

Perinatal Mortality 2007

June 2009
United Kingdom

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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. They do not override healthcare professionals' individual responsibility to make appropriate decisions in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

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Abbreviations

ART	Assisted Reproduction Techniques
BAPM	British Association of Perinatal Medicine
BMI	Body Mass Index
CEMACH	Confidential Enquiry into Maternal and Child Health
CEMD	Confidential Enquiry into Maternal Deaths
CESDI	Confidential Enquiry into Stillbirths and Deaths in Infancy
GROS	General Register Office for Scotland
HFEA	Human Fertilisation and Embryology Authority
IMD	Index of Multiple Deprivation
IVF	<i>In Vitro</i> Fertilisation
NCCHD	National Community Child Health Database
NHS QIS	National Health Service Quality Improvement Scotland
NICE	National Institute for Health and Clinical Excellence
NICORE	Neonatal Intensive Care Outcomes Research and Evaluation
NISRA	Northern Ireland Statistics and Research Agency
NI CHS	Northern Ireland – Child Health System
NN4B	NHS Numbers for Babies
ONS	Office for National Statistics
PCT	Primary Care Trust
PDN form	Perinatal Death Notification form
PSA	Public Service Agreement
SHA	Strategic Health Authority
SGA	Small for Gestational Age
SOA	Super Output Areas
SSBID survey	Scottish Stillbirth and Infant Death survey
WHO	World Health Organisation

Glossary

Body Mass Index (BMI)	The body weight of an individual in kilograms divided by their height in metres squared. A BMI below 18.5 is categorised as underweight, a BMI of 18.5-24.9 is normal weight, a BMI of 25.0-29.9 is overweight and a BMI of 30 and above is obese.
Crown dependencies	The Channel Islands and the Isle of Man.
Early neonatal death	Death of a live born baby before seven completed days from the time of birth.
Index of Multiple Deprivation (IMD)	This combines a number of indicators, chosen to cover a range of economic, social and housing issues, into a single deprivation score for each small area in England. This allows each area to be ranked relative to one another according to their level of deprivation.
Late neonatal death	Death of a live born baby occurring after the seventh day and before 28 completed days from the time of birth.
Legal abortion	Term used to describe the deliberate ending of a pregnancy, under the provisions of the current law (1967/1992 Act of Parliament) with the intention that the fetus will not survive.
Live birth	Delivery of an infant, which, after complete separation from its mother, shows signs of life.
Maternity	Pregnancy resulting in a live birth at any gestation or stillbirth occurring at 24 weeks' gestation onwards, with multiple births being counted only once.
NHS Numbers For Babies (NN4B)	NN4B was set up and implemented by the NHS Information Authority (NHSIA) in 2002. It ensures that all liveborn babies are issued with an NHS number at birth via a central computerised system.
Perinatal death	Death of a fetus or a newborn in the perinatal period that commences at 24 weeks' gestation and ends at six completed days from the time of birth.
Rate ratio	The ratio of the rate of a health outcome in an exposed population to the rate in the unexposed population.
Small for Gestational Age (SGA)	A baby that has a birth weight less than the 10 th percentile of all babies with the same gender and gestational age.
Super Output Areas (SOA)	Geographical areas used in the UK for the collection and publication of small area statistics.
Stillbirth	A baby delivered with no signs of life known to have died at 24 completed weeks of pregnancy onwards.
Teenage pregnancy	For this report, this is defined as pregnancy in a woman who is less than 20 years of age.

Preface



The death of a baby during or shortly after pregnancy is a tragic event, and the national CEMACH perinatal mortality surveillance report continues to be of prime importance to providers and commissioners of maternity and neonatal services in the UK and Crown Dependencies. CEMACH's surveillance programme provides ongoing monitoring of socio-demographic and clinical factors that may be associated with stillbirths and neonatal deaths, and also provides the opportunity for Trusts and Neonatal Networks to benchmark themselves against national performance indicators and other organisations. In this 2007 report, CEMACH has been able to provide perinatal mortality statistics on a UK-wide basis for the first time. CEMACH has also introduced a new classification system in 2008 and it is anticipated that future reports will provide more detail about possible causes of death of these babies.

This report contains a number of encouraging findings. There has been a decrease in the stillbirth rate from 5.7 per 1,000 total births in 2002-2004, to 5.2 per 1,000 total births in 2007, and ongoing surveillance will establish if this signals the start of a downward trend. The overall neonatal mortality rate has continued to decrease, as well as stillbirth and neonatal mortality rates in twin births.

There are specific areas where continued efforts are required. Extremes of maternal age, non-White ethnicity, maternal social deprivation and obesity continue to be risk factors for stillbirth and neonatal death. These factors are likely to be inter-related and represent a significant challenge for health services. While there are no 'quick fixes', health services should ensure that all women have early access to maternity care and appropriate social and/or community services where they are needed.

CEMACH has highlighted geographical variation in notifications of early neonatal deaths at non-viable gestations, with 213 of such deaths being reported in 2007. Variations in reporting affect the accuracy of mortality rate comparisons at regional, national and international levels, and it is important to have consistent reporting practices across the UK.

I welcome this report and recommend that all those involved in providing care to mothers and their babies in the UK should review its findings, and take steps to address the actions necessary.

A handwritten signature in black ink that reads "Liam Donaldson". The signature is written in a cursive, slightly slanted style.

Sir Liam Donaldson

Chief Medical Officer

Department of Health, England

Chapter 1 Context

This report is the fifth annual perinatal mortality surveillance report conducted under the auspices of the Confidential Enquiry into Maternal and Child Health (CEMACH). CEMACH was established in 2003 as the successor organisation to two previous national confidential enquiries, the Confidential Enquiry into Maternal Deaths (CEMD) and the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI). The programme of national confidential enquiries was started by CEMD in 1952 and by CESDI from 1992. Since its inception in 2003, CEMACH has successfully extended its remit to encompass a new national enquiry into child health and research on a wide range of relevant topics that include morbidity as well as mortality. CEMACH runs three overarching programmes:

- maternal and perinatal mortality surveillance/confidential enquiry
- topic-specific projects in maternal and perinatal health
- the child health enquiry.

CEMACH collects data on all stillbirths and neonatal deaths in England, Wales, Northern Ireland, the Channel Islands, and the Isle of Man. As in previous years, Scotland has an independent perinatal surveillance system, but through collaboration with NHS Quality Improvement Scotland (NHS QIS), we are very pleased that we can produce perinatal mortality statistics for the whole of the UK in this report. In addition, NHS QIS has revised their data collection tools for future years (see Chapter 5) with the result that we are now working with substantially the same documentation. This will make collaboration in the future all the more comparable and valuable.

The national CEMACH perinatal mortality report includes overall stillbirth and neonatal mortality rates and trends over time, causes of death and associated risk factors, comparisons of mortality rates by Strategic Health Authorities, Neonatal Networks and NHS Trusts, and one or more focus topics.

In addition to this national report, CEMACH produces individual reports for Trusts and Strategic Health Authorities. Data can also be produced for Neonatal Networks, Primary Care Trusts, and Local Safeguarding Children Boards, but funding constraints mean that we require a contribution to our costs from these local organisations in order to produce their local report. These reports provide valuable information to clinicians and policy-makers regarding the health and well-being of their local population, and they allow organisations to benchmark themselves against others. The national report and local-level reports are intended to stimulate discussion by providers and commissioners in order to identify local issues and put in place measures to address areas of concern.

In 2007, a new perinatal death notification (PDN) form was developed to provide CEMACH with more information on each death. The form includes the new CEMACH classification of cause of death, developed by an expert panel facilitated by CEMACH. The aim of the new classification is to provide more insight into why babies die and hopefully to help identify better intervention strategies. The new PDN form was introduced on 1 January 2008. In addition, a state-of-the-art web-based database was introduced in 2008 so that information sent to CEMACH regional offices is now updated in real time.

From 2007/08, due to resource issues, CEMACH has not collected data on late fetal losses less than 24 weeks' gestation, although it continues to receive notifications of neonatal deaths from 22 weeks. It is recognised that this limits the UK's ability to provide internationally comparable perinatal statistics. The perinatal period is defined by the WHO International Classification of Diseases (10th edition) as being from 22 weeks' gestation up to 7 days after birth.¹ In Australia and New Zealand, the perinatal period commences at 20 weeks' gestation and in Canada it commences at 22 weeks. The Chief Medical Officer's report in July 2008 strongly recommended that CEMACH should present a business case for reinstating notification and data collection for late fetal losses,² and this has been submitted in 2008. Scotland and the Northern Region (England) collect data on fetal losses from 20 weeks' gestation but these are not included in this report.

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

Chapter 2 Summary of key findings

Improvements in mortality

CEMACH's national perinatal surveillance programme for 2007 has highlighted a number of positive findings. These include:

- Continuing improvements in neonatal mortality with a rate of 3.3 per 1,000 live births in 2007.
- A downward trend in the stillbirth rate from 5.7 per 1,000 total births in 2002-2004 to 5.2 per 1,000 total births in 2007.
- Continuing improvements in stillbirth and neonatal mortality rates among twin births with a 2007 stillbirth rate of 12.2 per 1,000 total births and neonatal mortality rate of 18.0 per 1,000 live births. This is encouraging in the context of increasing numbers of twins born in the UK from 2000 to 2007, although it is important to note that this increase in numbers may result in an increased contribution to stillbirth.

Variations in mortality rates

The establishment of Neonatal Networks in England has provided the ability to review variations in mortality over a specific geographical area. For 2007, CEMACH has been able to provide comparator data for individual Trusts, Neonatal Networks, and different categories of Neonatal Units as designated by the British Association of Perinatal Medicine. Some variations in mortality have been noted, including:

- Variations in adjusted perinatal mortality rates (excluding notified terminations of pregnancy, babies with lethal congenital anomalies, babies born at less than 22 weeks' gestation, babies weighing less than 500 grams and transfers into the network) between Neonatal Networks in England ranging from 3.3 to 6.8 per 1,000 total births. These variations in mortality may reflect case mix and the socio-demographic characteristics of local populations. In general, mortality rates have been stable from 2005-2007 although some networks have seen a change in either stillbirth or neonatal mortality rates.
- A variation in the stillbirth rate for average-sized Trusts (approx. 4,000 births per year), from 1.4 to 6.9 per 1,000 total births, and a similar variation in neonatal mortality from 0.2 to 2.6 per 1,000 live births. These findings may reflect at least in part differences in risk factor profiles of the women and babies cared for by individual units.
- Some variation in neonatal mortality rates between neonatal units providing the same level of care. Level 1 and level 2 units are likely to have a similar case mix, but level 3 units may have a wider variation in case mix as a result of specific specialist services linked to some of these units, which would explain at least part of the variation seen.

Hospital-to-hospital transfers

For the first time in 2007, CEMACH has provided information on hospital-to-hospital transfer patterns for neonatal deaths born at 22 weeks' gestation onwards. A fifth of babies dying in the neonatal period whose mothers initially booked at level 1 or level 2 units, were not transferred to level 3 units until after birth; the median gestation of these babies was 30 and 26 weeks respectively. In-utero transfer of preterm babies may not always be appropriate or feasible, however it is important that review of non-transfers is carried out at unit and network levels.

Low maternal age

Teenage mothers (aged less than 20 years at delivery) had the highest neonatal mortality rate of 4.4 per 1,000 live births compared to other maternal age groups. This may be due to a number of associated factors such as social deprivation and a higher rate of preterm delivery in this age group. In 2007, teenage maternities contributed 9.6% to overall neonatal mortality in England, Wales and Northern Ireland.

Maternal risk factors

Extremes of maternal age, non-White ethnicity, and maternal social deprivation continue to be risk factors for stillbirth and neonatal death, and maternal obesity is also likely to be associated with these adverse outcomes. The increase in ethnic diversity, obesity and the proportion of older mothers within the UK maternity population suggests that achieving optimal pregnancy outcomes may become more challenging in the future.

Post mortem examinations

The proportion of stillbirths and neonatal deaths where a post mortem examination was not offered to parents has decreased substantially from 2005. This is an encouraging finding and is likely to reflect the uptake by local maternity services of national-level guidance on post mortem examination and consent. There were fewer post mortems carried out for stillbirths and neonatal deaths born to Asian mothers.

Reporting of pre-viable neonatal deaths

There is a wide variation in local reporting of early neonatal deaths at less than 22 weeks' (pre-viable) gestation. In 2007, there were 213 early neonatal deaths less than 22 weeks' gestation reported to CEMACH. Neonatal deaths constitute two-thirds of overall infant mortality, and the inclusion of pre-viable gestations inevitably increases neonatal and infant mortality rates, which has implications for national and international comparisons. For these reasons, it is important that there is consistent national reporting, and front-line staff should be aware that early neonatal deaths should not be reported prior to 22 weeks' gestation.

Chapter 3 Methodology

3.1 Data sources

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

These data are collected by a network of local health professionals coordinated by the CEMACH Regional Offices. In 2007 there were six CEMACH Regional Offices in England, one in Wales and one in Northern Ireland. Every maternity unit within England, Wales, Northern Ireland and the Crown Dependencies has a CEMACH coordinator who notifies the CEMACH Regional Office of the specified deaths. Notification is carried out by completing a Perinatal Death Notification form, an example of which can be seen in Appendix A. Completed forms are sent to the relevant Regional Office.

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

This year we have been able to extend the existing long-standing collaboration with NHS Quality Improvement Scotland to include data on stillbirths and neonatal deaths. This has allowed us to provide UK-wide perinatal mortality statistics for the first time.

3.2 Data validation and cleaning

Data are compiled centrally and cross-validated with statutory registration data on stillbirths and neonatal deaths from the Office for National Statistics (ONS). Any cases that have been omitted from the usual reporting sources described above are verified with the Trust where the death occurred and then included in CEMACH figures.

CEMACH Regional Offices maintain continual contact with local unit coordinators. This communication ensures that deaths are notified directly to CEMACH, missing or invalid data can be followed up at the source and deaths notified by other sources can be confirmed.

Logical and systematic data cleaning is undertaken by CEMACH Central Office in London to identify any data errors, with reference back to NHS Trusts where necessary.

3.3 Data reporting and analysis

Perinatal mortality data are presented using birth cohorts based on a date of delivery in 2007. Denominator data on the number of live births at individual NHS Trusts are provided directly by the NHS Trust. Population based denominator data on maternities and live births used to calculate national and Strategic Health Authority rates are obtained from the ONS for England and Wales, General Register Office for Scotland (GROS) and the Northern Ireland Statistics and Research Agency (NISRA). Additional data sources are referenced throughout the report.

Stillbirth and perinatal mortality rates are per 1,000 total births and neonatal mortality rates are per 1,000 live births. All analyses have been conducted in STATA (version 8).³

Small for gestational age (SGA) has been calculated using gender, gestational age and birth weight by comparing the CEMACH dataset to a table of expected values from a British population in 1990.⁴ A baby whose birth weight is less than the 10th centile for gestation is considered small for gestational age.

Classification of deprivation has been derived from the Index of Multiple Deprivation (IMD) score 2004⁵ 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 have been ranked and quintiles of deprivation derived for the national population, with cases then allocated to the appropriate quintile of deprivation. These scores are based on the mothers, not babies, and for multiple pregnancies only first born babies have been assigned a deprivation score, to avoid double counting.

Chapter 4 Overview of perinatal and neonatal mortality in the UK

This chapter provides a summary of stillbirth rates and perinatal and neonatal mortality rates in 2007 in the UK, including trends over time, mortality in multiple pregnancies and intrapartum-related deaths.

4.1 Summary of 2007 mortality rates

In 2007, there were 6,571 babies who were stillborn or died within the first 28 days after birth that were notified to CEMACH and General Register Office for Scotland (GROS) by maternity units in England, Wales, Northern Ireland and Scotland. Notifications included 4,037 stillbirths, 6,016 perinatal deaths and 2,534 neonatal deaths. There were 1,979 early neonatal deaths and 555 late neonatal deaths. There were 772,815 live births and 776,852 total births (live births and stillbirths) (Table 4.1).

Table 4.1
Summary of mortality rates; United Kingdom: 2007

	Number	Rate
Live births	772,815	..
Total births	776,852	..
Total notifications ^a	6,571	..
Stillbirths	4,037	5.2 ^b
Perinatal deaths	6,016	7.7 ^b
Neonatal deaths	2,534	3.3 ^c
Early neonatal deaths	1,979	2.6 ^c
Late neonatal deaths	555	0.7 ^c

^a Includes stillbirths and neonatal deaths

^b Rate is number of deaths per 1,000 total births

^c Rate is number of deaths per 1,000 live births

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

In 2007, the overall stillbirth rate for the UK was 5.2 per 1,000 total births, the perinatal mortality rate was 7.7 per 1,000 total births, and the neonatal mortality rate was 3.3 per 1,000 live births (Table 4.1).

Between 2000 and 2007, the UK perinatal mortality rate has decreased significantly from 8.3 per 1,000 total births to 7.7 per 1,000 total births, while the total number of births has increased in the same time period from 682,370 to 776,860. This has been due to a decrease in all mortality rates including the stillbirth rate, and early and late neonatal mortality rates (Table 4.2). The increase in the stillbirth rate which occurred in 2002 to 2004 has not continued, with a significant downward trend to 2007; while this is a positive finding it may be too soon to draw any firm conclusions about a sustained decrease. CEMACH will continue to monitor trends on an annual basis.

Table 4.2
Overall stillbirth, perinatal and neonatal mortality rates; United Kingdom: 2000-2007

Year	Live births	Stillbirth rate ^a	Perinatal mortality rate ^a	Neonatal mortality rate ^b		
				Early (<7 days)	Late (7-27 days)	Total
2000	678,718	5.4	8.3	2.9	0.9	3.9
2001	668,849	5.4	8.1	2.8	0.9	3.7
2002	668,569	5.7	8.4	2.7	0.8	3.5
2003	695,331	5.7	8.5	2.8	0.8	3.6
2004	715,996	5.7	8.3	2.6	0.7	3.4
2005	723,067	5.3	8.0	2.7	0.8	3.5
2006	749,056	5.3	7.9	2.6	0.8	3.4
2007	772,815	5.2	7.7	2.6	0.7	3.3

^a Rate is number of deaths per 1,000 total births

^b Rate is number of deaths per 1,000 live births

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

4.2 Mortality in singleton and multiple births

Compared with singletons, babies in a multiple pregnancy have a higher risk of complications during and after pregnancy, including discordant growth, preterm birth and excess mortality. It has been shown that the rate of cerebral palsy is at least six times higher for twins and 18 times higher for triplets than for singleton babies.⁶ Additionally, one UK study found that IVF twins are ten times more likely to be admitted to a neonatal special care unit than singleton IVF babies.⁷ Previous studies including CEMACH reports have also described the higher risk of stillbirth, perinatal and neonatal mortality in twins or higher order births compared to singleton births.⁸⁻¹¹

Table 4.3 shows the contribution of multiplicity to live births, stillbirths and neonatal deaths. In 2007, babies born following a multiple birth represented 3% of all live births but 7.3% of stillbirths and 17.6% of neonatal deaths, reflecting the excess risk of adverse outcomes for these babies.

Table 4.3

Contribution of multiple births to live births, stillbirths, perinatal and neonatal deaths; United Kingdom: 2007

	Number	Percentage (%) ^a
Live births		
Singleton	748,909	97.0
Multiple	23,333	3.0
<i>Twins</i>	22,879	3.0
<i>Triplets and higher order multiples</i>	454	0.1
Total	772,242	..
Stillbirths		
Singleton	3,705	92.7
Multiple	290	7.3
<i>Twins</i>	283	7.1
<i>Triplets and higher order multiples</i>	7	0.2
Total	3,995	..
Perinatal deaths		
Singleton	5,291	89.6
Multiple	617	10.4
<i>Twins</i>	593	10.0
<i>Triplets and higher order multiples</i>	24	0.4
Total	5,908	..
Neonatal deaths		
Singleton	2,006	82.4
Multiple	429	17.6
<i>Twins</i>	411	16.9
<i>Triplets and higher order multiples</i>	18	0.7
Total	2,435	..

^a Percentages are calculated removing missing values

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

There has been an increase in multiple pregnancy rates in developed countries worldwide since the early 1970s, with a parallel increase in the use of assisted reproductive techniques (ART).¹²⁻¹⁴ It has been suggested that such regimens may result in multiple pregnancies in about a quarter of births following ART.¹⁵ In the UK in 1978, 11,941 babies were born as part of a multiple birth and in 2003 that figure had risen to 18,395 babies.¹⁶ From 2003, the Human Fertilisation and Embryology Authority (HFEA) limited the number of embryos for transfer to two in women under 40, and to three for older women.¹⁷ These measures effectively halved the proportion of triplets born in the UK from 0.04% of all maternities in 2000 to 0.02% in 2007 (Table 4.4). On the other hand, the proportion of twin maternities in the UK has risen steadily from 1.42% of all maternities in 2000 to 1.51% in 2007 (Table 4.4), and the proportion of twin pregnancies (ending prior to 24 weeks' gestation) will be even higher than this figure.

