	54.9	8	53.3	70	54.7
Less than 2.5kg	2	1.8	-	-	2	1.6

Sources: CEMACH PDN 2005 & 2006

6.1.3 Conclusions

Many deaths of term babies with normal birth weight therefore remained unexplained by CEMACH's current classification system. Those that were explainable were mainly due to acute and mechanical events during labour, resulting in death during the neonatal period due to hypoxic ischaemia. Neonatal encephalopathy of hypoxic origin may therefore provide a focus for a future CEMACH enquiry to ascertain the contribution of intrapartum events and the quality of the clinical care delivered to those babies who died and the degree of neurodevelopmental impairment experienced by survivors.

6.2 Deliveries at home: stillbirths and neonatal deaths

6.2.1 Background

The Maternity Standard of the National Service Framework for Children, Young People and Maternity Services published by the Department of Health in 2003⁴⁵ recommends that "women should have easy access to supportive, high quality maternity services, designed around their individual needs and those of their babies". Women are currently able to choose a place to give birth from a number of different settings including hospital, a birth centre or home. The Maternity Standard advocates that "home births should be offered within a risk management framework and with adequate local infrastructure and support"⁴⁵. The relative safety of home birth has been examined in many large studies but remains an area of significant debate⁴⁶⁻⁴⁸. Home birth is defined in this analysis as a birth taking place at the mother's residence. We acknowledge that "planned" deliveries at home are not the same as "planned at the onset of labour" and that women may change plan during pregnancy. The CEMACH data at this time only allow for differentiation between planned and unplanned deliveries at home.

This analysis cannot provide a definitive answer to questions raised in the debate about the safety of home births, but it can provide information about the characteristics of pregnancies delivered at home and which ended in a stillbirth or a neonatal death, which are set out below.

6.2.2 Results

In 2005, there were 16737 home births in England, Wales and Northern Ireland (ONS data). Of the 7225 deaths that were notified to CEMACH in 2005 as resulting in late fetal loss, stillbirth or neonatal death deaths, 119 (1.6%) were delivered at home. Table 21 shows the type of deaths notified according to whether deliveries at home were planned or not. The vast majority of these 119 deaths during a delivery at home were not planned home births (unknown in 6 cases). Fifty-four percent were booked to deliver in hospital and 29% were unbooked. Only 14 out of 119 (12%) were planned home deliveries and these include four stillbirths and nine neonatal deaths (11%). The gestational age of these four stillbirths at the time of death was between 37 and 41 weeks. The gestational age of the neonatal deaths was between 37 and 42 weeks.

Table 21

Stillbirths and neonatal deaths according to unplanned/planned home births, England, Wales and Northern Ireland, 2005

Case type	Unplanned	Planned	Total
Total	105	14	119
Late fetal loss	16	1	17
Stillbirth	52	4	56
Early Neonatal death	31	7	38
Late Neonatal death	6	2	8

Sources: CEMACH PDN 2005 & 2006

Table 22 shows the causes of deaths of these deliveries occurring at home. The main cause of neonatal deaths in unplanned birth at home was prematurity and most stillbirths were recorded as “ante partum”. Overall, an intrapartum related cause of death (19/119) was more frequently represented than in the general population (16% versus 9%). Out of 14 planned home births that resulted in stillbirth and neonatal death, three deaths related to congenital anomalies, two neonatal deaths were attributed to sudden infant death syndrome and an intrapartum related cause was found in four (one stillbirth and three neonatal deaths).

Table 22

Cause of death according to unplanned/planned home births, England, Wales and Northern Ireland 2005

Cause of perinatal deaths	Unplanned		Planned		Total
	Late fetal loss and stillbirths	Neonatal deaths	Late fetal loss and stillbirths	Neonatal deaths	
Total	68	37	5	9	119
Congenital malformations	-	4	1	2	7
Antepartum stillbirth	48	-	3	-	51
Intrapartum related causes	8	7	1	3	19
Immaturity	-	21	-	-	21
Infection	1	1	-	1	3
Other specific causes	1	-	-	-	1
Sudden infant death syndrome	-	1	-	2	3
Unclassifiable	10	3	-	-	13
Missing	-	-	-	1	1

Sources: CEMACH PDN 2005 & 2006

6.2.3 Conclusions

Stillbirth and neonatal mortality remain commonly used indicators in examining the relative safety of different birth settings. When examining the intended place of delivery (as determined at booking for antenatal care), it is clear that the vast majority of cases were not originally planned home births and should not of themselves give rise to concern about risk management standards in respect of planned home deliveries: over half these cases originally intended to deliver at a hospital and over one quarter were unbooked pregnancies. It is possible that in many of these cases, women went into labour unexpectedly (one third of deaths in this group were related to prematurity). The high number of home births that were unexpected home deliveries or unbooked pregnancies may also explain the high proportion of deaths classified as 'intrapartum related' deaths. A strategy to reduce perinatal mortality in these cases is likely to be difficult.

A minority of cases, four stillbirths and nine neonatal deaths, occurred in planned home births and four of these were related to an intrapartum cause. While these cases could be reviewed and compared to UK CESDI data published ten years ago⁴⁹, it would be invaluable to gather information on denominator data for planned home births in the future. The CEMACH data collection system cannot estimate the perinatal mortality in deliveries occurring at home or planned home births, as information on the number of live births that occur at home is not currently available for the whole of England, Wales and Northern Ireland and data about intended place of delivery are incomplete in maternity HES⁷. In order to provide further information relevant to evaluation of the safety of planned home deliveries, CEMACH has, during 2006, collected information on deaths in hospital where delivery, at onset of labour, was planned to be at home. This will help to provide a more complete picture of perinatal mortality and its relationship with both planned and unplanned home delivery.

7 The CEMACH work programme

CEMACH perinatal mortality surveillance in context

CEMACH's work on perinatal mortality surveillance is one important part of an overall integrated enquiry programme. This section places this work in the context of the Enquiry's wider programme.

Maternal mortality

CEMACH undertakes ongoing enquiries into maternal mortality. The annual mortality surveillance report for 2006, due by the end of December 2007, will include both maternal and perinatal mortality for the first time. This will enable CEMACH to integrate information about outcomes for both mother and baby. At the same time, CEMACH aims to continue to issue periodic "Why Mothers Die" reports, which will contain the results of case reviews of all maternal deaths. These will include analyses of trends and recommendations for improving clinical practice and for national policy on maternity. The next "Why Mothers Die" report (to be published at the end of 2007) will contain the results of enquiries into maternal deaths occurring between 2003 and 2005.

Maternal deaths due to psychiatric causes

An in-depth review is currently being undertaken of all deaths during pregnancy and up to a year after delivery from psychiatric illness or substance misuse. With support from the Office for National Statistics CEMACH will be able to achieve near full ascertainment for these deaths. CEMACH aims to issue a report in 2008 which will be intended for mental health professionals and primary care practitioners, as well as midwives, obstetricians and neonatologists.

Diabetes in pregnancy

The final report of the CEMACH diabetes in pregnancy project was issued in late February 2007. This report includes the outcome of an audit of the care provided to 440 women with diabetes in pregnancy. It also brings together the findings of the two earlier reports from this project: the organisational survey of local arrangements for diabetes in pregnancy (April 2004) and the descriptive study of all 3808 pregnancies included in the study (October 2005).

This work has led to a three-year joint project between CEMACH and University College London to enable further development of the national study (funded by Novo Nordisk). This will include a qualitative study of preconception care, which was found by the national CEMACH study to be a key area requiring further attention.

Child death review

CEMACH is conducting an enquiry into all deaths of children aged from 28 days to 18 years of age in Wales, Northern Ireland and the West Midlands, South West and North East of England, occurring between

1 January and 31 December 2006. In addition to collecting and analysing mortality data, a sample of 150 of those deaths is being reviewed in depth by confidential enquiry panels. The aim is to identify the extent of avoidability of these deaths with a view to assessing the potential benefits and likely focus of future confidential enquiries into childhood mortality. The work is also being used to inform the development of a minimum data set for use by Local Safeguarding Children Boards when they take up their child death review functions in April 2008. The final CEMACH report on the child death review is expected in 2008.