An expert group convened recently by the HFEA has highlighted the risk of increased multiple pregnancy rates due to *in vitro* fertilisation (IVF) and has recommended that this can be avoided by elective single-embryo transfer in 'at risk' women.¹⁸ A comprehensive consultation conducted by the HFEA has now concluded that there should be a professionally-led, coordinated national strategy to reduce the number of multiple births. The goal is to achieve a multiple birth rate of not more than 10% of IVF live births by 2011. This policy may impact on the proportion of twin births in future years.

Table 4.4
Proportions of maternities by multiplicity; United Kingdom: 2000-2007

	Proportions ^a of maternities (%)							
	2000	2001	2002	2003	2004	2005	2006	2007
Singleton	98.53	98.52	98.50	98.51	98.50	98.51	98.47	98.47
All multiples	1.47	1.48	1.50	1.49	1.50	1.49	1.53	1.53
<i>Twins</i>	1.42	1.45	1.47	1.47	1.47	1.47	1.51	1.51
<i>Triplets and higher order multiples</i>	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.02

^a Percentages are calculated removing missing values

Sources: ONS, NISRA-GRO, GROS

There has been a significant decrease in the stillbirth rate for twin births from 16.7 per 1,000 total births in 2000, when it was 3.4 times higher than the singleton stillbirth rate, to 12.2 per 1,000 total births in 2007. While the stillbirth rate for triplets and higher order births does not show a consistent trend over the same time frame, there has been a decrease since 2003 from being 11.8 times higher than the singleton stillbirth rate to 3.1 times higher (Table 4.5). The neonatal mortality rate in twins has declined significantly between 2000 and 2007 to reach 18.0 per 1,000 live births, although there has been no change in the risk of twin neonatal mortality compared to singletons. The neonatal mortality rate in triplets and higher order births has decreased to 39.6 per 1,000 live births in 2007 (Table 4.7). Rates for all multiples can be found in Appendix B.

During 2000–2007, first twins accounted for 41% of stillbirths in multiple births and second twins accounted for 59% of stillbirths. With regard to neonatal deaths in the same time period, 50% were first twins and 50% were second twins.

A recent study (1998-2005) of neonatal death among preterm babies in a population-based study of the Northern region of England found that only extremely premature twins (23-25 weeks' gestation) had an increased risk of neonatal death compared to singletons born at the same gestational age.¹⁹ There was no increased risk of death for twins at later gestational age groups (26-27 weeks or 28-29 weeks). In addition, when only the most recent time period was analysed (2002-2005), there was no significant difference in neonatal mortality between twins and singletons born at 23-29 weeks' gestation.¹⁹ The authors concluded that since 2002 the disadvantage of being a preterm twin has disappeared. CEMACH data show that the neonatal mortality rate has remained approximately 6-7 times higher for twins than singletons over the past eight years (Table 4.7). Given these new findings, CEMACH will use its historical data to conduct a more detailed analysis of excess risk of neonatal death among multiple births, to account for gestational age and other known risk factors.

Table 4.5
Stillbirth trends by multiplicity; United Kingdom: 2000-2007

Year	Stillbirth rates ^a			Rate ratios [95% CI] ^b	
	Singletons	Twins	Triplets and higher order multiples	Twins	Triplets and higher order multiples
2000	5.0	16.7	23.8	3.4 [3.0, 3.8]	4.8 [3.1, 7.3]
2001	5.0	17.4	40.3	3.5 [3.1, 3.9]	8.1 [5.7, 11.5]
2002	5.2	17.8	51.0	3.4 [3.0, 3.8]	9.7 [6.9, 13.7]
2003	5.3	19.1	62.2	3.6 [3.3, 4.0]	11.8 [8.2, 17.0]
2004	5.3	16.1	47.6	3.0 [2.7, 3.4]	8.9 [6.0, 13.2]
2005	5.0	13.1	32.8	2.6 [2.3, 3.0]	6.6 [4.0, 10.6]
2006	4.9	12.2	19.0	2.5 [2.2, 2.8]	3.9 [2.0, 7.5]
2007	4.9	12.2	15.2	2.5 [2.2, 2.8]	3.1 [1.5, 6.4]

^a Rate is number of deaths per 1,000 total births

^b Rate ratios are calculated using singletons as the reference group

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

Table 4.6
Perinatal mortality trends by multiplicity; United Kingdom: 2000-2007

Year	Perinatal mortality rates ^a			Rate ratios [95% CI] ^b	
	Singletons	Twins	Triplets and higher order multiples	Twins	Triplets and higher order multiples
2000	7.5	33.6	69.2	4.5 [4.1, 4.9]	9.3 [7.3, 11.8]
2001	7.2	34.9	80.6	4.8 [4.5, 5.2]	11.1 [8.7, 14.2]
2002	7.5	33.2	75.7	4.4 [4.1, 4.8]	10.0 [7.6, 13.2]
2003	7.6	34.6	129.0	4.5 [4.2, 4.9]	16.9 [13.2, 21.6]
2004	7.6	30.7	101.2	4.1 [3.7, 4.4]	13.4 [10.3, 17.4]
2005	7.2	29.4	79.9	4.1 [3.8, 4.4]	11.1 [8.2, 15.0]
2006	6.8	26.3	80.3	3.8 [3.5, 4.2]	11.7 [8.6, 15.9]
2007	7.0	25.6	43.4	3.6 [3.3, 4.0]	6.2 [4.0, 9.5]

^a Rate is number of deaths per 1,000 total births

^b Rate ratios are calculated using singletons as the reference group

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

Table 4.7
Neonatal mortality trends by multiplicity; United Kingdom: 2000-2007

Year	Neonatal mortality rates ^a			Rate ratios [95% CI] ^b	
	Singletons	Twins	Triplets and higher order multiples	Twins	Triplets and higher order multiples
2000	3.3	21.5	58.1	6.5 [5.8, 7.2]	17.6 [13.4, 23.1]
2001	3.1	22.4	53.2	7.3 [6.6, 8.1]	17.4 [12.7, 23.8]
2002	3.0	19.8	34.7	6.6 [5.9, 7.4]	11.5 [7.5, 17.7]
2003	3.0	19.9	93.4	6.6 [5.9, 7.3]	30.7 [22.6, 41.7]
2004	2.8	18.8	68.8	6.6 [5.9, 7.4]	24.2 [17.4, 33.7]
2005	2.9	20.6	63.6	7.1 [6.4, 7.9]	21.9 [15.4, 31.0]
2006	2.6	18.7	79.7	7.2 [6.5, 8.0]	30.6 [22.4, 41.8]
2007	2.7	18.0	39.6	6.7 [6.0, 7.5]	14.8 [9.4, 23.3]

^a Rate is number of deaths per 1,000 live births

^b Rate ratios are calculated using singletons as the reference group

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

4.3 Trends in intrapartum-related deaths

The last two CEMACH reports have included special focus sections on intrapartum-related mortality.^{10 11} As noted in the Chief Medical Officer's annual report in 2007, intrapartum-related deaths are of particular concern as there may be avoidable factors during labour and delivery.² The cause for many of these deaths is currently categorised as 'unknown' using the extended Wigglesworth and Obstetric classifications, but as these do not recognise fetal growth restriction as a category, they may represent missed opportunities for both appropriate diagnosis and intervention. Despite the encouragingly lower rate of intrapartum stillbirths in 2007, Table 4.8 shows that there has been no statistically significant systematic change in the rates of intrapartum-related deaths since 2000.

Table 4.8
Mortality trends by intrapartum-related^a deaths; United Kingdom: 2000-2007

Year	Stillbirths		Perinatal deaths		Neonatal deaths	
	Number	Rate ^b	Number	Rate ^b	Number	Rate ^c
2000	247	0.36	422	0.62	190	0.28
2001	242	0.36	447	0.66	227	0.34
2002	257	0.38	454	0.68	202	0.30
2003	296	0.42	495	0.71	223	0.32
2004	298	0.41	551	0.77	263	0.37
2005	293	0.40	528	0.73	239	0.33
2006	299	0.40	496	0.66	184	0.25
2007	210	0.27	445	0.57	249	0.32

^a Coded using Wigglesworth Classification category 3²⁰ for England, Wales and Northern Ireland and Paediatric Classification category 11 and 12^{21 22} for Scotland

^b Rate is number of deaths per 1,000 total births

^c Rate is number of deaths per 1,000 live births

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

In various national and regional audits, rates of substandard care among intrapartum-related deaths have been found to be high. In three audits performed in the UK - in Scotland,²³ the West Midlands²⁴ and Trent²⁵ - between 40% and 75% of cases were found to have significant or major suboptimal care factors, which may have affected the final outcome. In an international study of confidential enquiries into fetal and neonatal deaths, all 10 European countries had high levels of suboptimal care (significant or major suboptimal care in 46% of all European cases), although the regions of England and Scotland included in the study were among the highest.²⁶

It is critically important, therefore, to study in depth any possible factors during the intrapartum period that may influence pregnancy outcomes. To this end, the next major CEMACH project in its maternal and perinatal programme will be a national confidential enquiry into intrapartum-related stillbirths and neonatal deaths occurring at term. The aims of the project are to identify possible risk factors for such deaths and identify areas where service provision and clinical care during labour and delivery may be improved in order to optimise outcomes for mothers and babies.

Chapter 5 Perinatal and neonatal mortality in UK nations and Crown Dependencies

This chapter provides perinatal and neonatal mortality rates for the UK nations and Crown Dependencies, and includes an overview of maternity and neonatal services in Northern Ireland, Scotland and Wales.

England, Wales, Northern Ireland, Scotland, the Channel Islands, and the Isle of Man report stillbirths and neonatal deaths to CEMACH and GROS. The number of live births and the adjusted mortality rates for each nation and the Crown Dependencies (the Channel Islands and the Isle of Man) are shown in Table 5.1. Rates have been adjusted to exclude notified terminations of pregnancy, babies with lethal congenital anomalies, babies born at less than 22 weeks' gestation and babies weighing less than 500 grams, as it is recognised there are geographical variations in reporting of deaths in these categories. This year is the first time that CEMACH has reported the Crown Dependencies (Jersey, Guernsey and the Isle of Man) separately from England; the three islands have been combined to increase reliability of estimates. The data used to create these rates and figures are shown in Appendix C.

Table 5.1
Adjusted^a stillbirth, perinatal and neonatal mortality rates by nation: 2007

	Live births	Stillbirth rate ^b	Perinatal mortality rate ^b	Neonatal mortality rate ^c
England	655,357	3.9	5.4	2.0
Northern Ireland	24,500	3.1	4.1	1.1
Scotland	57,781	4.6	5.9	2.1
Wales	34,414	3.6	5.4	2.4
Crown Dependencies	2,477	3.6	5.2	2.0

^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams

^b Rate is number of deaths per 1,000 total births

^c Rate is number of deaths per 1,000 live births

Sources: CEMACH, ONS, NISRA-GRO, GROS

In 2007, the UK and the Crown Dependencies had an overall* adjusted stillbirth rate of 3.9 per 1,000 total births (excluding notified terminations of pregnancy, babies with lethal congenital anomalies, babies born at less than 22 weeks' gestation and babies weighing less than 500 grams), and an average** stillbirth rate of 3.8 per 1,000 total births. Stillbirth rates and relevant 95% confidence intervals are shown for each nation and the Crown Dependencies in Figure 5.1. Stillbirth rates among the nations ranged from 3.1 per 1,000 total births in Northern Ireland to 4.6 per 1,000 total births in Scotland. Scotland had a significantly higher stillbirth rate than the average stillbirth rate for the UK nations. This is the first time that comparative UK nation rates have been reported and it is possible that there will be some annual variation in rates of individual countries due to chance.

The UK and the Crown Dependencies had an overall† neonatal mortality rate of 2.0 per 1,000 live births and an average†† neonatal mortality rate of 1.9 per 1,000 live births. Neonatal mortality rates and relevant 95% confidence intervals are shown for each nation and the Crown Dependencies in Figure 5.2. Neonatal mortality rates ranged from 1.1 deaths per 1,000 live births in Northern Ireland to 2.4 deaths per 1,000 live births in Wales. Northern Ireland's neonatal mortality rate was significantly lower than the average neonatal mortality rate for the UK nations and Wales' neonatal mortality rate was significantly higher. Again, this may be due to random fluctuations, and it will be important to look at comparative mortality rates in future years.

* All stillbirths divided by all total births

** Addition of all stillbirth rates divided by the number of rates

† All neonatal deaths divided by all live births

†† Addition of all neonatal mortality rates divided by the number of rates

Figure 5.1
Adjusted^a stillbirth rates by nation: 2007

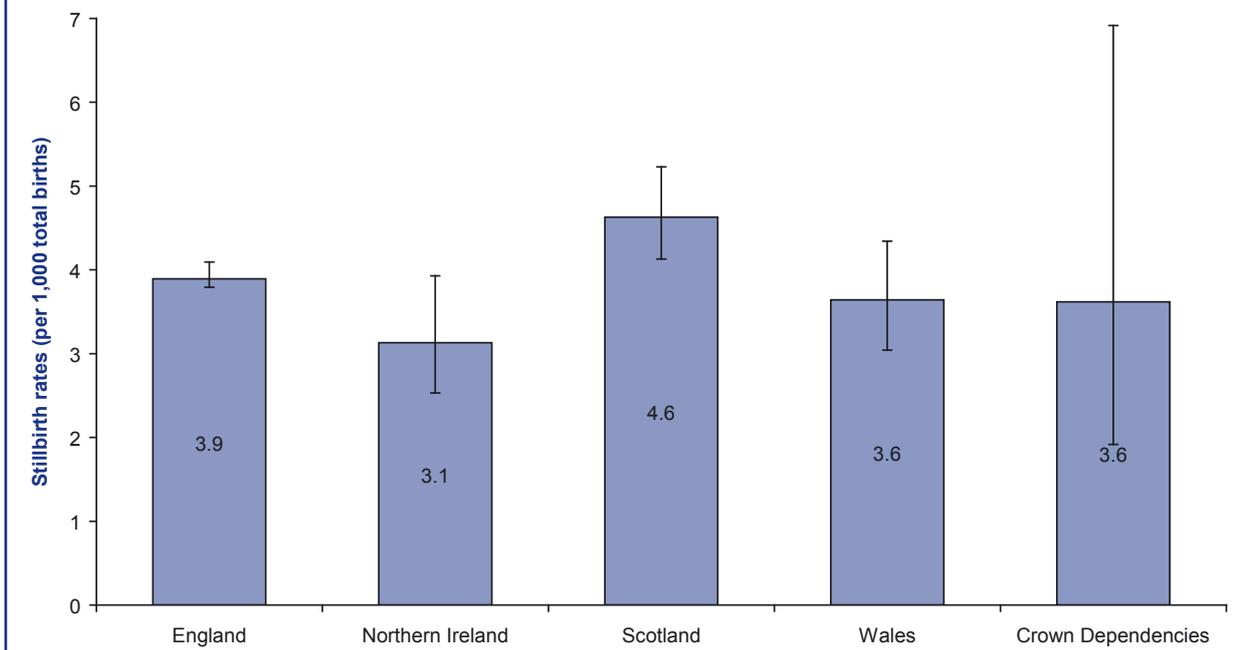
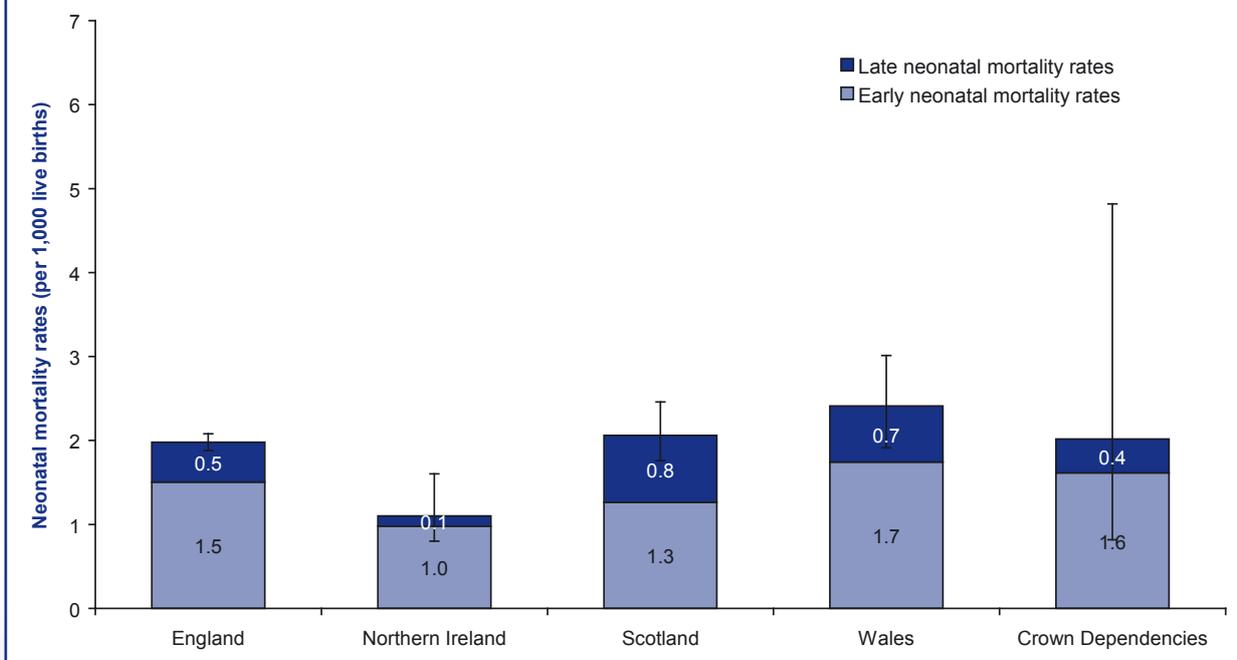


Figure 5.2
Adjusted^a neonatal mortality rates by nation: 2007



^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation and birth weight <500 grams

CEMACH leads a national perinatal and maternal surveillance system which maintains affiliation with Northern Ireland, Scotland and Wales. In this 2007 report, it has been possible to represent UK-wide perinatal mortality rates for the first time, due to strengthening of CEMACH ties with the UK nations as a whole. The continuing partnership of each nation is critical to the future success of UK-wide perinatal surveillance, and we have invited each nation to contribute to this report. In the following spotlight sections, collaborators in Northern Ireland, Scotland and Wales have provided an overview of maternity and infant services, including a discussion of the policies, initiatives, challenges, and successes for each nation.

Spotlight on Northern Ireland

Maternity and Newborn Services in Northern Ireland: Challenges and Successes by Dr. Angela Bell and Dr. Elizabeth Reaney

Overview

Northern Ireland is a region with a growing population of over 1.75 million, with 24,500 births registered in 2007. Its size brings advantages of good networking and communication but also means that on occasions some patients do have to travel outside of Northern Ireland for highly specialised care such as Extra Corporeal Membrane Oxygenation (ECMO).

Maternity services

Maternity services in Northern Ireland are currently provided by five Trusts in 12 different units, ten of which provide consultant-led inpatient obstetric services and two providing only outpatient services. The size of the ten consultant-led units ranges from around 1,200 to 5,500 births per year. Tertiary perinatal services are provided in one centre at the Royal Jubilee Maternity Hospital, the largest of the units.

An increasing number of women choose to have midwifery-led care. Whilst this is offered by all of the maternity services, in two of the units it is provided in dedicated along-side midwifery-led units. Factors likely to affect future provision of maternity services include reconfiguration of acute hospital services; the need to increase consultant obstetric cover in labour wards; and the need for obstetric units to have on-site paediatric services.

Newborn services

Regional neonatal services are provided in the Royal Jubilee Maternity Hospital in Belfast. In addition, four area units across Northern Ireland provide neonatal services at all three levels of care. Two additional units provide special care only. The neonatal units work closely together through a developing regional neonatal network providing neonatal care for the majority of babies born in Northern Ireland. Occasionally a baby may require transfer outside Northern Ireland for clinical reasons or very rarely if all cots are occupied. CONNECCT (Child Or Neonate NEeding Critical Care Transport) is a new regional neonatal and paediatric transport service which will ultimately provide specialist transfer for ill babies and children. Initial and ongoing development of the service and staff training has also led to increased networking opportunities between units.

Challenges

The organisation of health and social services in Northern Ireland has been undergoing major change. Eighteen Trusts were merged to form five Health and Social Care Trusts, which came into being in April 2007. This presented many challenges for staff as new personnel were appointed and new policies put in place. The Regional Quality Improvement Authority (RQIA), the independent health and social care regulatory body for Northern Ireland, has just commenced a review of maternity services which will take place over the next year.