'BEADI' project

The national charity BLISS has funded CEMACH to carry out a study, the BLISS trial for the Effect of Active Dissemination of Information. This will compare the impact of an active strategy for dissemination of confidential enquiry findings with more traditional approaches.

Head injury in children

CEMACH is developing a protocol for a study into head injury in children, which will include a focus on pre-hospital care. Head injury is a leading cause of childhood mortality and in non-fatal cases may result in severe morbidity in children. CEMACH is grateful to the London Ambulance Service for their help with the development of a pilot study for this project, which CEMACH aims to roll-out nationally in due course.

Work with individual Trusts

CEMACH is also working as part of a local review and, in some regions, is able to undertake locally commissioned work using a confidential enquiry approach.

Further information

Further information on CEMACH's plans for future work or range of services provided by CEMACH can be obtained from Richard Congdon, Chief Executive, email richard.congdon@cemach.org.uk

8 The Health Care Commission and the CEMACH perinatal mortality surveillance programme

CEMACH is developing links with the Healthcare Commission in order that, where appropriate, findings and indicators may be shared. This initiative will have the potential to reduce duplication of data collection, and to improve consistency and clarity of information provided to practitioners, Trusts and commissioners so that service needs can be better understood and processes can be developed to support best practice with consequent improvement in the quality of care.

The information in this report is in the public domain, but is anonymised to respect the confidentiality agreement which covers the reporting process. In Summer 2007, the Healthcare Commission is conducting a detailed review of maternity services, from antenatal care through to postnatal midwife discharge which will require completion by a Trust representative of a comprehensive web-based statistical return. This review will result in a comprehensive and widely accessible database, enabling clinicians and others to compare outcomes, staffing levels and a number of other factors. One section of the review questionnaire is likely to request details of neonatal death and stillbirth to enable this benchmarking and comparison to be comprehensive. In order to reduce duplication, the Healthcare Commission will offer Trusts the option of permitting CEMACH to share the mortality data direct rather than Trusts having to complete a long set of questions to provide the same information. CEMACH will not share this limited data set without a Trust's permission, but sharing this data will reduce the administrative burden and improve utilisation of the information.

The results of the service review will be published in Autumn 2007 alongside (but not a part of) the Healthcare Commission Annual Health Check for NHS organisations. Further details are available from www.healthcarecommission.org.uk.

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The following symbols have been used in all tables:

- .. not available/not applicable
- nil
- 0.0 negligible

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Appendix A CEMACH Perinatal Death Notification form (PDN)