Other challenges faced in Northern Ireland are similar to many areas of the UK. The number of births has risen for the fifth year in succession, with 1,200 more babies born in 2007 compared with 2006 (5% increase). The two main factors accounting for this increase are the rising number of births to women in their thirties and also an increase in births to mothers who have moved to Northern Ireland from other countries, particularly Eastern Europe. Caring for a more diverse range of women poses additional challenges of culture and language.

Successes

Despite the rising birth rate and major reorganisation of health services in Northern Ireland, trends in neonatal mortality and stillbirth rates have shown a reduction in this report. Since 2000, Northern Ireland has shown a steady reduction in stillbirth rate during the years when CEMACH has been concerned about the failure to make any improvement in stillbirth rates in England and Wales. The reasons for this reduction are likely to be complex and warrant further investigation.

The Neonatal Intensive Care Outcomes, Research and Evaluation (NICORE) group work very closely with CEMACH to investigate factors relating to the quality of neonatal care and outcome for those babies who received specialist neonatal care. This work has been ongoing since 1993 and provides qualitative and quantitative information to complement the CEMACH reports.

Previous CEMACH reports have highlighted the importance of accurate documentation and communication between professionals. One new initiative in Northern Ireland, which will impact on quality of care, is the development of a standard hand-held maternity record for use across Northern Ireland. It is hoped to pilot this in 2009. In the field of neonatal care, another new initiative is the introduction of a live patient management system for neonatal care (Badgernet; Clevermed). It is also hoped to roll this out during 2009.

When considering successes it is important to applaud the ongoing support and participation of staff from all the units through their unit coordinators. Without their contribution reports such as this would not be possible. In Northern Ireland we look forward to continued cooperation and good working relationships with all staff involved in the full range of CEMACH enquiries.

Spotlight on Scotland

Perinatal Mortality in Scotland: Reporting and Developments by Dr. Christopher Lennox

Scotland has collected and analysed information on perinatal mortality since 1974 with a gradually increasing amount of detail. Since 1986, deaths have been classified using the Wigglesworth system.¹⁻³ In recent years, information on post neonatal mortality (28 days to one year of age), late fetal losses (20-24 weeks' gestation) and the birth prevalence of certain congenital anomalies has also been gathered. A variety of agencies have overseen this process over the years, and the work is currently undertaken jointly by the Information Services Division of NHS Scotland and the Reproductive Health Programme of NHS Quality Improvement Scotland. Information collected depends on stillbirth and death registrations and on data gathered from designated coordinators within Scotland's maternity units. While much of this still depends on a paper trail, consideration is being given to collecting as much information as possible electronically, which may improve confidentiality, data completeness and analysis.

One of the strengths of the Scottish system has been the continuity of methodology and the consistency of classification of the causes of perinatal mortality. Since the Wigglesworth classification was introduced 22 years ago, only four individuals have classified the deaths. This has allowed valid comparisons of rates and causes on a continuing annual basis. In recent years, however, the weakness of a functional classification system based on knowledge in the 1980s has been recognised. Recent advances in the understanding of placental function and pathophysiology and in the recognition of fetal growth restriction (FGR) cannot be reflected in the existing classification system. This, among other reasons, is probably responsible for the persistently high proportion of stillbirths which are classified as "unexplained" – 65% of singleton stillbirths in 2007. CEMACH have reached similar conclusions and have introduced a perinatal death notification form which recognises this. In 2009, Scotland will introduce additional limited coding to identify placental dysfunction and FGR and will consider utilising notification forms similar to the new CEMACH form in 2010. The experiences of CEMACH in the completion of the new form and its analysis will be informative.

Changes in the administration and oversight of data collection during 2008 and recognition of the wealth of longitudinal information available have led to the production of a report on trends and associations in Scottish perinatal mortality since the present recording system was established in the 1970s. This report will be published early in 2009. Issues highlighted in this report will include the following:

- A rise in the birth rate in recent years after many years of decline
- After a steep fall in stillbirths in the 1970s, little decline in the stillbirth rate since the 1980s
- The association between perinatal mortality and a number of factors, notably: preterm birth; maternal age; multiple births; certain obstetric conditions; babies small for gestational age; socio-economic deprivation; smoking
- Changes in post mortem examination rates
- Trends in antepartum and intrapartum stillbirths.

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Spotlight on Wales

Perinatal and infant mortality surveillance in Wales

by Dr. Roshan Adappa

The perinatal surveillance has been carried out for the last 15 years by the All Wales Perinatal Survey (AWPS), funded by the Welsh Assembly Government, and it works alongside the Confidential Enquiry into Maternal and Child Health (CEMACH). The survey provides CEMACH with a subset of the collected data. The survey collects data from 20 weeks' gestation to one year of age.

Wales has a population of about 2.9 million, distributed over a geographical area of 8,016 square miles. The most densely populated urban areas are in the South East, and there are large rural areas in the North and the Mid West of Wales. The obstetric and paediatric services are provided by 13 consultant-led units and several smaller midwifery-led units. Having seen a declining birth rate in the 1990s until 2002, there has been a year-on-year increase in births. In 2007, the number of registrable births in Wales was 34,644 - a rise of 15.7% since 2002. Of these, 96% of births to Welsh resident mothers occurred in Welsh hospitals and midwifery-led units. Homebirths in 2007 constituted 3.6% (1,230) of the total births. As part of our data collection from units, we also collect rates of caesarean section rates (24.2%), induction of labour (20%), ventouse delivery (5.8%) and forceps delivery (4%).

The last 15 years of perinatal and infant mortality surveillance has led to several local projects including:

- A study of two-year outcomes following preterm birth and concordance with Health status questionnaire
- A study of perinatal and infant post mortem examination, which has led to centralisation of perinatal pathology services
- A project focusing on the association between deprivation and mortality rates
- Ongoing review of post mortem examination rates
- Ongoing review of infant mortality rates
- Development of one-year survival charts showing survival rates of preterm infants by gestation and birth weight for use by clinicians across Wales.¹⁻⁵

Wales has been an active participant in CEMACH projects and, in addition, has been involved as one of the pilot areas for the recently concluded childhood death review. Clinicians, public health personnel, local health boards and the Welsh Assembly Government are actively using the CEMACH/AWPS data for clinical, public health and managerial purposes, as evidenced by annual feedback. We look forward to continued cooperation and joint working with CEMACH.

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Chapter 6 Perinatal and neonatal mortality in Strategic Health Authorities, Neonatal Networks and individual NHS Trusts

This chapter provides an overview of stillbirth, perinatal and neonatal mortality rates in Strategic Health Authorities and Neonatal Networks (England), and individual NHS Trusts in England, Wales and Northern Ireland.

6.1 Strategic Health Authorities (England)

Strategic Health Authorities (SHAs) came into being in 2002 to manage the NHS at a regional level. SHAs are responsible for ensuring the quality and performance of local health services and integrating national priorities. There are currently 10 SHAs in England.

The adjusted mortality rates for each NHS Strategic Health Authority for 2005-2007 are shown in Table 6.1. SHAs have been presented by their number of live births in descending order. Rates have been adjusted to exclude notified terminations of pregnancy, babies with lethal congenital anomalies, babies born at less than 22 weeks' gestation and babies weighing less than 500 grams. Deaths are assigned to an SHA using the postcode of the mother's residential address. It is recognised that variations in mortality rates between SHAs may reflect socio-demographic differences of the local maternity populations, and should therefore not be used as a measure of the quality of maternity care provided. In addition, there is inevitably some variation in rates from year to year and it is also important to review trends over time. Data used to create the table and figures are included in Appendix D.

Table 6.1
Adjusted^a stillbirth, perinatal and neonatal mortality rates by SHA; England: 2005-2007

	Stillbirth rate ^b			Perinatal mortality rate ^b			Neonatal mortality rate ^c		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
England	4.1	4.1	3.9	5.7	5.7	5.4	2.1	2.3	2.0
London	4.7	4.7	4.4	6.3	6.4	5.9	2.3	2.4	2.1
North West	4.3	4.1	4.0	5.8	6.0	5.3	2.3	2.5	1.8
West Midlands	4.6	4.0	4.0	6.7	5.8	6.0	2.7	2.5	2.5
East of England	3.2	3.3	3.4	4.5	4.6	4.9	1.6	1.8	1.7
Yorkshire and the Humber	4.8	4.3	4.6	6.6	6.4	6.3	2.2	2.7	2.4
South West	3.3	3.7	3.4	4.6	5.0	4.7	1.9	1.9	1.8
East Midlands	4.0	4.4	3.5	5.6	6.1	5.0	2.2	2.6	2.1
South Central	4.0	3.7	3.5	5.3	5.0	4.8	1.7	1.5	1.7
South East Coast	3.2	3.5	3.6	4.6	4.7	4.8	1.7	1.8	1.6
North East	4.4	4.5	3.7	6.0	6.6	5.2	2.1	2.8	1.9

^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams

^b Rate is number of deaths per 1,000 total births

^c Rate is number of deaths per 1,000 live births

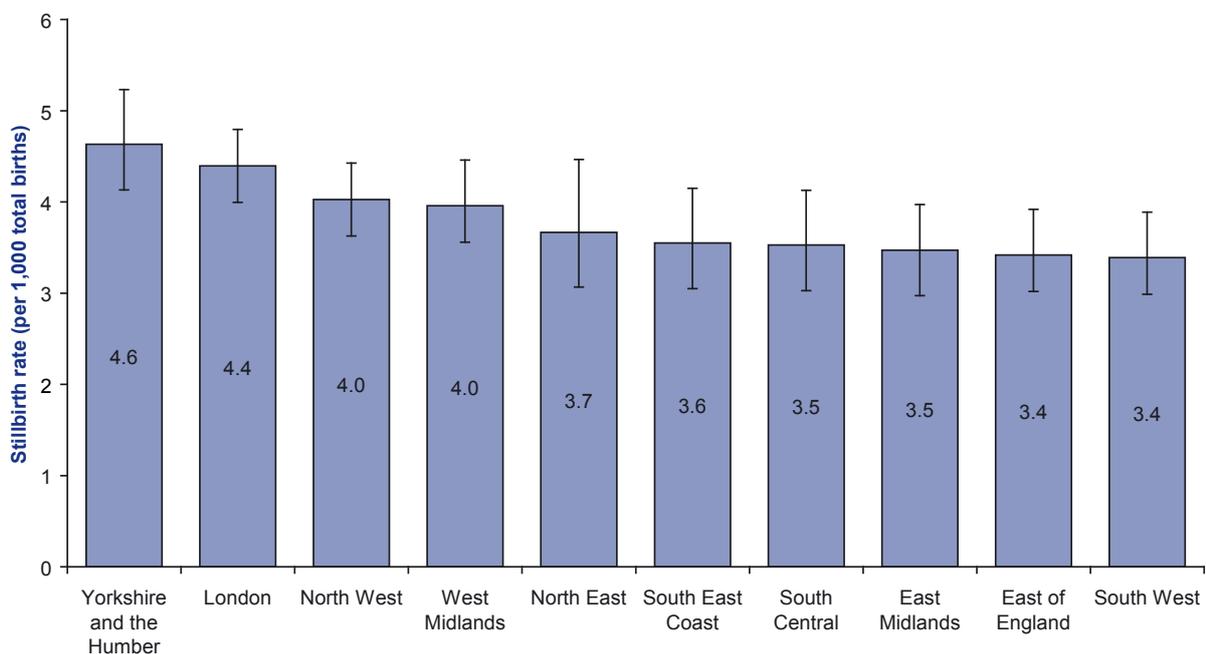
Sources: CEMACH, ONS

In 2007, England had an overall* stillbirth rate of 3.9 per 1,000 total births and the SHA average** stillbirth rate was 3.8 per 1,000 total births. Stillbirth rates and relevant 95% confidence intervals are shown for each SHA in Figure 6.1. Stillbirth rates among SHAs ranged from 3.4 per 1,000 total births (East of England and the South West) to 4.6 per 1,000 total births (Yorkshire and the Humber). London and Yorkshire and the Humber had stillbirth rates that were significantly higher than the average SHA rate; as mentioned above, this is likely to reflect socio-demographic differences in the local maternity populations.

Early and late neonatal mortality rates and relevant 95% confidence intervals are shown for each SHA in Figure 6.2. In 2007, England had an overall† neonatal mortality rate of 2.0 per 1,000 live births and the average†† SHA neonatal mortality rate was also 2.0 per 1,000 live births. Neonatal mortality rates among SHAs ranged from 1.6 deaths per 1,000 live births (South East Coast) to 2.5 deaths per 1,000 live births (West Midlands). West Midlands and Yorkshire and the Humber had neonatal mortality rates that were significantly higher than the average SHA rate and South East Coast had a neonatal mortality rate that was significantly lower than the average SHA rate. Again, this is likely to reflect socio-demographic differences in the local maternity populations.

In general, SHA stillbirth and neonatal mortality rates have been fairly stable over 2005–2007 although some SHAs have shown an encouraging decrease in stillbirth or neonatal mortality rates.

Figure 6.1
Adjusted^a stillbirth rates by SHA; England: 2007



^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation and birth weight <500 grams

* All stillbirths divided by all total births

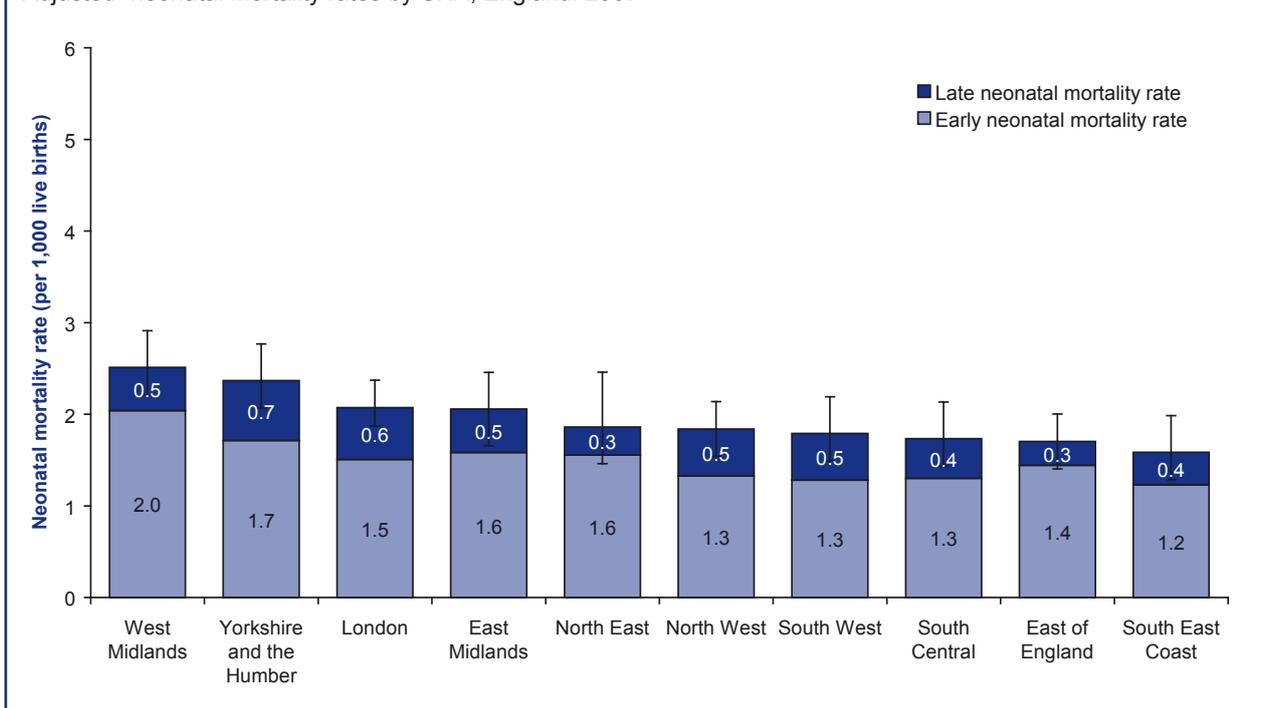
** Addition of all stillbirth rates divided by the number of rates

† All neonatal deaths divided by all live births

†† Addition of all neonatal mortality rates divided by the number of rates

Figure 6.2

Adjusted^a neonatal mortality rates by SHA; England: 2007



^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation and birth weight <500 grams

6.2 Neonatal Networks (England)

Managed Clinical Neonatal Networks are a linked group of neonatal units which work together to deliver different levels of perinatal care to a defined geographical area with a shared referral pattern. The goal of a Managed Clinical Network is to deliver care in a coordinated manner to ensure equitable provision of a high-quality clinically effective service.²⁷ Since 2005, CEMACH has reported stillbirth and neonatal mortality rates by Neonatal Network.

In 2007, there were a total of 24 Neonatal Networks in England covering from 16,804 to 41,910 live births each. Table 6.2 shows the adjusted mortality rates for Neonatal Networks for 2005–2007. Rates have been adjusted to exclude notified terminations of pregnancy, babies with lethal congenital anomalies, babies born at less than 22 weeks' gestation, babies weighing less than 500 grams and in-utero and ex-utero transfers into the Network. The numerator therefore reflects only those babies who booked and died within the Network. It should be noted that the denominator for these rates is all babies (including in-utero and ex-utero transfers into the Network) born within the Trusts in the Network, as transfer status of live births is not currently available. Neonatal Networks have been presented according to their number of live births in descending order. In general, mortality rates have been stable over 2005–2007 although some Neonatal Networks have seen a change in either stillbirth or neonatal mortality rates.

There was marked geographical variation in the percentage of neonatal deaths reported at pre-viable gestations (0% to 25% of neonatal deaths reported were less than 22 weeks' gestation, see Appendix E). There was also a variation in deaths due to lethal congenital anomalies, ranging from 10% in the South West Peninsula Neonatal Care Managed Clinical Network to 25% in the North Central London Neonatal Network (Appendix E). This may be due to differences in identification and reporting procedures but may also be due to differences in local population risks.

It is recognised that there may be reasons for variations in mortality rates, including differences in the risk factor profiles of women and babies cared for by Trusts within a Network and the socio-demographic characteristics of the local maternity population. Additionally, it should be noted that by definition 2.5% of Networks may be above and below the 95% confidence limit of the average network rate due to chance alone. Networks should be aware of their position and review their data, especially if they are an outlier over consecutive years.

We are grateful to Neonatal Networks for their agreement to include their data in this chapter.

Table 6.2
Adjusted^a stillbirths, perinatal and neonatal mortality rates by Neonatal Network; England: 2005-2007

Neonatal Network	Stillbirth rate ^b			Perinatal mortality rate ^b			Neonatal mortality rate ^c		
	2005	2006	2007	2005	2006	2007	2005	2006	2007
Yorkshire	4.6	3.4	4.4	5.7	4.8	5.6	1.6	1.7	1.7
Greater Manchester	4.5	3.6	4.2	5.5	5.3	5.6	1.9	2.1	1.8
Northern	4.2	4.2	3.6	5.5	6.1	5.0	1.7	2.4	1.7
Central	3.8	4.1	3.0	4.9	5.3	4.6	1.4	1.6	1.9
Western	3.0	3.2	2.9	3.9	4.2	3.9	1.3	1.5	1.5
North East London and North Middlesex	4.5	4.1	4.3	5.5	5.1	5.4	1.2	1.5	1.5
North West London	3.5	3.7	3.8	5.0	4.6	4.8	1.9	1.4	1.3
Southern West Midlands	4.7	4.5	4.1	6.6	6.4	5.8	2.2	2.3	1.9
Cheshire and Merseyside	3.6	3.9	3.5	5.2	5.3	4.6	2.3	1.8	1.4
Thames Valley	3.3	3.1	3.9	4.5	4.1	5.3	1.6	1.2	1.8
Surrey and Sussex	3.1	3.2	3.1	4.1	4.1	3.9	1.2	1.2	1.0
Central South Coast	3.6	3.1	2.9	4.4	4.1	4.0	1.1	1.3	1.2
Norfolk, Suffolk and Cambridgeshire	2.2	2.9	3.2	3.2	4.0	4.5	1.3	1.5	1.5
South East London	3.1	4.5	5.2	4.2	5.8	6.8	1.3	1.5	1.9
North Trent	3.8	3.7	4.3	5.2	4.9	5.9	1.7	1.8	2.0
Staffordshire, Shropshire and Black Country	4.5	3.9	4.0	6.5	5.4	6.2	2.8	2.0	2.6
Trent	3.7	3.6	3.3	5.6	5.1	4.5	2.4	2.2	1.7
South West Peninsula	2.9	3.2	3.9	4.1	4.3	5.2	1.7	1.5	1.7
Kent and Medway	3.7	2.8	3.3	5.0	3.4	4.3	1.5	0.8	1.1
Essex	3.0	2.9	2.9	3.8	3.9	3.6	0.9	1.2	0.7
Beds and Herts	3.7	3.3	3.5	4.8	3.9	4.8	1.2	0.6	1.3
Lancashire and South Cumbria	3.4	4.1	3.5	4.3	4.9	4.6	1.2	1.1	1.5
North Central London	3.4	3.5	2.7	4.5	4.5	3.3	1.2	1.1	0.8
South West London	3.5	3.9	3.1	4.8	5.4	4.0	1.6	1.7	1.0

^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500g and transfers into the Network

^b Rate is number of deaths per 1,000 total births

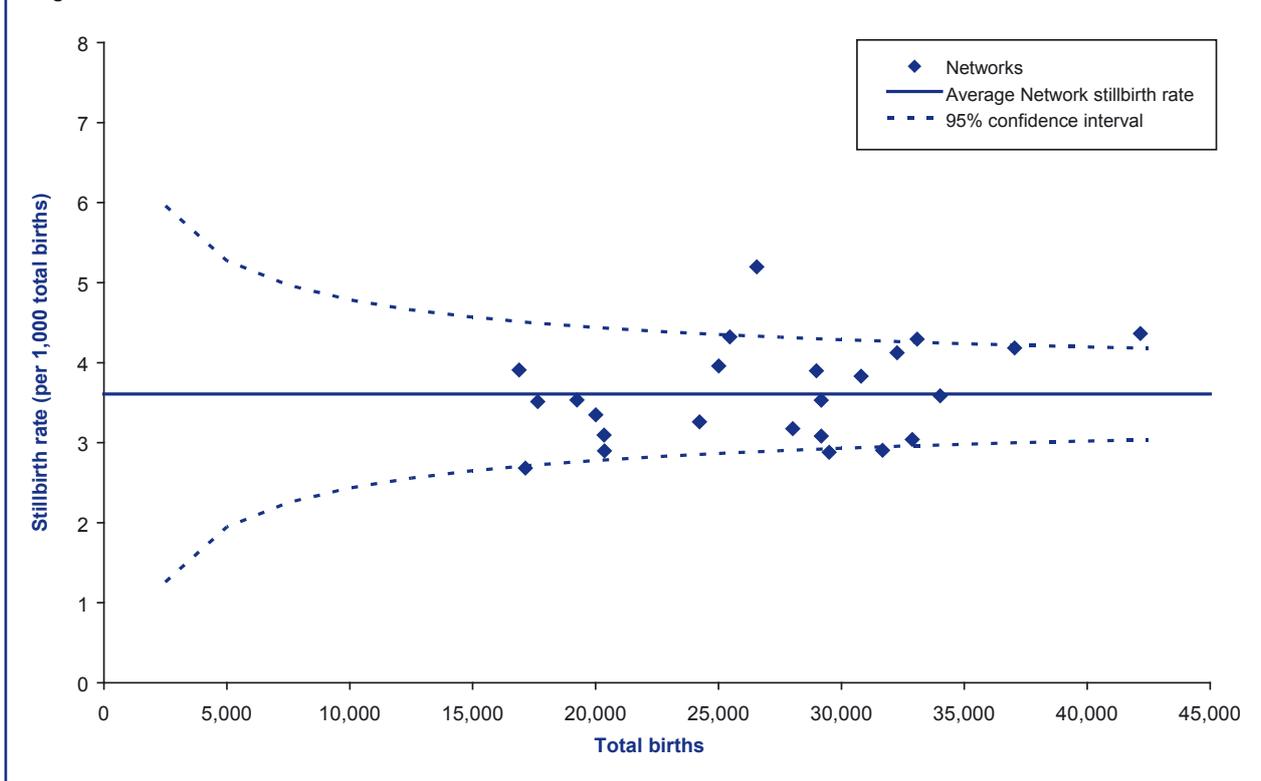
^c Rate is number of deaths per 1,000 live births

Sources: CEMACH

Figures 6.3, 6.4 and 6.5 further illustrate the data seen in Table 6.2. The funnel plots show the mortality rate for each Network plotted against the total number of births for that Network. The average rate of all Networks is indicated by the solid horizontal line, and the 95% confidence limits are delineated by the dotted lines. Networks above or below the dotted lines have a mortality rate that is significantly different from the average Network rate. For instance, in Figure 6.4, there are five Networks above the dotted line, and these have a perinatal mortality rate that is statistically greater than the average perinatal mortality rate.

Figure 6.3

Adjusted^a stillbirth rates compared to the average Network stillbirth rate and associated 95% confidence interval: England, 2007



^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams and transfers into the Network

Figure 6.4

Adjusted^a perinatal mortality rates compared to the average Network perinatal mortality rate and associated 95% confidence interval: England, 2007

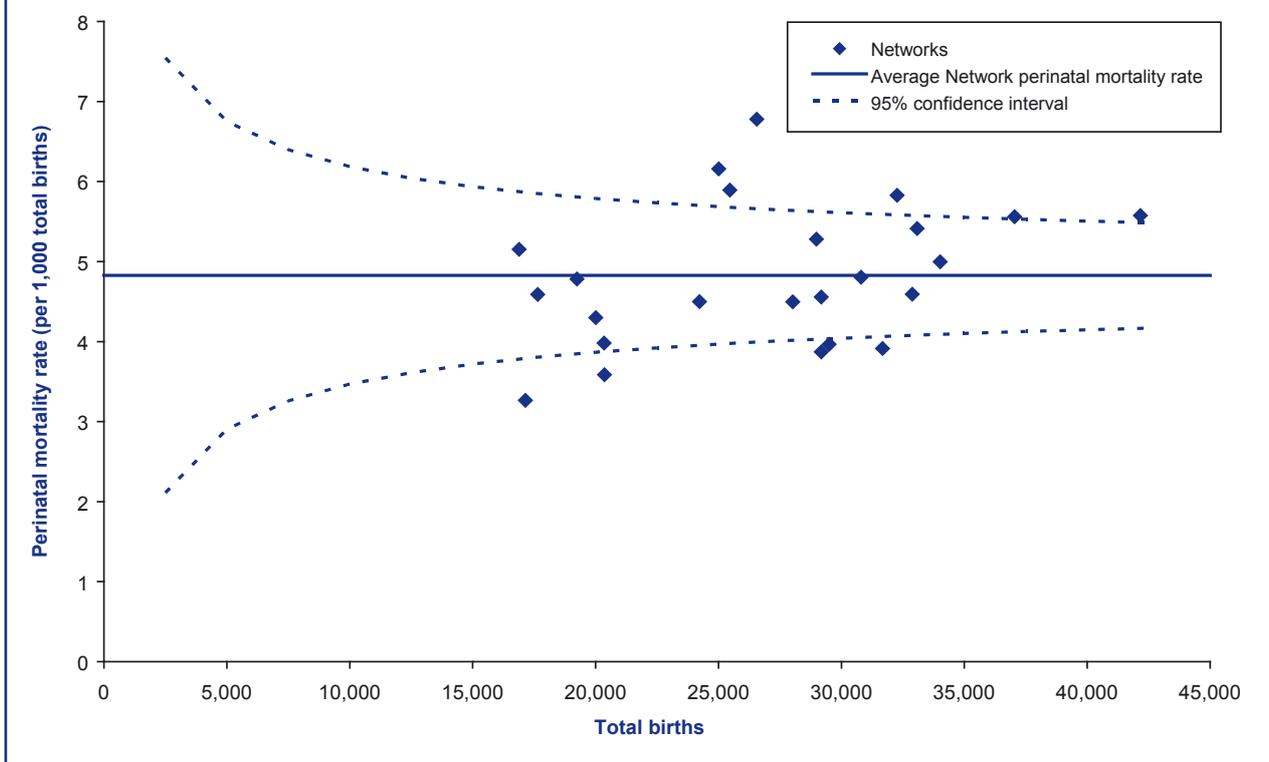
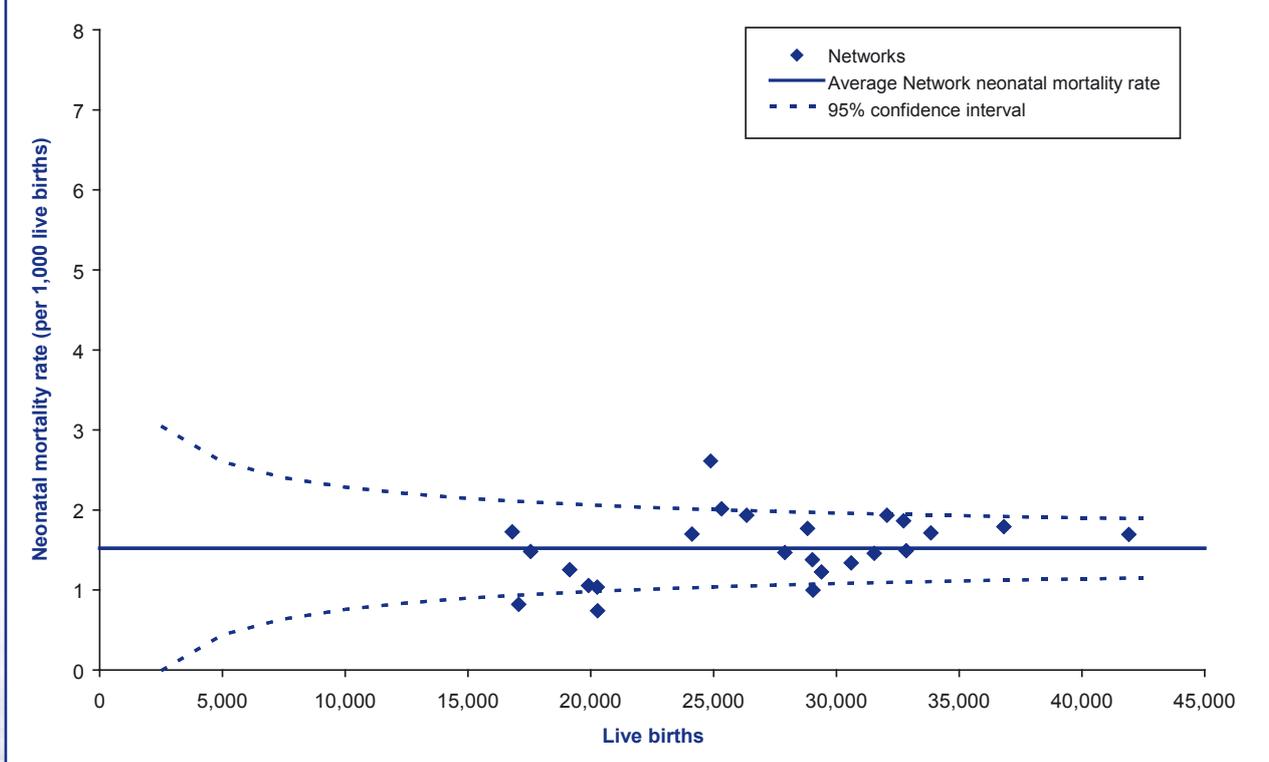


Figure 6.5

Adjusted^a neonatal mortality rate compared to the average Network neonatal mortality rate and associated 95% confidence interval: England, 2007



^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams and transfers into the Network

6.3 NHS Trusts

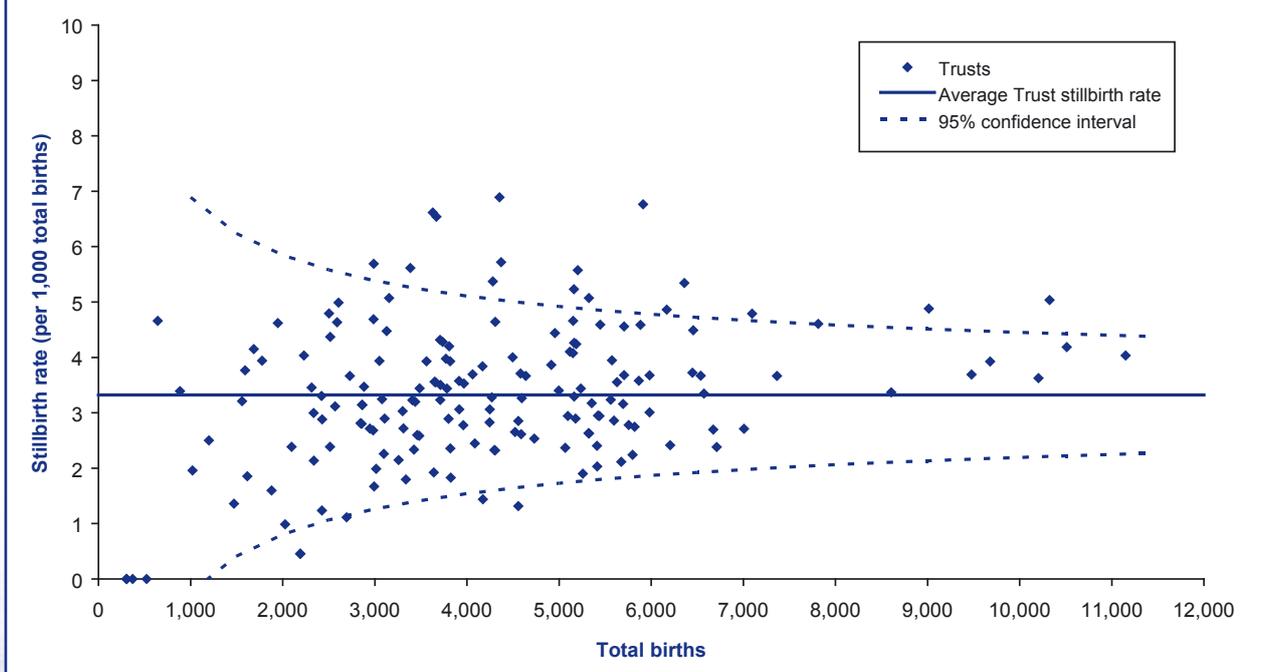
In 2007, there were a total of 168 Trusts with maternity services in England, Wales, Northern Ireland and the Crown Dependencies with a range of 304 to 11,151 total births. Mortality rate variations between Trusts are presented in Figures 6.6, 6.7 and 6.8. Rates have been adjusted to exclude notified terminations of pregnancy, babies with lethal congenital anomalies, babies born at less than 22 weeks' gestation, babies weighing less than 500 grams and transfers into the Trust. As with the Network data in the previous section, the funnel plots (Figures 6.6, 6.7 and 6.8) show the mortality rate for each Trust plotted against the number of total births for that Trust. The average Trust mortality rate is indicated by the solid horizontal line, and the 95% confidence limits are delineated by the dotted lines. Trusts above or below the dotted lines have mortality rates that are significantly different from the average Trust rate.

In 2007, the average Trust size in England, Wales, Northern Ireland and the Crown Dependencies was 4,268 total births per year. Trusts with a range of 4,168 to 4,368 total births per year had a marked variation in stillbirth rates (ranging from 1.4 to 6.9 per 1,000 total births) (Figure 6.6) and in neonatal mortality (ranging from 0.2 to 2.6 per 1,000 live births) (Figure 6.8).

It is recognised that there may be reasons for variations in mortality rates between Trusts, including differences in the risk factor profiles of women cared for by the individual Trust and the socio-demographic characteristics of the local maternity population. It should, therefore, not be used as a measure of the quality of maternity care provided. CEMACH produces annual reports for each Trust which compares their mortality rates against the national average. Additionally, it should be noted that by definition 2.5% of Trusts may be above and below the 95% confidence limit of the average Trust rate due to chance alone. Trusts should be aware of their position and review their data, especially if they are an outlier over consecutive years.

Figure 6.6

Adjusted^a stillbirth rates compared to the average Trust stillbirth rate and associated 95% confidence interval: England, Wales, Northern Ireland and the Crown Dependencies, 2007



^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams and transfers into the Trust

Figure 6.7

Adjusted^a perinatal mortality rates compared to the average Trust perinatal mortality rate and associated 95% confidence interval: England, Wales, Northern Ireland and the Crown Dependencies, 2007

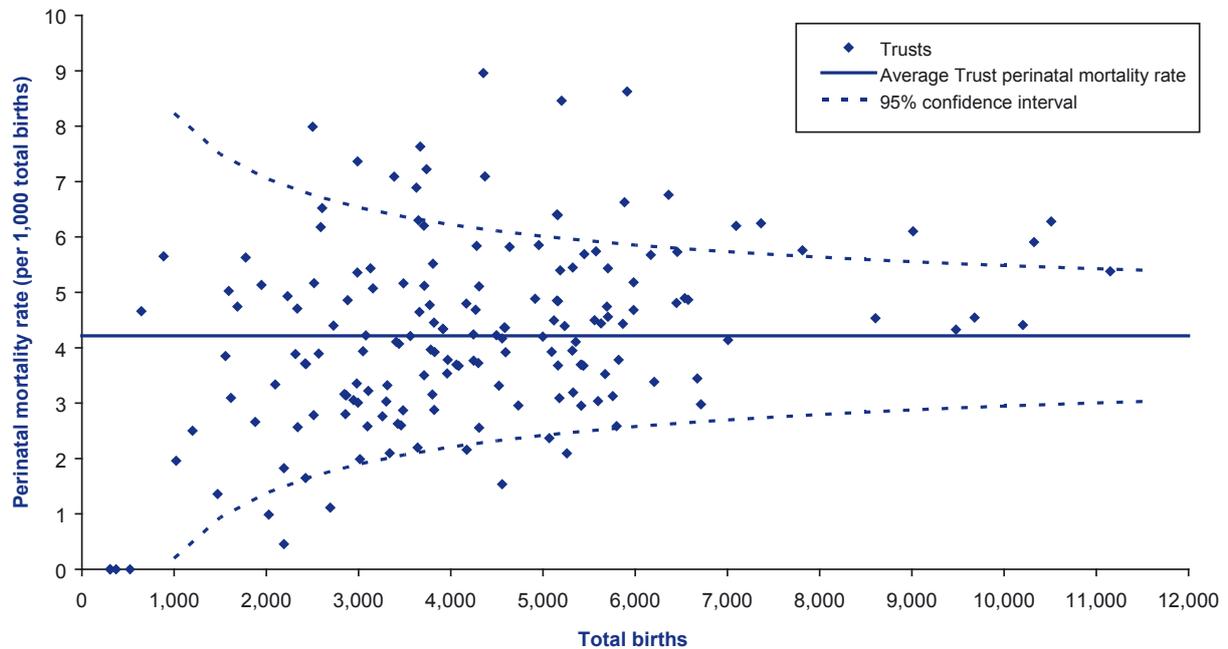
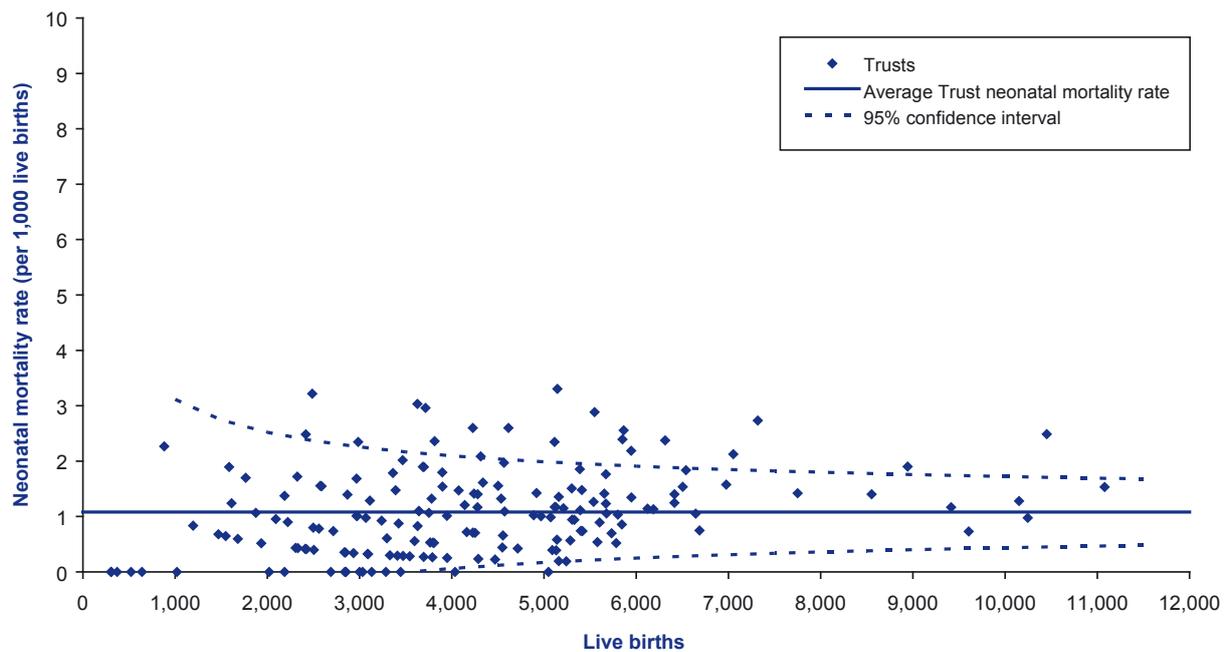


Figure 6.8

Adjusted^a neonatal mortality rates compared to the average Trust neonatal mortality rate and associated 95% confidence interval: England, Wales, Northern Ireland and the Crown Dependencies, 2007



^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams and transfers into the Trust

Chapter 7 Risk factors for stillbirths and neonatal deaths

This chapter summarises the known risk factors for stillbirth and neonatal death in England, Wales, and Northern Ireland in 2007. Ongoing investigation of the risk factors for stillbirths and neonatal deaths is essential in order to consider strategies to reduce mortality at a population level. Neonatal mortality currently contributes 68% to overall infant mortality in England and Wales.²⁸

Previous CEMACH reports have demonstrated that certain maternal socio-demographic characteristics, as well as earlier gestational age and lower birth weight, are significantly associated with stillbirth and neonatal death. This agrees with other recent studies, which have demonstrated an association of specific health-related and socio-demographic maternal characteristics with adverse pregnancy outcome.^{29 30}

For the first time, CEMACH has been able to examine late booking for antenatal care as a risk factor for stillbirth and neonatal death.