CEMACH - Confidential Enquiry into Maternal and Child Health - 2005 Perinatal Death Notification		Survey Number Office use only																											
One form should be filled in for each fetus born after 22 weeks of pregnancy (or birthweight>400grams if weeks not known) and each live birth dying before 28 completed days of life , including legal abortions.		<table border="1" style="margin: auto;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px; text-align: center;">0</td> <td style="width: 20px; height: 20px; text-align: center;">5</td> <td style="width: 20px; height: 20px;"></td> </tr> </table>			0	5																							
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MOTHER 2. NHS No. <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 3. Surname _____ 4. First name _____ 5. Hospital No. _____ 6. Usual residential address at time of delivery/birth _____ 7. Postcode <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> N/K <input type="checkbox"/>															BABY 21. NHS No. <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 22. Surname _____ 23. First name _____ 24. Hospital No. _____ 25. Residential address at time of death if different from Q6. _____ 26. Postcode <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> N/K <input type="checkbox"/>														
8. Mother's date of birth <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Day Month Year or <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Estimated age N/K <input type="checkbox"/>						27. Sex of fetus / baby Male <input type="checkbox"/> Female <input type="checkbox"/> Indeterminate <input type="checkbox"/> N/K <input type="checkbox"/> 28. Birth weight (kg) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Never recorded <input type="checkbox"/> N/K <input type="checkbox"/>																							
9. Ethnic group of mother White <input type="checkbox"/> Black African <input type="checkbox"/> Black Carib. <input type="checkbox"/> Black other <input type="checkbox"/> Indian <input type="checkbox"/> Pakistani <input type="checkbox"/> Bangladeshi <input type="checkbox"/> Chinese <input type="checkbox"/> Mixed <input type="checkbox"/> please give details: _____ Other <input type="checkbox"/> please give details: _____ N/K <input type="checkbox"/>	29. Gestation at delivery <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> weeks + <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td></tr></table> days N/K <input type="checkbox"/> 30. Gestation death confirmed - Late fetal losses and stillbirths only <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> weeks + <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td></tr></table> days N/K <input type="checkbox"/>																												
10. Past obstetric history Number of previous live births <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td></tr></table> Number of previous stillbirths (24+ weeks) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td></tr></table> N/K <input type="checkbox"/>			31. Was this a legal abortion? (Notifiable under 1967/92 Abortion Act) Yes <input type="checkbox"/> No <input type="checkbox"/> N/K <input type="checkbox"/> <i>NB: a case can be both a registrable death (stillbirth or neonatal death) AND a legal abortion</i>																										
11. Maternal height and weight OR Body Mass Index (BMI) Height <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> cm N/K <input type="checkbox"/> Weight <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> kg N/K <input type="checkbox"/> BMI <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> N/K <input type="checkbox"/>									32. When did death occur? - Late fetal losses and stillbirths only Antepartum <input type="checkbox"/> Intrapartum <input type="checkbox"/> N/K <input type="checkbox"/> 33. Place of death - Live births only <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> office use only Name of unit/place _____ N/K <input type="checkbox"/>																				
12. Expected date of delivery <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Day Month Year N/K <input type="checkbox"/> 13. Gestation at first scan <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> weeks + <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td></tr></table> days N/K <input type="checkbox"/> Never scanned <input type="checkbox"/>								34. Date and time of death - Live births only <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Day Month Year <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 24hr clock Time N/K <input type="checkbox"/> Date & time N/K <input type="checkbox"/>																					
14. Intended place of delivery <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> office use only Name of unit/place _____					35. Cause of death - clinical details a. MAIN FETAL / INFANT disease or conditions _____ b. OTHER FETAL / INFANT diseases or conditions _____ c. MAIN MATERNAL disease or conditions affecting fetus/neonate _____ d. OTHER MATERNAL disease or conditions affecting fetus/neonate _____ e. OTHER RELEVANT causes or comments _____																								
15. Actual place of delivery <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> office use only Name of unit/place _____					36. Was there evidence of fetal growth restriction? Yes <input type="checkbox"/> No <input type="checkbox"/> N/K <input type="checkbox"/> 37. Extended Wigglesworth classification (see guidelines) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table>																								
16. Date and time of delivery / birth <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Day Month Year <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 24hr clock Time N/K <input type="checkbox"/> Date & time N/K <input type="checkbox"/>							38. Fetal and Infant classification (see guidelines) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table>																						
17. Number of fetuses / babies this delivery All identifiable fetuses at delivery, including papyraceous <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td></tr></table> N/K <input type="checkbox"/> 18. Birth order this fetus / baby 0=singleton <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td></tr></table> N/K <input type="checkbox"/>			39. Obstetric (Aberdeen) classification (see guidelines) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table>																										
19. Mode of delivery Spont. vaginal <input type="checkbox"/> Forceps <input type="checkbox"/> Ventouse <input type="checkbox"/> Elective C.S. <input type="checkbox"/> Other C.S. <input type="checkbox"/> N/K <input type="checkbox"/> Other <input type="checkbox"/>	40. Postmortem / autopsy Held / being arranged <input type="checkbox"/> Not requested <input type="checkbox"/> Requested but consent not given <input type="checkbox"/> Coroner's postmortem <input type="checkbox"/> Parental consent but no autopsy performed <input type="checkbox"/> N/K <input type="checkbox"/>																												
20. Was this a breech presentation? (immediately prior to delivery) Yes <input type="checkbox"/> No <input type="checkbox"/> N/K <input type="checkbox"/>	39. Obstetric (Aberdeen) classification (see guidelines) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table>																												
Please give the details of the person who completed this form Name: _____ Position: _____ Contact address: _____ Tel. number/email address: _____																													