7.1 Maternal age

Stillbirth, perinatal and neonatal mortality rates vary considerably by maternal age. Mothers who are over 35 years have been found to have an increased risk of stillbirth and neonatal death compared to younger mothers, with the magnitude of the risk increasing from 40 years of age onwards.³¹⁻³³ Maternal age less than 20 years has also been found to be associated with increased risk of neonatal death,³⁴ although this may be partially explained by higher levels of deprivation³⁵ and an increased risk for preterm delivery in these women.³⁶

The proportion of all maternities in each age group is described in Table 7.1. Since 2000, the proportion of teenage maternities (defined for this report as women aged less than 20 years) appears to be decreasing (significant test for trend $p < 0.001$). The proportion of maternities in mothers 35-39, as well as 40 years old and above, is increasing (significant test for trend $p < 0.001$).

Table 7.1
Proportions of all maternities by maternal age; England, Wales and Northern Ireland: 2000-2007

Year	Proportions ^a of maternities (%)					
	<20	20-24	25-29	30-34	35-39	40+
2000	7.7	17.9	28.3	29.7	14.0	2.5
2001	7.5	18.4	27.0	30.0	14.5	2.7
2002	7.3	18.7	25.8	30.2	15.1	2.9
2003	7.2	18.8	25.4	30.1	15.6	3.0
2004	7.1	18.9	25.1	29.7	15.9	3.2
2005	7.0	18.9	25.5	29.1	16.0	3.4
2006	6.8	19.1	25.9	28.3	16.4	3.5
2007	6.5	19.0	26.6	27.7	16.6	3.6

^a Percentages are calculated removing missing values

Sources: ONS, NISRA-GRO

Table 7.2 shows the overall stillbirth, perinatal and neonatal mortality rates for each maternal age group. Women in the age group 30-34 years have the lowest rate of stillbirths, perinatal and neonatal death. Compared to women aged 30-34 years, women aged 40 years and above have a significantly higher rate of stillbirth (7.7 per 1,000 maternities, $p < 0.001$), while women aged less than 20 years have a significantly higher rate of neonatal death (4.4 per 1,000 maternities, $p < 0.001$). This may reflect the fact that while teenage pregnancies and pregnancies in women greater than 40 years are both associated with preterm delivery and low birth weight,^{32 34 36 37} older women have a higher incidence of antenatal complications such as essential hypertension, pre-eclampsia, gestational diabetes and placental abruption, which can all contribute to stillbirth.^{32 33}

Maternities in women less than 20 years currently contribute 9.6% to overall neonatal mortality in England, Wales and Northern Ireland. Univariate analysis is necessarily limited in explaining the reasons for the increased risk of stillbirth and neonatal death seen in these women; however Tables 7.3 and 7.4 show that 80% of teenage mothers having a stillbirth or neonatal death are of White ethnic origin and 73% are in the two most deprived population quintiles.

Table 7.2

Stillbirth, perinatal and neonatal mortality rates by maternal age; England, Wales, Northern Ireland and Channel Islands: 2007

Maternal age	Stillbirths ^a		Perinatal deaths ^a		Neonatal deaths ^a	
	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c
<20	5.6 [4.9, 6.3]	1.2 [1.0, 1.4]	8.9 [8.1, 9.8]	1.3 [1.1, 1.4]	4.4 [3.8, 5.1]	1.6 [1.3, 1.8]
20-24	5.1 [4.7, 5.5]	1.1 [1.0, 1.2]	7.6 [7.1, 8.1]	1.1 [1.0, 1.2]	3.2 [2.9, 3.5]	1.1 [1.0, 1.3]
25-29	5.1 [4.7, 5.4]	1.1 [1.0, 1.2]	7.2 [6.8, 7.6]	1.0 [1.0, 1.1]	2.7 [2.5, 3.0]	1.0 [0.9, 1.1]
30-34	4.7 [4.4, 5.0]	..	6.9 [6.6, 7.3]	..	2.8 [2.6, 3.1]	..
35-39	5.3 [4.9, 5.7]	1.1 [1.0, 1.2]	7.6 [7.2, 8.2]	1.1 [1.0, 1.2]	3.0 [2.7, 3.3]	1.1 [0.9, 1.2]
40+	7.7 [6.7, 8.8]	1.6 [1.4, 1.9]	10.3 [9.1, 11.6]	1.5 [1.3, 1.7]	3.4 [2.7, 4.2]	1.2 [1.0, 1.5]

^a Second and subsequent deaths from pregnancies with multiple losses excluded from this table

^b Rate is number of deaths per 1,000 maternities

^c Rate ratios are calculated using 30-34 as the reference group

Sources: CEMACH, ONS, NISRA-GRO

Table 7.3
Proportions of ethnicity in stillbirths and neonatal deaths by maternal age group; England: 2007

Maternal age	Proportions ^a of ethnicity within each maternal age group (%)											
	Stillbirths ^b						Neonatal deaths ^b					
	White	Black	Asian	Chinese	Mixed	Other	White	Black	Asian	Chinese	Mixed	Other
<20	79.5	7.8	7.8	0.0	4.1	0.9	81.2	7.1	7.1	0.0	2.9	1.8
20-24	68.3	9.6	17.7	0.7	1.7	2.1	67.3	7.4	21.0	0.6	2.0	1.7
25-29	60.3	10.6	23.1	1.1	1.3	3.5	60.5	10.5	23.5	0.7	1.8	2.9
30-34	64.1	13.6	16.3	0.7	2.1	3.1	69.6	9.3	15.8	0.7	1.5	3.0
35-39	68.3	14.6	10.7	0.2	1.8	4.4	68.5	13.8	12.8	0.4	0.7	3.8
40+	68.2	15.0	12.1	0.0	1.7	2.9	71.4	15.7	10.0	0.0	2.9	0.0

^a Percentages are calculated removing missing values

Source: CEMACH

^b Second and subsequent deaths from pregnancies with multiple losses excluded from this table

Table 7.4
Proportions of deprivation in stillbirths and neonatal deaths by maternal age group; England: 2007

Maternal age	Proportions ^a of deprivation within each maternal age group (%)									
	Stillbirths ^b					Neonatal deaths ^b				
	1 (least deprived)	2	3	4	5 (most deprived)	1 (least deprived)	2	3	4	5 (most deprived)
<20	5.1	10.1	12.2	24.5	48.1	5.3	12.1	12.1	26.3	44.2
20-24	5.2	10.8	13.5	23.2	47.3	4.4	7.5	13.4	26.6	48.1
25-29	9.7	10.6	16.9	24.4	38.3	5.9	12.8	16.6	27.3	37.5
30-34	14.4	17.2	18.5	21.3	28.7	15.0	15.4	19.2	22.3	28.1
35-39	16.8	19.7	16.7	21.8	25.1	16.0	18.2	16.3	20.5	29.0
40+	15.0	15.6	27.8	20.0	21.7	22.1	18.2	16.9	15.6	27.3

^a Percentages are calculated removing missing values

Source: CEMACH

^b Second and subsequent deaths from pregnancies with multiple losses excluded from this table

7.2 Maternal Body Mass Index

Body Mass Index (BMI) is a useful measure of obesity and is calculated by dividing a person's weight in kilograms by the square of their height in metres (kg/m^2). Maternal pre-pregnancy BMI has been shown to be a risk factor for stillbirths and neonatal deaths for women who are underweight (BMI less than 18.5), overweight (BMI 25–29.9), obese (BMI 30–34.9), and very obese (BMI greater than or equal to 35) compared to normal weight (BMI 18.5–24.9).^{31 37 38}

CEMACH has collected data on BMI since 2005. Unfortunately, up-to-date denominator data does not exist for all maternities, as this information is currently not routinely included in the collection of national statistics. Table 7.5 shows the proportion of stillbirths, perinatal and neonatal deaths by maternal BMI group. While Table 7.5 illustrates that there appears to have been some increase in the proportion of women in underweight, overweight and obese BMI categories experiencing a stillbirth or neonatal death since 2005, there is no available comparison with the general maternity population. Therefore, no firm conclusions about excess risk can be drawn from these data. It should also be recognised that BMI itself is not causative for stillbirth and neonatal death, and there will be a number of associated factors including maternal social deprivation and specific co-morbidities.

Table 7.5

Proportions of stillbirths, perinatal and neonatal deaths by maternal BMI; England, Wales, Northern Ireland, Channel Islands and the Isle of Man: 2007

Year	Proportions ^a of stillbirths ^b (%)					Proportions ^a of perinatal deaths ^b (%)					Proportions ^a of neonatal deaths ^b (%)				
	<18.5	18.5-24.9	25-29.9	30-34.9	35+	<18.5	18.5-24.9	25-29.9	30-34.9	35+	<18.5	18.5-24.9	25-29.9	30-34.9	35+
2005	2.2	40.3	27.2	12.2	18.1	2.6	41.3	25.8	12.3	18.0	3.6	44.6	22.2	12.3	17.3
2006	2.7	43.7	27.7	14.7	11.2	3.0	43.7	28.5	14.5	10.2	3.6	45.2	29.2	13.9	8.2
2007	2.9	44.3	26.8	15.6	10.4	3.1	44.8	26.5	14.9	10.7	3.9	46.5	26.0	13.1	10.5

BMI missing: 32% in 2005, 18% in 2006 and 17% in 2007

Source: CEMACH

^a Percentages are calculated removing missing values

^b Second and subsequent deaths from pregnancies with multiple losses excluded from this table

Trends over time for women with a BMI greater than or equal to 35 are not as clear as in other groups, although the proportion of women with a BMI greater than or equal to 35 appears to have decreased among stillbirths from 18.1% in 2005 to 10.4% in 2007. A limitation of maternity BMI data is the large proportion of missing values, which precludes any identification of definite trends at the present time. CEMACH will continue to collect information on this important risk factor and will seek to improve data quality by liaison with local health professionals in its network.

In order to further investigate the prevalence of obesity in pregnancy, health outcomes for women and their babies and the provision of appropriate care, CEMACH is currently conducting a national Obesity in Pregnancy project. This project will:

- Provide information about maternity service provision for pregnant women with obesity in the UK, the Channel Islands and the Isle of Man
- Develop national consensus standards of service provision and clinical care for women with obesity in pregnancy
- Carry out an audit to determine: 1) national and regional prevalence of obesity (BMI greater than or equal to 35) in pregnancy; 2) demographic and clinical information on a sample of women with obesity in pregnancy; and 3) clinical standards of care during pregnancy, labour and delivery.

Results of the CEMACH Obesity in Pregnancy project will be available in 2009 and 2010.

7.3 Maternal ethnicity

Non-White ethnicity has been associated with increased risk of stillbirth and neonatal death in the UK,³⁹ the USA,³¹ and in Europe.⁴⁰ Ethnicity is likely to be associated with other risk factors such as deprivation and should not be regarded as an independent variable.

The proportion of maternities in each ethnic group is described in Table 7.6. There appears to be a trend since 2000 wherein the proportion of White mothers is decreasing and the proportion of mothers from other ethnic groups is increasing.

Table 7.6
Proportions of all maternities by maternal ethnicity; England: 2000-2007

Year	Proportions ^a of maternities (%)					
	White	Black	Asian	Chinese	Mixed	Other
2000	88.0	2.8	6.0	0.3	0.0	2.9
2001	88.2	3.0	6.4	0.2	0.3	1.8
2002	85.4	4.1	7.7	0.3	0.7	1.8
2003	83.6	4.6	8.3	0.3	0.9	2.1
2004	82.7	4.9	8.8	0.4	1.1	2.1
2005	81.5	5.2	9.3	0.5	1.2	2.3
2006	80.5	5.5	9.6	0.5	1.4	2.5
2007	79.9	5.3	10.1	0.6	1.4	2.6

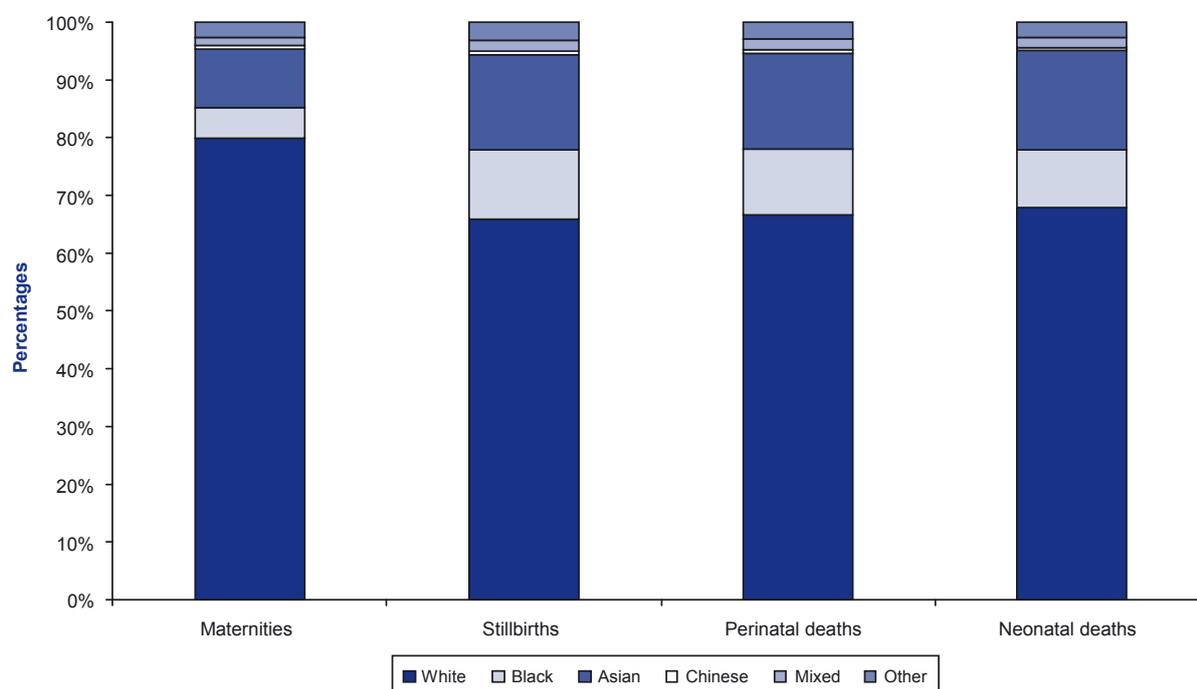
^a Percentages are calculated removing missing values

Source: HES

Figure 7.1 shows the contribution of different ethnic groups to maternities, stillbirths, perinatal and neonatal deaths. While women of White ethnic origin constitute the largest proportion of all maternities, they represent a smaller proportion of stillbirths and neonatal deaths. Conversely, women of Black and Asian ethnic origin represent a relatively small proportion of all maternities but a higher proportion of stillbirths and neonatal deaths.

Figure 7.1

Proportions of maternities, stillbirths, perinatal and neonatal deaths by ethnicity; England: 2007



In 2007, the stillbirth rates for women of Black and Asian ethnicity were 2.7 times and 2.0 times higher, respectively, than those for women of White ethnicity (Table 7.7). Neonatal mortality rates were 2.2 times higher for Black women and 2.0 times higher for Asian women compared to White women (Table 7.9). While there is evidence of a decrease between 2005-2007 in the neonatal mortality rate for women of White ethnicity (from 2.7 to 2.3 per 1,000 maternities), the neonatal mortality rate for Asian and Black women has remained at about the same level.

Table 7.7

Stillbirth rates and rate ratios by ethnicity; England: 2007

Ethnicity	2005 ^a		2006 ^a		2007 ^a	
	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c
White	4.2 [4.0, 4.4]	..	4.0 [3.8, 4.2]	..	3.9 [3.8, 4.1]	..
Black	9.6 [8.6, 10.7]	2.3 [2.0, 2.6]	9.7 [8.8, 10.8]	2.4 [2.2, 2.7]	10.7 [9.6, 11.8]	2.7 [2.4, 3.0]
Asian	8.8 [8.0, 9.6]	2.1 [1.9, 2.3]	7.9 [7.2, 8.7]	2.0 [1.8, 2.2]	7.8 [7.2, 8.5]	2.0 [1.8, 2.2]
Chinese	3.4 [1.9, 6.4]	0.8 [0.4, 1.5]	2.6 [1.4, 5.1]	0.7 [0.3, 1.3]	5.1 [3.3, 8.0]	1.3 [0.8, 2.0]
Mixed	5.6 [4.2, 7.6]	1.3 [1.0, 1.8]	4.8 [3.5, 6.4]	1.2 [0.9, 1.6]	6.4 [4.9, 8.2]	1.6 [1.3, 2.1]
Other	5.5 [4.6, 6.5]	1.3 [1.1, 1.6]	5.7 [4.9, 6.7]	1.4 [1.2, 1.7]	5.6 [4.6, 6.8]	1.4 [1.2, 1.7]

^a Second and subsequent deaths from pregnancies with multiple losses excluded from this table

^b Rate per 1,000 maternities

^c Rate ratios are calculated using White as the reference group

Sources: CEMACH, HES, ONS

Table 7.8
Perinatal mortality rates and rate ratios by ethnicity; England: 2007

Ethnicity	2005 ^a		2006 ^a		2007 ^a	
	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c
White	6.3 [6.0, 6.5]	..	5.9 [5.7, 6.1]	..	5.8 [5.6, 6.0]	..
Black	13.7 [12.5, 15.0]	2.2 [2.0, 2.4]	13.9 [12.8, 15.2]	2.4 [2.2, 2.6]	14.7 [13.5, 16.0]	2.5 [2.3, 2.8]
Asian	12.4 [11.4, 13.4]	2.0 [1.8, 2.2]	11.3 [10.5, 12.3]	1.9 [1.8, 2.1]	11.4 [10.6, 12.3]	2.0 [1.8, 2.1]
Chinese	5.9 [3.6, 9.4]	0.9 [0.6, 1.5]	5.0 [3.1, 8.0]	0.9 [0.5, 1.4]	7.2 [5.0, 10.4]	1.2 [0.9, 1.8]
Mixed	8.2 [6.4, 10.4]	1.3 [1.0, 1.7]	6.4 [4.9, 8.2]	1.1 [0.8, 1.4]	8.7 [7.0, 10.8]	1.5 [1.2, 1.9]
Other	8.0 [6.9, 9.2]	1.3 [1.1, 1.5]	7.8 [6.8, 8.9]	1.3 [1.2, 1.5]	7.8 [6.6, 9.2]	1.3 [1.1, 1.6]

^a Second and subsequent deaths from pregnancies with multiple losses excluded from this table

Sources: CEMACH, HES, ONS

^b Rate per 1,000 maternities

^c Rate ratios are calculated using White as the reference group

Table 7.9
Neonatal mortality rates and rate ratios by ethnicity; England: 2007

Ethnicity	2005 ^a		2006 ^a		2007 ^a	
	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c
White	2.7 [2.5, 2.8]	..	2.4 [2.3, 2.5]	..	2.3 [2.2, 2.5]	..
Black	5.5 [4.7, 6.3]	2.0 [1.8, 2.4]	5.4 [4.7, 6.2]	2.3 [1.9, 2.6]	5.1 [4.4, 5.9]	2.2 [1.9, 2.6]
Asian	4.7 [4.1, 5.3]	1.8 [1.5, 2.0]	4.4 [3.9, 5.0]	1.8 [1.6, 2.1]	4.6 [4.1, 5.2]	2.0 [1.8, 2.3]
Chinese	3.4 [1.9, 6.4]	1.3 [0.7, 2.4]	2.6 [1.4, 5.1]	1.1 [0.6, 2.1]	2.3 [1.2, 4.5]	1.0 [0.5, 1.9]
Mixed	3.2 [2.2, 4.7]	1.2 [0.8, 1.8]	2.3 [1.5, 3.5]	0.9 [0.6, 1.5]	3.4 [2.4, 4.8]	1.5 [1.0, 2.1]
Other	3.4 [2.7, 4.2]	1.3 [1.0, 1.6]	2.9 [2.3, 3.6]	1.2 [1.0, 1.5]	2.7 [2.0, 3.6]	1.2 [0.9, 1.6]

^a Second and subsequent deaths from pregnancies with multiple losses excluded from this table

Sources: CEMACH, HES, ONS

^b Rate per 1,000 maternities

^c Rate ratios are calculated using White as the reference group

7.4 Maternal social deprivation

Maternal social deprivation is associated with an increased risk of stillbirth and neonatal death.^{30 41-43} Previous studies have shown that women with greater levels of deprivation are more likely to have a pregnancy outcome of stillbirth or neonatal death; in Wales for example, it was found that those in the most deprived quintile had a 53% increased risk of stillbirth and infant death compared to those in the least deprived quintile.⁴⁴

The proportion of maternities in each deprivation quintile is described in Table 7.10. From these data, it seems that there has been a trend since 2000 wherein the proportion of mothers in the least deprived quintiles (1 and 2) is decreasing slightly and the proportion of mothers in the most deprived quintiles (4 and 5) is increasing slightly.

Table 7.10

Proportions of all maternities by maternal deprivation; England: 2000-2007

Year	Proportions ^a of maternities (%)				
	1 (least deprived)	2	3	4	5 (most deprived)
2000	17.3	17.2	18.0	20.6	26.9
2001	17.2	17.0	18.0	20.7	27.0
2002	17.2	16.9	18.0	20.8	27.2
2003	16.9	17.0	18.1	20.9	27.1
2004	16.7	16.8	18.2	21.1	27.3
2005	16.3	16.6	18.1	21.4	27.6
2006	16.1	16.5	18.2	21.5	27.7
2007	16.0	16.3	18.1	21.7	27.8

^a Percentages are calculated removing missing values

Source: ONS

In 2006, the CEMACH Perinatal Mortality report showed that stillbirth rates and neonatal mortality were 1.7 times higher among women in the most deprived quintile in England compared to women in the least deprived quintile.¹¹ This trend has continued in 2007 with the stillbirth rate (6.5 per 1,000 maternities) of women in the most deprived quintile being 1.8 times higher than the stillbirth rate (3.6 per 1,000 maternities) among women in the least deprived quintile. Similarly, neonatal mortality (3.9 per 1,000 maternities) of women resident in the most deprived areas was 2.0 times higher in 2007 than neonatal mortality (1.9 per 1,000 maternities) in the least deprived areas.

Table 7.11

Stillbirths, perinatal, and neonatal mortality rates by maternal deprivation; England: 2007

Deprivation quintile	Stillbirths ^a		Perinatal deaths ^a		Neonatal deaths ^a	
	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c	Rate [95% CI] ^b	Rate ratio [95% CI] ^c
1 (least deprived)	3.6 [3.3, 4.0]	..	5.2 [4.8, 5.6]	..	1.9 [1.7, 2.2]	..
2	4.5 [4.1, 4.9]	1.2 [1.1, 1.4]	6.4 [6.0, 6.9]	1.2 [1.1, 1.4]	2.5 [2.2, 2.8]	1.3 [1.1, 1.6]
3	4.8 [4.4, 5.2]	1.3 [1.2, 1.5]	6.9 [6.5, 7.4]	1.3 [1.2, 1.5]	2.7 [2.4, 3.0]	1.4 [1.2, 1.7]
4	5.4 [5.0, 5.8]	1.5 [1.3, 1.7]	8.0 [7.6, 8.5]	1.5 [1.4, 1.7]	3.3 [3.1, 3.7]	1.7 [1.5, 2.1]
5 (most deprived)	6.5 [6.1, 6.9]	1.8 [1.6, 2.0]	9.5 [9.1, 10.0]	1.8 [1.7, 2.0]	3.9 [3.6, 4.2]	2.0 [1.7, 2.4]

^a Second and subsequent deaths from pregnancies with multiple losses excluded from this table

Sources: CEMACH, ONS

^b Rate is number of deaths per 1,000 maternities^c Rate ratios are calculated using least deprived (1) as the reference group

7.5 Antenatal care: booking by 12 weeks' gestation

The national target for England is for all pregnant women to access maternity care at around 6-8 weeks of pregnancy and book for antenatal care by 10-12 weeks.⁴⁵ This reflects the NICE Antenatal Care guideline that antenatal booking should ideally occur by 10 weeks.⁴⁶ The target supports the government's Public Service Agreement (PSA) to achieve a 10% reduction in the difference in infant mortality between the routine and manual socio-economic group and the population as a whole by 2010, as compared to 1997-1999 baseline values.⁴⁷ Early antenatal booking is therefore viewed as a key indicator of progress toward reduction in health inequalities.⁴⁸ The National Services Framework for Children, Young People and Maternity Services⁴⁹ and the Operating Framework for the NHS in England⁵⁰ both consider early booking for antenatal care a priority for Primary Care Trusts (PCTs) and an important part of improving maternity services and clinical outcomes as a whole. In a survey of pregnant women in England in 2005, 95% of women had their first pregnancy-related appointment in the first trimester and 71% of women had their booking appointment by 12 weeks.⁵¹

In 2007, 49% of women who had a stillbirth and 52% of women who experienced a neonatal death booked by 12 weeks' gestation (Table 7.12), compared to 71% of women in the general maternity population booking by 12 weeks in 2005. This suggests that booking for maternity care after 12 weeks may be more common in women who have a stillbirth and neonatal death; this may be related to issues such as maternal social deprivation and poor access to health services.

Table 7.12

Stillbirths and neonatal deaths by timing of booking, England, Wales, Northern Ireland, Channel Islands and the Isle of Man, 2007

	Stillbirths ^a		Neonatal deaths ^a	
	Number	Percentage (%)	Number	Percentage (%)
Total	3,413	100.0	1,756	100.0
Unbooked	78	2.3	53	3.0
< 12+0 weeks'	1,685	49.4	914	52.1
12+0 to 19+6 weeks'	1,329	38.9	632	36.0
≥ 20+0 weeks'	321	9.4	157	8.9

^a Cases have been excluded if date of booking is missing, if EDD is missing or if the gestation at booking is <0 or >42 (6% of stillbirths and 19% of neonatal deaths)

^b Second and subsequent deaths from pregnancies with multiple losses excluded from this table

Sources: CEMACH

7.6 Socio-demographic characteristics of women experiencing neonatal deaths compared to the general maternity population

Table 7.13 summarises some of the socio-demographic characteristics of women experiencing neonatal deaths in 2007 compared to the general maternity population.

- Nearly a tenth of women were teenage mothers compared to 6.5% of the general maternity population.
- Nearly two-thirds of women lived in the most deprived areas (quintile 4 and 5) compared to just under half of the general maternity population.
- 28% of women were from a non-White ethnic group compared to 16% of the general maternity population.

Table 7.13

Socio-demographic characteristics of women experiencing neonatal deaths; England, Wales, Northern Ireland, the Channel Islands and the Isle of Man: 2007

Socio-demographic characteristics	% of neonatal deaths	% of maternity population
Teenagers (Maternal age <20)	9.6 ^a	6.5 ^a
Most deprived (IMD quintile 4 and 5)	60.2 ^b	49.5 ^b
Ethnic minorities (Black, Asian and Chinese)	27.7 ^b	16.1 ^b

^a Data for England, Wales, Northern Ireland and the Channel Islands

^b Data for England only

Sources: CEMACH, ONS, HES

7.7 Gestational age

The risk of stillbirth, perinatal and neonatal death varies by gestational age for England, with babies born less than 37 weeks' gestation having an increased risk of mortality compared to term babies. In 2007, 66% of stillbirths and 74% of neonatal deaths in England, Wales and Northern Ireland were born preterm; this compares with 67% and 77% respectively in 2006.¹¹

Unfortunately, denominator data for gestational age is currently not available for England; however, in 2005 the ONS linked the NHS Numbers for Babies (NN4B) dataset to birth registration data for England and Wales as part of a pilot exercise to provide gestational age distribution on a national basis. Gestational age is collected in Wales by their National Community Child Health Database (NCCHD) and in Northern Ireland by their Child Health Systems. For the purpose of this report, the proportion of infants born at each week of gestation in 2005 was applied to the number of births in 2007, to calculate the estimated numbers of infants born during each week of pregnancy. Using these denominators, mortality rates were calculated for gestational age groups as shown in Table 7.14.

As in previous years' reports, infants delivered at preterm gestations had an increased rate of both stillbirth and neonatal death compared to infants born at full term (greater than or equal to 37 weeks). The lower stillbirth rate seen in the 42+ gestational age category compared to 37-41 weeks may be due to the fact that the majority of stillbirths will have already occurred before this gestation, and induction of labour carried out in high-risk pregnancies. This is similar to the findings of previous studies which showed lower mortality rates at 40+ weeks compared to earlier term gestations, but a higher mortality risk per 1,000 ongoing pregnancies.^{52 53}

Table 7.14

Stillbirth, perinatal and neonatal mortality rates by gestational age; England, Wales and Northern Ireland: 2007

Gestational age (weeks)	Stillbirth rate [95% CI] ^a	Perinatal mortality rate [95% CI] ^a	Neonatal mortality rate [95% CI] ^b
<24	-	785.2 [723.7, 852.0]	838.4 [774.7, 907.3]
24-27	246.7 [231.0, 263.5]	359.9 [340.7, 380.1]	203.6 [187.3, 221.4]
28-31	90.2 [83.5, 97.4]	112.3 [104.8, 120.3]	33.6 [29.5, 38.4]
32-36	20.0 [18.7, 21.3]	24.8 [23.4, 26.3]	6.2 [5.5, 7.0]
37-41	1.9 [1.8, 2.0]	2.5 [2.4, 2.6]	0.9 [0.8, 1.0]
42+	1.1 [0.8, 1.6]	1.7 [1.3, 2.3]	0.7 [0.4, 1.0]

^a Rate per 1,000 total births^b Rate per 1,000 live births

Sources: CEMACH, ONS, NI CHS

7.8 Birth weight

Preterm birth, low birth weight and small-for-gestational age (SGA) are all recognised as contributors to stillbirth and neonatal death.^{11 31 54-56} Preterm birth accounts for nearly half of neonatal mortality in England, Wales and Northern Ireland (see Chapter 8) and very low birth weight (less than 1500 grams) and low birth weight (less than 2500 grams) are used as thresholds for increased risk associated with birth weight. More recently, population-based studies in the US have shown that macrosomic babies, especially those with a birth weight greater than 4500 grams, also have a higher risk of stillbirth and neonatal death.^{57 58}

In 2007, babies with very low birth weight (less than 1500 grams) had a neonatal mortality rate of 164.4 per 1,000 live births. For low birth weight babies (less than 2500 grams), the neonatal mortality rate was 32.5 per 1,000 live births compared to 0.8 per 1,000 live births in babies with a birth weight of greater than or equal to 2500 grams. This is similar to findings in 2006.¹¹ It should be noted that since birth weight is dependent on gestational age, a disadvantage of using birth weight categories is that they will include both preterm babies who are appropriately grown and more mature babies with fetal growth restriction.

Babies weighing 4000 grams and above at birth had a stillbirth rate of 1.4 per 1,000 total births, significantly lower than the rate in babies weighing 2500-3999 grams (2.0 per 1,000 total births, $p=0.001$). However, the neonatal mortality rate in these infants of 0.7 per 1,000 live births was similar to babies weighing 2500-3999 grams (0.9 per 1,000 live births). The difference in stillbirth rates may be due to the fact that babies in the 2500-3999 grams birth weight category will include a higher proportion of babies with fetal growth restriction with an increased risk of adverse outcome, than babies in the 4000+ grams birth weight category.

Table 7.15

Birth weight specific stillbirth, perinatal and neonatal mortality rates; England, Wales and Northern Ireland: 2007

Birth weight (g)	Stillbirths		Perinatal deaths		Neonatal deaths	
	N	Rate [95% CI] ^a	N	Rate [95% CI] ^a	N	Rate [95% CI] ^b
<1000	1,102	251.2 [236.8, 266.5]	2,038	464.6 [444.8, 485.2]	1,117	340.0 [320.7, 360.6]
1000-1499	498	93.1 [85.3, 101.7]	652	121.9 [112.9, 131.6]	220	45.4 [39.7, 51.8]
1500-1999	425	39.8 [36.2, 43.8]	537	50.3 [46.2, 54.7]	145	14.1 [12.0, 16.6]
2000-2499	422	12.8 [11.6, 14.1]	554	16.8 [15.5, 18.3]	174	5.4 [4.6, 6.2]
2500-2999	457	3.9 [3.5, 4.2]	608	5.1 [4.7, 5.6]	203	1.7 [1.5, 2.0]
3000-3499	431	1.7 [1.5, 1.9]	551	2.2 [2.0, 2.4]	167	0.7 [0.6, 0.8]
3500-3999	215	1.0 [0.9, 1.2]	309	1.5 [1.3, 1.7]	129	0.6 [0.5, 0.7]
4000+	110	1.4 [1.1, 1.6]	156	1.9 [1.6, 2.3]	57	0.7 [0.5, 0.9]
Missing	38	..	130	..	118	..

^a Rate per 1,000 total births^b Rate per 1,000 live births

Sources: CEMACH, ONS, NI CHS

7.9 Conclusions

Since 2000, the proportion of teenage maternities is decreasing and the proportion of maternities in women aged 35 and above increasing. Women in the age group 30–34 years had the lowest risk of stillbirth and neonatal death. Women aged 40 years and above have the highest risk of stillbirth while women aged less than 20 years have the highest risk of neonatal death. More than three-quarters of teenage mothers having a stillbirth or neonatal death are of White ethnic origin and three-quarters are in the two most deprived population quintiles.

CEMACH has collected data on BMI since 2005. Unfortunately, up-to-date denominator data does not exist for all maternities and there is a large proportion of missing values in maternity BMI data. CEMACH will continue to seek to improve data quality by liaison with local health professionals in its network.

While women of White ethnic origin constitute the largest proportion of all maternities, they represent a smaller proportion of stillbirths and neonatal deaths. Conversely, women of Black and Asian ethnic origin represent a relatively small proportion of all maternities but a higher proportion of stillbirths and neonatal deaths. In 2007, women of Black and Asian ethnic origin had stillbirth and neonatal mortality rates more than two times higher than for White women. Ethnicity is often associated with levels of maternal social deprivation; in 2007 stillbirth and neonatal mortality rates for women in the most deprived population quintile were approximately two times higher than for women resident in the least deprived areas.

In 2007, half of all women having a stillbirth or neonatal death booked for maternity care before 12 weeks compared to 71% of women in the general maternity population. These findings may be related to issues such as maternal social deprivation and poor access to health services.

Babies delivered preterm (less than 37 weeks) have an increased rate of both stillbirth and neonatal death, with mortality increasing with decreasing gestation. While it is recognised that low birth weight (less than 2500 grams) and very low birth weight (less than 1500 grams) include both appropriately grown preterm babies and more mature babies with fetal growth restriction, babies in these categories had an increased risk of neonatal mortality compared to babies with a birth weight of 2500 grams or more.

Chapter 8 Cause of death

This chapter provides a description of the causes of stillbirths and neonatal deaths using different classification systems, cause-specific mortality rates, and an overview of post mortem examinations.

8.1 Causes of stillbirths

For 2007, CEMACH used the extended Wigglesworth and Obstetric (Aberdeen) classifications of cause of death to categorise stillbirths. A full description of the categories is included in Appendix F.

Figure 8.1 illustrates the proportion of stillbirths that were assigned to each Wigglesworth category, with the majority (76.1%) classified as unexplained. For the unexplained stillbirths, the Obstetric (Aberdeen) classification shows the additional factors identified that may have been associated with deaths. After analysis of the obstetric factors, 74.4% of the original 76.1% were still unexplained. Of these, 37.9% were small for gestational age (birth weight less than 10th centile for gestation).

CEMACH has now developed a new classification system¹¹ which aims to reduce the proportion of deaths with an unexplained or non-specific cause. A new Perinatal Death Notification form was introduced from 1 January 2008 to include this new classification, and the findings will be reported early in 2010.

The cause-specific stillbirth rates are shown in Table 8.1. There is a higher rate of unexplained antepartum fetal death among low birth weight babies less than 2500 grams (1.5 stillbirths per 1,000 total births) than among babies with birth weights greater than or equal to 2500 grams (1.0 per 1,000 total births). Pregnancies complicated by fetal congenital malformations or antepartum haemorrhage both had stillbirth rates of 0.4 per 1,000 total births.

Table 8.1

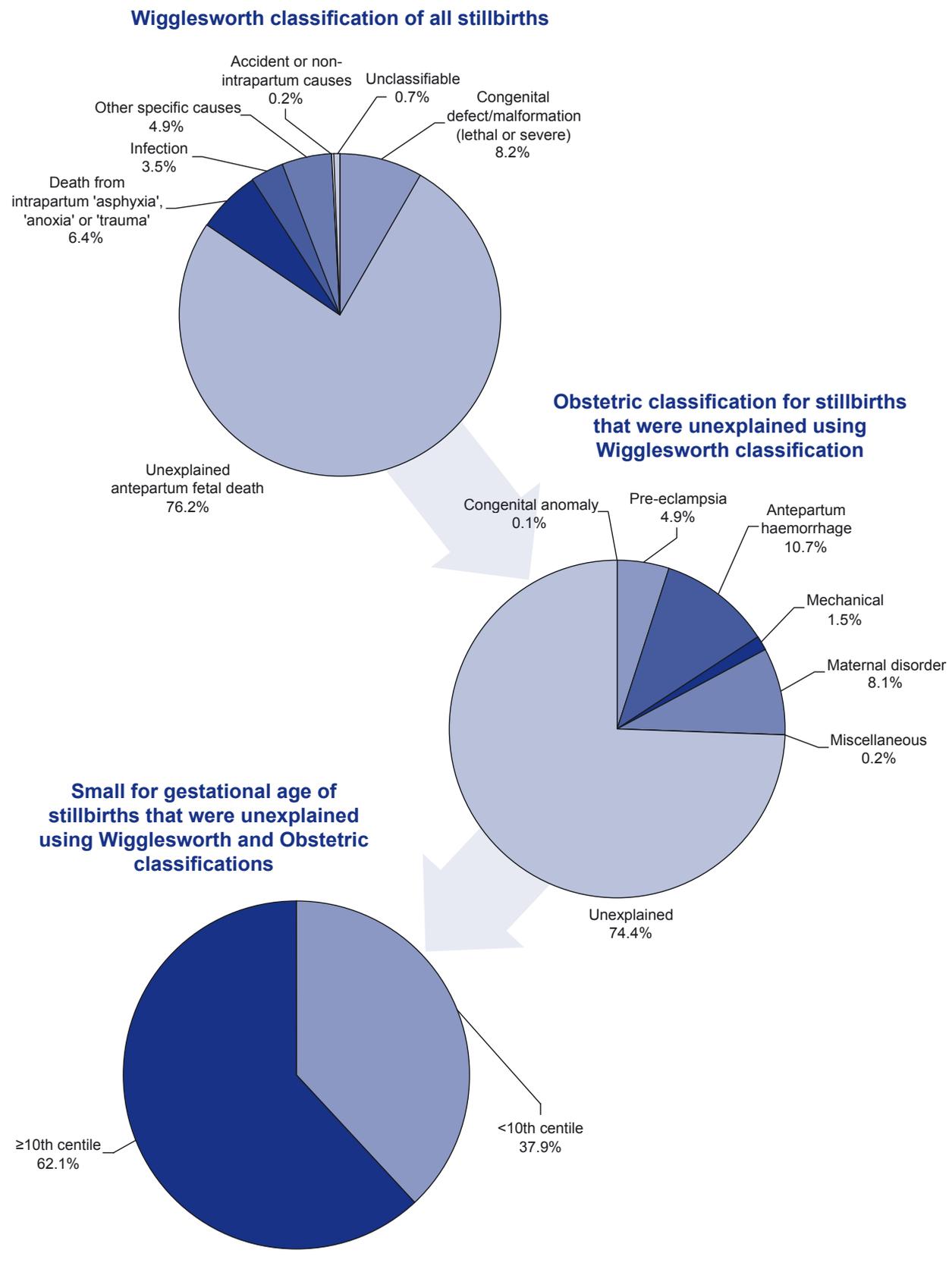
Cause-specific stillbirth rates; England, Wales, Northern Ireland, Channel Islands and the Isle of Man: 2007

Cause of death	Antepartum		Intrapartum		Total	
	Number	Rate [95% CI] ^a	Number	Rate [95% CI] ^a	Number	Rate [95% CI] ^a
Congenital malformation	227	0.3 [0.3, 0.4]	27	0.0 [0.0, 0.1]	265	0.4 [0.3, 0.4]
Antepartum haemorrhage	259	0.4 [0.3, 0.4]	1	0.0	263	0.4 [0.3, 0.4]
Maternal disorder	198	0.3 [0.2, 0.3]	-	-	200	0.3 [0.2, 0.3]
Pre-eclampsia	120	0.2 [0.1, 0.2]	-	-	121	0.2 [0.1, 0.2]
Death from intrapartum causes	-	-	199	0.3 [0.2, 0.3]	205	0.3 [0.2, 0.3]
Infection	94	0.1 [0.1, 0.2]	15	0.0	113	0.2 [0.1, 0.2]
Other specific causes	185	0.3 [0.2, 0.3]	11	0.0	202	0.3 [0.2, 0.3]
Accident or non-intrapartum causes	5	0.0	-	-	5	0.0
Unexplained antepartum fetal death <2500 grams	1,057	1.5 [1.4, 1.6]	-	-	1,076	1.5 [1.4, 1.6]
Unexplained antepartum fetal death 2500+ grams	726	1.0 [0.9, 1.1]	-	-	737	1.0 [1.0, 1.1]
Unclassifiable	16	0.0	2	0.0	35	0.0 [0.0, 0.1]
Not known	7	..	-	..	46	..