Appendix B Stillbirth and neonatal mortality rates by maternal region of residence - England, Wales and Northern Ireland, 2005

Stillbirth and neonatal mortality rates by maternal region of residence, England, Wales and Northern Ireland, 2005				
Maternal region of residence	Stillbirth rate	95% CI	Neonatal mortality rate	95% CI
England, Wales and Northern Ireland	5.5	[5.3, 5.7]	3.5	[3.4, 3.6]
Wales	5.4	[4.7, 6.3]	2.9	[2.4, 3.6]
Northern Ireland	4	[3.3, 5.0]	4.7	[4.0, 5.8]
England	5.5	[5.3, 5.7]	3.5	[3.3, 3.6]
Yorkshire and Humberside	6.3	[5.7, 7.0]	3.9	[3.4, 4.4]
West Midlands	6.1	[5.5, 6.7]	4.9	[4.4, 5.5]
South West	4.4	[3.9, 5.0]	3.1	[2.7, 3.6]
South East Coast	4.6	[4.0, 5.2]	2.7	[2.3, 3.2]
North West	5.6	[5.1, 6.1]	3.9	[3.5, 4.3]
North East	5.8	[5.0, 6.8]	3.3	[2.7, 4.0]
London	6.3	[5.9, 6.8]	3.5	[3.1, 3.8]
East Midlands	5	[4.4, 5.7]	3.5	[3.0, 4.0]
East of England	4.4	[4.0, 5.0]	2.6	[2.2, 3.0]
Central South Coast	5.5	[4.9, 6.2]	3	[2.5, 3.5]

Sources: CEMACH PDN 2005, 2006

Appendix C Maternal age-specific stillbirth and neonatal mortality rates - England, Wales and Northern Ireland, 2005

Maternal age-specific stillbirth and neonatal mortality rates, England, Wales and Northern Ireland, 2005						
	Live births		Stillbirths		Neonatal deaths	
	Number	Number	Rate [95% CI]	Number	Rate [95% CI]	
Total	668,708	3676	5.5 [5.3, 5.7]	2356	3.5 [3.4, 3.7]	
<20	46,240	305	6.6 [5.9, 7.3]	218	4.7 [4.1, 5.4]	
20-24	125,905	647	5.1 [4.7, 5.5]	467	3.7 [3.4, 4.1]	
25-29	170,378	899	5.2 [4.9, 5.6]	574	3.4 [3.1, 3.7]	
30-34	195,326	934	4.8 [4.4, 5.1]	581	3.0 [2.7, 3.2]	
35-39	107,886	652	6.0 [5.6, 6.5]	360	3.3 [3.0, 3.7]	
40-44	21,849	159	7.2 [6.2, 8.5]	88	4.0 [3.3, 5.0]	
45+	1,118	15	13.2 [9.0, 22.0]	4	3.6 [3.1, 9.5]	
Not known	6	65	..	64	..	

Sources: CEMACH PDN 2005 & 2006, ONS 2005, NI CHS 2005

Note: Total number of live births by multiplicity has been obtained from ONS and Northern Ireland Child Health System. There are 30 cases recorded by NI Child Health System and not by NI General Registrar Office, hence the increase in number of total live births for the year 2005 when compared to earlier tables in this report.



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CEMACH, Chiltern Court, 188 Baker Street, London, NW1 5SD

Tel: **0207 486 1191** Fax: **0207 486 6543**

Email: info@cemach.org.uk Website: www.cemach.org.uk

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