^a Rate per 1,000 total births

Sources: CEMACH, ONS, NISRA-GRO

Figure 8.1
Cause of death classification of stillbirths; England, Wales, Northern Ireland, Channel Islands and the Isle of Man: 2007

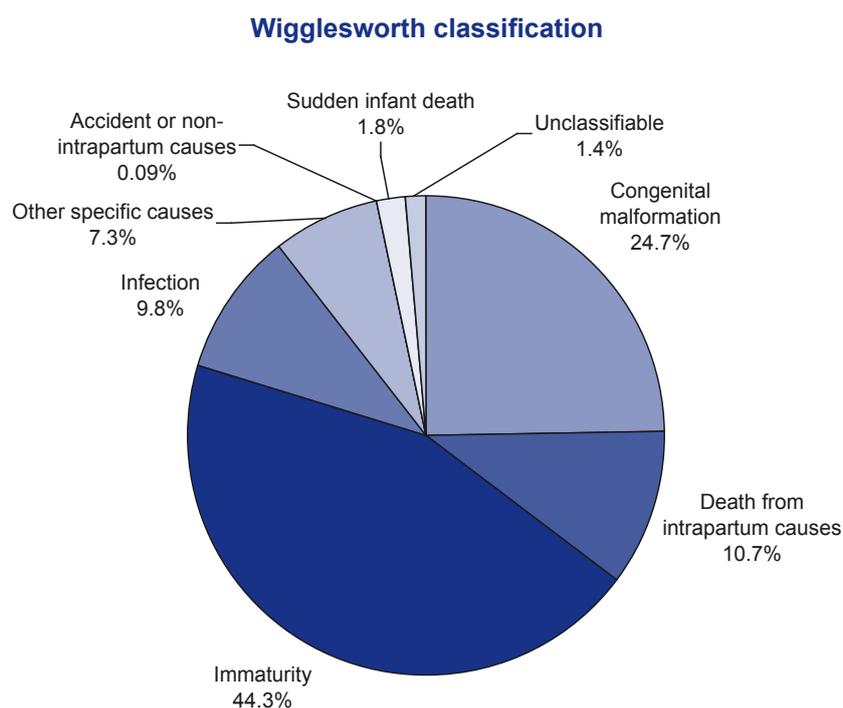


8.2 Causes of neonatal deaths

The extended Wigglesworth classification of cause of death was used to categorise neonatal deaths. Figure 8.2 illustrates the proportion of neonatal deaths that were assigned to each category, with the majority (44.3%) classified as due to immaturity (preterm birth). Of the neonatal deaths, 1.4% were unclassifiable.

Figure 8.2

Percentage distribution of causes of neonatal deaths; England, Wales and Northern Ireland: 2007



The cause-specific neonatal mortality rates are shown in Table 8.2. The highest cause-specific neonatal mortality was in babies born before 37 weeks (1.3 per 1,000 live births), babies with congenital malformations (0.7 per 1,000 live births), babies who died due to a catastrophic event during labour and delivery (0.3 per 1,000 live births), and babies who had a diagnosis of infection (0.3 per 1,000 live births).

Table 8.2

Cause-specific neonatal mortality rates; England, Wales and Northern Ireland: 2007

Cause of death	Early neonatal deaths		Late neonatal deaths		Neonatal deaths	
	Number	Rate [95% CI] ^a	Number	Rate [95% CI] ^a	Number	Rate [95% CI] ^a
Congenital malformation	385	0.5 [0.5, 0.6]	152	0.2 [0.2, 0.2]	537	0.7 [0.7, 0.8]
Death from intrapartum causes	215	0.3 [0.3, 0.3]	17	0.0	232	0.3 [0.3, 0.4]
Immaturity	822	1.1 [1.1, 1.2]	141	0.2 [0.2, 0.2]	963	1.3 [1.3, 1.4]
Infection	120	0.2 [0.1, 0.2]	92	0.1 [0.1, 0.2]	212	0.3 [0.3, 0.3]
Other specific causes	123	0.2 [0.1, 0.2]	35	0.0 [0.0, 0.1]	158	0.2 [0.2, 0.3]
Accident or non-intrapartum causes	1	0.0	1	-	2	0.0
Sudden infant death	21	0.0	18	0.0	39	0.1 [0.0, 0.1]
Unclassifiable	19	0.0	12	0.0	31	0.0 [0.0, 0.1]
Not known	69	..	27	..	96	..

^a Rate per 1,000 live births

Sources: CEMACH, ONS, NISRA-GRO

8.3 Post mortem examinations

Post mortem examinations may be crucial to gaining a full understanding of the true cause of death for babies that have died during pregnancy or in the neonatal period. Each year CEMACH reports the number of deaths that did and did not have post mortem examinations. In 2007, 45.0% of stillbirths (Table 8.3) and 21.3% of neonatal deaths (Table 8.4) had post mortem examinations, and 0.4% of stillbirths (Table 8.3) and 8.4% of neonatal deaths (Table 8.4) underwent a coroner's post mortem examination. Post mortem examinations were not performed in the remaining cases due either to this being declined by parents/guardians, failure of health professionals to offer an examination or failure to follow through with examination after parental consent was received. It is encouraging to note that the proportion of deaths where the parents were not offered a post mortem examination has fallen markedly for the past two years, although this has been offset by an increased percentage of refusal for an examination by parents and/or guardians. The numbers of post mortem examinations following stillbirths and neonatal deaths can be found in Appendix G.

Tables 8.5 and 8.6 show the proportion of post mortem examinations in stillbirths and neonatal deaths by ethnic group. Proportionally fewer post mortem examinations were carried out following stillbirths among women of Asian origin compared to women of White or Black ethnicity, and there appeared to be a higher proportion of refusal to give consent in the Asian group. There were also proportionately fewer post mortem examinations for neonatal deaths amongst Asian mothers, although in this case the percentage of refusal to give consent was not higher than for other ethnic groups.

Table 8.3

Proportions of post mortem examinations among stillbirths; England, Wales, Northern Ireland, Channel Islands, and the Isle of Man: 2000-2007

Year	Proportions ^a of stillbirths (%)				
	Held/being arranged	Coroner's PM	Parent or guardian refused permission	Not offered	Consent given but PM not performed
2000	54.7	0.6	33.1	11.2	0.4
2001	48.8	0.5	35.2	15.1	0.4
2002	45.0	0.6	33.6	20.0	0.8
2003	45.3	0.7	36.6	16.9	0.5
2004	44.5	0.7	36.0	18.2	0.6
2005	44.3	0.4	36.3	18.5	0.4
2006	42.7	0.5	48.4	7.5	1.0
2007	45.0	0.4	47.1	6.8	0.7

^a Percentages are calculated removing not known

Sources: CEMACH

Table 8.4

Proportions of post mortem examinations among neonatal deaths; England, Wales, Northern Ireland, Channel Islands, and the Isle of Man; 2000-2007

Year	Proportions ^a of neonatal deaths (%)				
	Held/being arranged	Coroner's PM	Parent or guardian refused permission	Not offered	Consent given but PM not performed
2000	28.2	7.8	40.8	22.8	0.4
2001	21.8	8.6	41.7	27.5	0.4
2002	21.4	9.1	39.8	29.0	0.7
2003	21.7	8.6	41.6	28.0	0.1
2004	20.6	8.8	41.0	29.3	0.4
2005	19.8	9.0	41.1	29.6	0.5
2006	21.3	7.3	52.9	17.9	0.7
2007	21.1	8.3	51.6	18.3	0.8

^a Percentages are calculated removing not known

Sources: CEMACH

Table 8.5

Proportions of post mortem examinations by ethnic group among stillbirths; England, Wales, Northern Ireland, Channel Islands, and the Isle of Man; 2007

Proportions^a of post mortem examinations by ethnic group (%)					
Ethnicity	Held/being arranged	Coroner's PM	Parent or guardian refused permission	Not offered	Consent given but PM not performed
White	47.2	0.3	45.5	6.4	0.7
Black	47.8	0.5	46.2	4.1	1.4
Asian	27.8	0.4	60.8	10.3	0.8
Chinese	42.1	-	47.4	10.5	-
Mixed	54.5	1.8	40.0	1.8	1.8
Other	48.1	-	43.4	8.5	-

^a Percentages are calculated removing missing values

Source: CEMACH

Table 8.6

Proportions of post mortem examinations by ethnic group among neonatal deaths; England, Wales, Northern Ireland, Channel Islands, and the Isle of Man; 2007

Proportions^a of post mortem examinations by ethnic group (%)					
Ethnicity	Held/being arranged	Coroner's PM	Parent or guardian refused permission	Not offered	Consent given but PM not performed
White	22.3	7.4	51.9	17.6	0.8
Black	25.1	7.3	56.4	10.1	1.1
Asian	11.5	8.5	55.1	23.9	1.0
Chinese	22.2	-	55.6	22.2	-
Mixed	27.3	9.1	51.5	12.1	-
Other	17.6	2.0	51.0	29.4	-

^a Percentages are calculated removing missing values

Source: CEMACH

Chapter 9 Focus on neonatal mortality

9.1 Introduction

Worldwide, over 4 million babies die every year in the first four weeks of life, with the majority of these deaths occurring in developing countries.⁵⁹ Globally, important causes of neonatal deaths are infections, preterm birth, complications during birth, and congenital anomaly. In the UK, the two largest contributors to neonatal mortality are preterm birth and congenital anomaly, which account for nearly half and a quarter of all neonatal deaths respectively (Chapter 8).

While the UK already has a low neonatal mortality rate and has achieved significant improvements in recent years, this should not be taken as implying that an irreducible minimum has been achieved. The current system of robust national perinatal and neonatal mortality surveillance makes a valuable contribution towards monitoring of mortality trends, identification of modifiable risk factors, and evaluation of the effect of any national initiatives.

9.2 Managed clinical neonatal networks

In 2003, the Department of Health published its review on Neonatal intensive care services: Strategy for Improvement.⁶⁰ The review concluded that the existing delivery of neonatal care was not sustainable in view of the increasing numbers of very preterm babies being born alive with complex care needs, and recommended that all neonatal care be provided within managed clinical neonatal networks, consisting of hospitals with different types of neonatal units working together. Each neonatal unit within the network would have an agreed level of neonatal care (special, high dependency or intensive) that it could provide. It was anticipated in this review that this would minimise the number of long-distance transfers and facilitate the provision of appropriate neonatal care as close to home as possible, thus lessening the burden on families.

Since then, twenty four Neonatal Networks have been established in England. Mortality rates for Neonatal Networks are presented in Chapter 6.

9.3 Average neonatal mortality rates for units providing different levels of neonatal care

For the first time, CEMACH is able to provide rates of neonatal mortality by level of neonatal care provision at all hospitals, to allow more meaningful comparison of units which are more likely to be similar in terms of case mix and in the complexity of neonatal care they provide. The British Association of Perinatal Medicine (BAPM) recognises three categories of neonatal unit⁶¹ (Table 9.1) which have been included in the Department of Health review of neonatal intensive care services.

Table 9.1
Definition of categories of neonatal units

	Definition
Level 1 neonatal unit	Unit provides Special Care but does not aim to provide any continuing High Dependency or Intensive Care.
Level 2 neonatal unit	Unit provides High Dependency Care and some short-term Intensive Care as agreed within the regional neonatal network.
Level 3 neonatal unit	Unit provides the whole range of medical neonatal care but not necessarily all specialist services such as neonatal surgery.

Source: BAPM

In the first half of 2008, all maternity units in England, Wales and Northern Ireland were requested to self-report their level of neonatal care provision to the relevant CEMACH Regional Office. The neonatal network for each unit in England was identified through BAPM, and self-reported levels of neonatal care were validated by the manager and Clinical Lead of that Neonatal Network. In Northern Ireland, self-reported levels of neonatal care were validated by Neonatal Intensive Care Outcomes Research and Evaluation (NICORE). In Wales, self-reported levels of neonatal care were validated by the All Wales Perinatal Survey.

In 2008, 27% (57/209) of neonatal units in England, Wales and Northern Ireland were level 1 units, 43% (90/209) were level 2 units and 30% (62/209) were level 3 units.

Average neonatal mortality for the three levels of neonatal unit are shown in Table 9.2. It is important to recognise that comparisons of mortality rates at unit level do not necessarily provide the best overview of how these individual units work together as networks.

Level 1 units, which are generally expected to provide care to babies born at 34 weeks' gestation onwards, had the lowest average neonatal mortality rate. As expected, level 3 units had the highest average neonatal mortality rate (2.9 per 1,000 live births). However, this mortality rate became significantly lower after excluding transfers into hospitals with level 3 units. These transfers are likely to be high risk pregnancies or very preterm or sick babies, which would explain the higher neonatal mortality rate when they are included.

Table 9.2
Average adjusted^a neonatal mortality rates by level of neonatal unit; England, Wales, Northern Ireland, Channel Islands, and the Isle of Man: 2007

	Number of neonatal units	Average adjusted^a neonatal mortality rate^b	
		All babies who died at the neonatal unit	Excluding in- and ex-utero transfers into the unit
Level 1	57	0.8	0.7
Level 2	90	1.2	0.9
Level 3	62	2.9	1.5

^a Excluding all terminations of pregnancy, all lethal congenital anomalies, all babies <22 weeks' gestation and all babies with birth weight <500 grams

^b Rate per 1,000 live births

Source: CEMACH

9.4 Variations in mortality between units providing the same level of neonatal care

Providing neonatal mortality rates for hospitals by the category of their neonatal unit may be more comparable than mortality rates which do not take account of neonatal unit category, due to the inevitable differences in case mix across different levels of neonatal care provision. Level 1 units and level 2 units are likely to have a similar case mix; on the other hand, level 3 neonatal units may have quite a broad variation in case mix. For example a level 3 unit associated with a neonatal surgical unit is more likely to accept referrals of babies with a very high risk of mortality. Funnel plots have been used to show the variation in neonatal mortality between neonatal units providing the same level of care, with each unit being represented by a single dot. Units with a significantly different neonatal mortality rate from the average mortality for all units of the same level are represented by dots outside the dotted 'funnel-shaped' lines (95% confidence limits).

The majority of individual hospitals with level 1 neonatal units had similar neonatal mortality rates (Figure 9.1). However, some hospitals with level 1 neonatal units had a significantly higher adjusted neonatal mortality rate (adjusted to exclude notified terminations of pregnancy, babies with lethal congenital anomalies, babies born at less than 22 weeks' gestation and babies weighing less than 500 grams) than the average mortality for level 1 units. Excluding transfers into the units did not make a difference to this variation in mortality (Figure 9.2).

Hospitals with level 2 neonatal units generally provide care to babies born at 28 weeks' gestation and more. Four level 2 units had a significantly higher adjusted neonatal mortality than the average mortality for level 2 units (Figure 9.3). Excluding transfers into the units resulted in a small increase in the number of units with higher neonatal mortality (Figure 9.4). This may be because the majority of the transfers received by level 2 units are babies with a low risk of mortality - either less preterm babies or babies who were being transferred back to their local hospital in a stable condition.

Level 3 neonatal units provide care to babies at all gestations including babies born at the limits of viability (22-25 weeks' gestation). The obstetric units associated with level 3 neonatal units are also more likely to provide maternity care to women with complex pregnancies.

Figure 9.5 shows the variations in neonatal mortality between individual level 3 neonatal units. As noted above, there may be a great deal of variation in the case mix of level 3 neonatal units and this is borne out by the greater variation in neonatal mortality rates compared to level 1 units (Figure 9.1) and level 2 units (Figure 9.3). Eight units had a neonatal mortality rate significantly higher than the average mortality for level 3 units. When transfers into the neonatal unit or associated obstetric unit were excluded, this variation in neonatal mortality decreased markedly (Figure 9.6).

Figure 9.1 & Figure 9.2

Adjusted^a neonatal mortality rates for hospitals with level 1 neonatal units; England, Wales and Northern Ireland: 2007

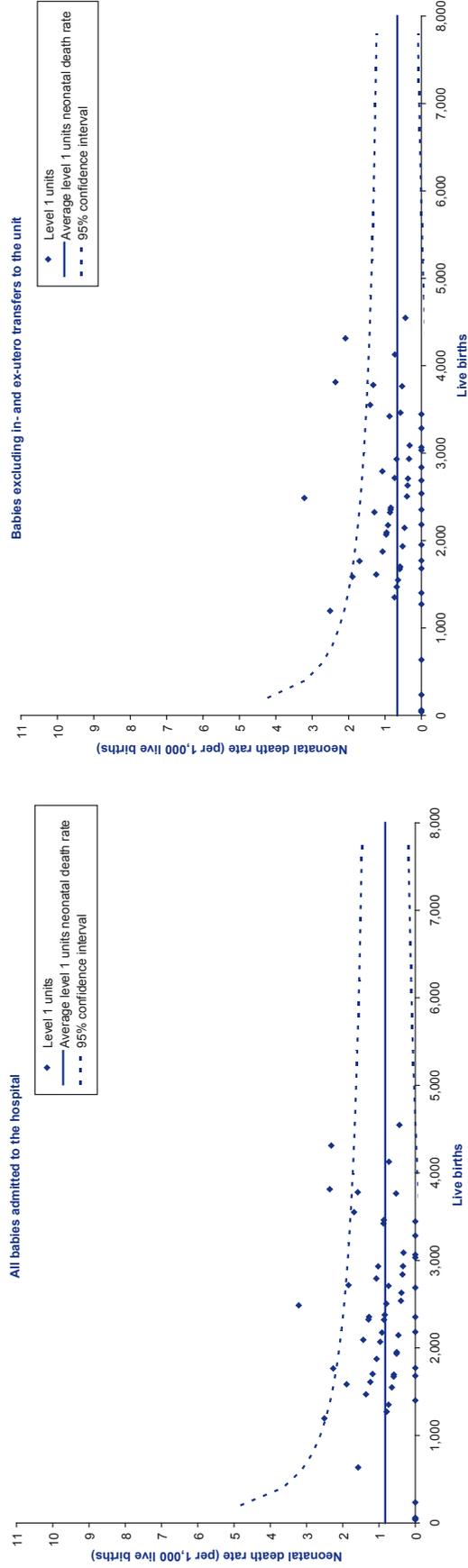
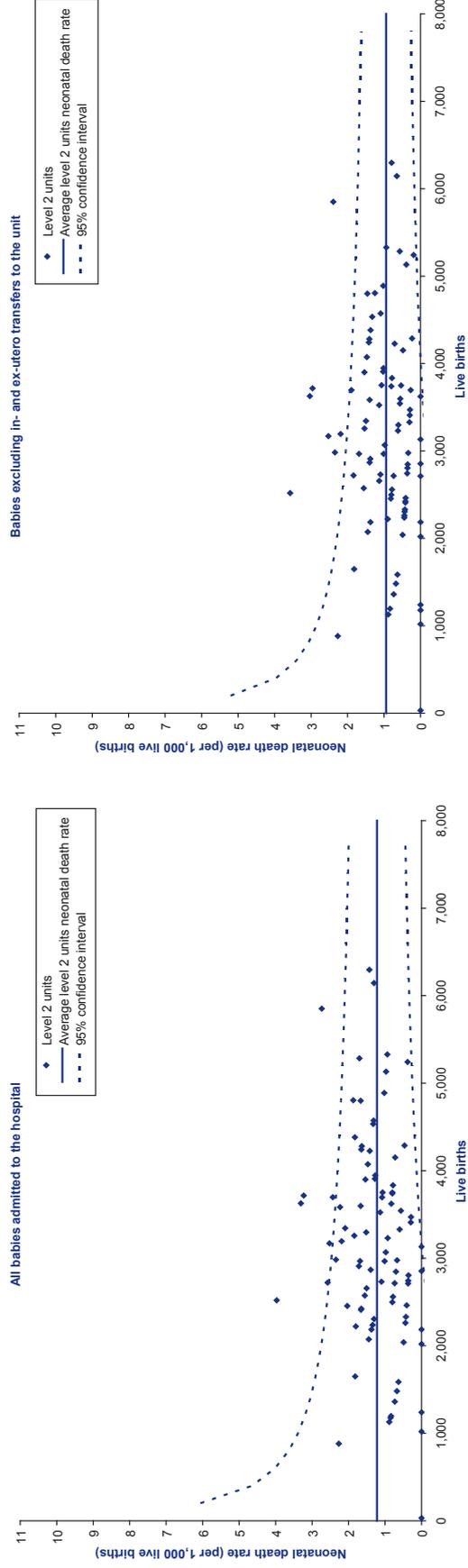


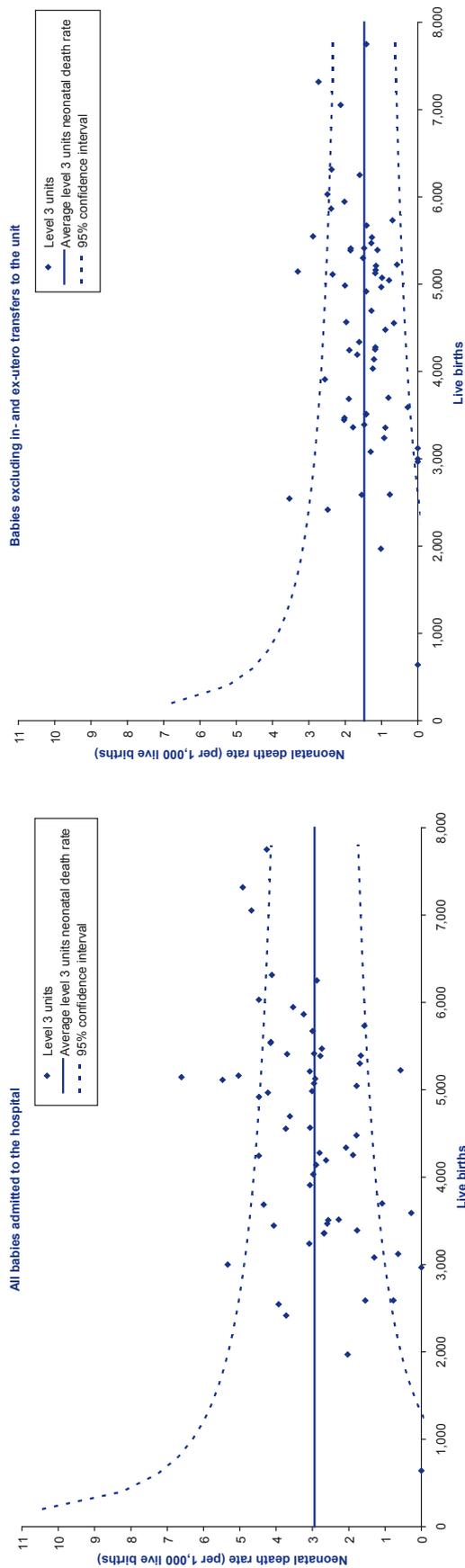
Figure 9.3 & Figure 9.4

Adjusted^a neonatal mortality rates for hospitals with level 2 neonatal units; England, Wales and Northern Ireland: 2007



^aThe rates have been adjusted by excluding all terminations of pregnancy, all lethal congenital anomalies, all babies <22 weeks' gestation and all babies with birth weight <500 grams

Figure 9.5 & Figure 9.6
 Adjusted^a neonatal mortality rates for hospitals with level 3 neonatal units; England, Wales and Northern Ireland: 2007



^a The rates have been adjusted by excluding all terminations of pregnancy, all lethal congenital anomalies, all babies <22 weeks' gestation and all babies with birth weight <500 grams

9.5 Transfer of babies to more specialist care

Babies may sometimes require transfer to another maternity or neonatal unit if they require specialist care not available at the referring unit. The National Perinatal Epidemiology Unit (NPEU) survey in 2006 showed that the two main reasons (excluding back transfers) for transferring a baby from one hospital to another were the need for specialist services and capacity issues.⁶² The best-case scenario in these circumstances is to transfer the mother while she is still pregnant (in-utero transfer) to minimise ambulance transfer of very preterm or sick babies. However, in some circumstances, in-utero transfer is not feasible due to rapid progress of preterm labour, concerns about maternal condition or lack of capacity in those hospitals providing tertiary or specialist neonatal care. Table 9.3 shows that overall there is a gradient with a proportion of babies being transferred to more specialist care during pregnancy, labour or after birth.

Table 9.3

Intended and actual place of birth and place of death for babies who died in the first 28 days after birth: England, Wales, Northern Ireland, Channel Islands, and the Isle of Man: 2007

Level of neonatal unit	Intended place of delivery at booking	Intended place of delivery at onset of labour	Place of delivery	Place of death
Hospital with level 1 unit	370 (16.8%)	322 (15.4%)	303 (13.3%)	209 (8.9%)
Hospital with level 2 unit	832 (37.9%)	722 (34.6%)	742 (32.6%)	584 (25.0%)
Hospital with level 3 unit	901 (41.0%)	985 (47.2%)	1,164 (51.1%)	1,373 (58.7%)
Maternity unit with no NNU	31 (1.4%)	14 (0.7%)	7 (0.3%)	4 (0.2%)
Home	16 (0.7%)	17 (0.8%)	49 (2.2%)	39 (1.7%)
Children's hospital	97 (4.1%)
Hospice	4 (0.2%)
Other	48 (2.2%)	27 (1.3%)	14 (0.6%)	28 (1.2%)
Missing	152	263	71	12

^a Includes unbooked, outside the UK, in transit and other non maternity hospitals

Source: CEMACH

Figure 9.7 shows the timing of transfers for babies who died in the neonatal period. Of the 339 babies whose mothers booked for maternity care in a level 1 unit, 65 were in-utero transfers to a level 3 unit, while 145 babies (with a median gestation of 28 weeks) delivered and died in the level 1 unit. Seventy two of the 339 babies were transferred to a level 3 unit after birth; the median gestation of these babies was 30 weeks. Since level 1 units provide special care as designated by BAPM, it is possible that transfer of some of these babies should ideally have been effected prior to birth according to the Network guidance. However, possible reasons for lack of transfer may have been clinical inadvisability of transfer or lack of capacity at level 2 or 3 units. Networks should investigate these incidents to ensure that reasons underlying non-transfer are addressed where appropriate.

Similarly, of the 783 babies whose mothers booked for maternity care in a level 2 unit, 151 were in-utero transfers to a level 3 unit, while 427 babies with a median gestation of 27 weeks delivered and died in the level 2 unit. One hundred and thirty eight of the 783 babies were transferred to a level 3 unit after birth, the median gestation of these babies was 26 weeks. It is recognised that in some cases a considered decision may have been taken to provide short-term intensive care at the level 2 unit, while in other cases the clinical situation or lack of capacity within the local and adjacent neonatal networks may have precluded transfer.

Table 9.4 shows that 13% of all babies transferred from a level 1 or level 2 unit to a level 3 unit following birth died of intrapartum causes, which could not have been predicted prior to birth. However, the single most common cause of death for babies transferred to level 3 units following birth was immaturity (48% of all babies transferred).

While the decisions taken regarding the movement of babies between different categories of neonatal units are complex and often multifactorial, networks should investigate non-transfers to ensure that any underlying factors are addressed where necessary.

Table 9.4

Cause of death of neonatal deaths transferred after birth from level 1 and level 2 units to level 3 units.

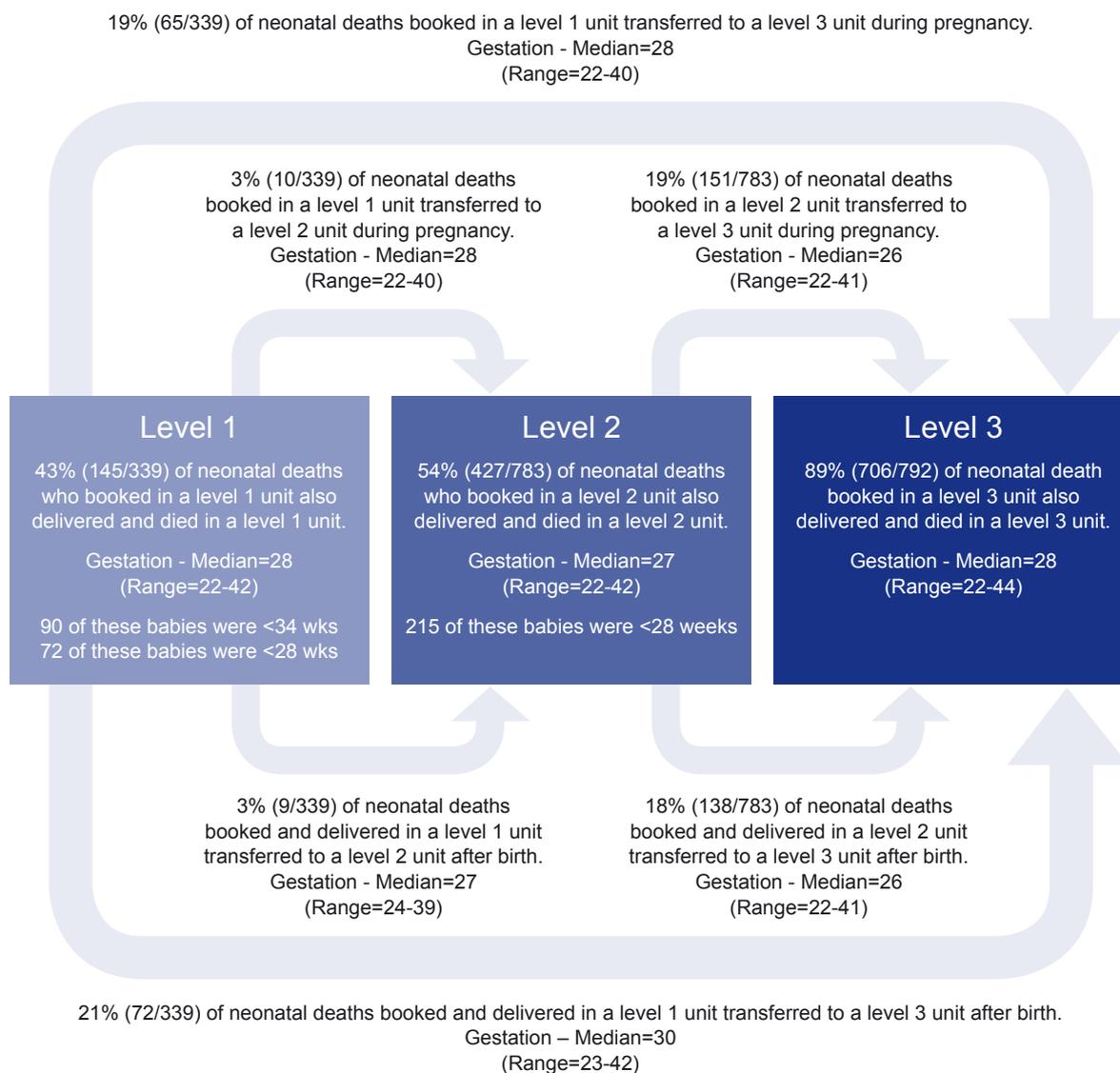
Cause of death	Number	Percentage (%) ^a
Congenital malformation	26	12.6
Death from intrapartum causes	26	12.6
Immaturity	98	47.6
Infection	33	16.0
Other specific causes	18	8.7
Sudden infant death	4	1.9
Unclassifiable	1	0.5
Not known	4	..

^a Percentages are calculated removing not known values

Source: CEMACH

Figure 9.7

Timing of transfers to more specialist care for babies dying in the neonatal period; England, Wales, Northern Ireland, the Channel Islands and the Isle of Man: 2007



All babies presented in this flow chart were born at 22 or more weeks' gestation.

- 3% (9/339) of neonatal deaths booked in a level 1 unit delivered at home or in transit and got transferred back to hospital after birth.
- 9% (29/339) of neonatal deaths booked in a level 1 unit died outside of a maternity unit, mostly in Children's hospitals.
- 1% (7/783) of neonatal deaths booked in a level 2 unit transferred to a level 1 unit.
- 1% (8/783) of neonatal deaths booked in a level 2 unit delivered at home or in transit and got transferred back to hospital after birth.
- 7% (52/783) of neonatal deaths booked in a level 2 unit died outside of a maternity unit, mostly in Children's hospitals.
- 3% (21/792) of neonatal deaths booked in a level 3 unit transferred to a level 1 or level 2 unit.
- 2% (13/792) of neonatal deaths booked in a level 3 unit delivered at home or in transit and got transferred back to hospital after birth.
- 7% (52/792) of neonatal deaths booked in a level 3 unit died outside of a maternity unit, mostly in Children's hospitals.

9.6 Reporting of neonatal deaths less than 22 weeks' gestation

The 2006 report by the Nuffield Council on Bioethics⁶³ stated that as there is no evidence of any therapeutic developments likely to improve the prospects of survival for babies born before 22 weeks in the near future, no baby born at this gestation should be resuscitated except in the context of a research project. However, CEMACH still receives a number of notifications of pre-viable neonatal deaths less than 22 weeks, with 11.5% of all early neonatal deaths in 2007 being less than 22 weeks' gestation (Table 9.5). There is also wide geographical variation in the proportion of pre-viable neonatal deaths being reported, from 4.2% to 18% of all early neonatal deaths in different Strategic Health Authorities and from 0% to 25% of all early neonatal deaths in different Neonatal Networks (Tables 9.5 and 9.6).

In this report, all mortality rates have been adjusted to exclude infants less than 22 weeks' gestation. However, neonatal deaths constitute two-thirds of overall infant mortality, and the inclusion of pre-viable gestations will inevitably increase infant mortality rates, which has implications for national and international comparisons of infant and neonatal mortality. To illustrate this, Table 9.7 shows that after excluding neonatal deaths less than 22 weeks' gestation, the infant mortality rate for England and Wales in 2007 dropped significantly from 4.8 to 4.6 per 1,000 live births.

For the reasons outlined above it is important that there is consistent national reporting of neonatal deaths. The decision regarding pregnancy outcome is usually taken by front-line staff and it is important that all obstetricians and midwives are aware that a pre-viable pregnancy loss prior to 22 weeks' gestation should not be reported as a neonatal death.

Table 9.5

Percentage of early neonatal deaths delivered at less than 22 weeks' gestation by SHA; England, Wales, Northern Ireland, Channel Islands and the Isle of Man: 2007

	Proportions ^a of early neonatal deaths (%)		
	2005	2006	2007
Total	13.8	10.2	11.5
England	14.0	10.0	12.0
Wales	6.8	11.9	2.3
Northern Ireland	17.0	11.3	12.9
Crown Dependencies	-	-	-
East Midlands	11.4	11.6	14.3
East of England	9.6	13.2	12.9
London	9.7	5.1	7.7
North East	9.2	8.5	4.2
North West	20.6	15.5	13.7
South Central	12.9	9.5	10.5
South East Coast	13.0	11.5	9.3
South West	22.2	8.1	18.0
West Midlands	17.5	15.3	16.0
Yorkshire and the Humber	10.5	2.1	9.4

^a Percentages are calculated removing missing values

Sources: CEMACH

Table 9.6

Percentage of early neonatal deaths delivered at less than 22 weeks' gestation by Neonatal Network;
England: 2007

	Proportions ^a of early neonatal deaths (%)		
	2005	2006	2007
Total	13.8	10.2	11.5
Beds and Herts Neonatal Network	8.8	14.3	14.6
Central Newborn Network	17.6	16.3	19.6
Central South Coast Neonatal Network	25.9	14.1	12.1
Cheshire and Merseyside Neonatal Network	19.0	12.1	13.6
Essex Neonatal Network	3.7	25.0	14.7
Greater Manchester Neonatal Network	18.5	9.8	10.6
Kent and Medway Perinatal Network	18.9	15.6	4.8
Lancashire and South Cumbria Neonatal Network	33.3	42.1	17.9
Norfolk, Suffolk and Cambridgeshire Neonatal Network	13.3	11.8	14.5
North Central London Neonatal Network	18.9	7.7	8.3
North East London and North Middlesex Perinatal Network	8.8	1.3	3.9
North Trent Neonatal Network	6.2	-	-
North West London Perinatal Network	3.1	1.3	1.4
Northern Neonatal Network	8.0	7.7	3.4
South East London Neonatal Network	9.5	1.4	11.2
South West London Neonatal Network	7.5	2.0	15.9
South West Peninsula Neonatal Care Managed Network	29.5	13.2	25.0
Southern West Midlands Newborn Network	26.0	19.0	22.6
Staffordshire, Shropshire and Black Country Managed Network	7.4	13.8	10.5
Surrey and Sussex Perinatal Network	11.4	8.2	15.6
Thames Valley Perinatal Network	11.5	9.7	7.6
Trent Perinatal Network	3.2	3.4	8.8
Western Neonatal Network	15.3	1.4	17.2
Yorkshire Neonatal Network	13.2	3.1	14.8

^a Percentages are calculated removing missing values

Sources: CEMACH

Table 9.7

Infant mortality rate adjusted for infants born at less than 22 weeks' gestation; England and Wales: 2007

	Unadjusted	Adjusted
Neonatal deaths	2,282	2,079
Post neonatal deaths	1,063	1,063
Total infant deaths	3,345	3,142
Total live births	690,013	690,013
Infant mortality rate ^a	4.8	4.6

^a Rate per 1,000 live births

Source: ONS

9.7 Conclusions

The emergence of neonatal managed clinical networks since 2003 has led to the designation of neonatal units as level 1, 2 or 3 according to their level of neonatal care provision. There is a difference in average neonatal mortality rates for these three categories of neonatal unit which is likely to reflect differences in case mix. Level 3 units have a greater variation in neonatal mortality rates than level 1 and level 2 units, probably because some of these units are associated with neonatal surgical units and therefore have a wider variation in case mix. A comparison of neonatal units providing the same level of care shows that a small number of units had a significantly higher mortality rate in 2007 than the national average for that level of unit. While there may be good reasons for this variation such as case mix and local population socio-demographics, it is important that all networks have processes in place to ensure ongoing local review of their neonatal deaths.

In England, the system of Neonatal Networks works on the assumption that babies requiring more specialist care will be transferred to an appropriate maternity or neonatal unit, ideally within the same network. Transfers are best carried out during pregnancy, although this may not always be appropriate or possible depending on the clinical situation. In 2007, half of the babies whose mothers had initially booked at hospitals with level 1 or 2 neonatal units also delivered and died at these units; half of these babies were less than 28 weeks' gestation. Another fifth of babies whose mothers initially booked at level 1 or level 2 units, who had a median gestation of 30 and 26 weeks respectively, were not transferred to level 3 units until after birth. In-utero transfer of preterm babies may not always be clinically appropriate or feasible; however Neonatal Networks should investigate non-transfers and address the underlying reasons where possible.

There continues to be wide geographical variations in the reporting of pre-viable (less than 22 weeks' gestation) neonatal deaths, from 0% to 25% of all early neonatal deaths in different Neonatal Networks. There needs to be consistent national reporting to allow accurate national and international comparisons of neonatal and infant mortality rates.

The last national-level enquiry into neonatal outcomes was the CESDI Project 27/28 which investigated standards of care and outcomes for babies born at 27 and 28 weeks' gestation.⁶⁴ The National Neonatal Audit programme, established in 2006, is auditing key standards of neonatal care, addressing nine audit questions.⁶⁵ In December 2008, 131 units in England had submitted data.⁶⁵ The findings of this chapter indicate the need for national collection of comprehensive data relating to case mix and transfers between neonatal units.

Chapter 10 Feedback on 2006 report

10.1 Introduction

In addition to the national perinatal mortality report, CEMACH has, since 2003, provided annual individualised perinatal mortality reports for the 168 NHS Trusts with maternity services in England, Wales and Northern Ireland. It has also provided separate reports for the 24 Neonatal Networks and 10 Strategic Health Authorities (SHA) in England. In the North East of England, the Regional Maternity Services Office (RMSO) provides individual-level reports.

For 2006 data, each Trust report was sent to the Head of Midwifery and the CEMACH coordinator within each Trust, with a request to forward the reports to the following key contacts:

- Clinical Director of Obstetrics and Gynaecology
- Clinical Director of Paediatrics and Neonatology
- Maternity Risk Manager and Clinical Governance Lead
- Relevant health professionals including consultant neonatologists, obstetricians, midwives and pathologists.

Each Neonatal Network report was sent to the Network Chair and Lead Clinician, and each SHA report was sent to the Chief Executive, Director of Public Health and to the Local Supervisory Authority (LSA) midwife.

In 2007, the following changes were introduced for the individualised reports based on feedback from Trusts, Neonatal Networks and SHAs:

- details of home deliveries
- comparison of mortality rates with hospitals providing the same category of neonatal care
- a description of transfers of babies who died into and out of the Trust, SHA or Neonatal Network.

10.2 Evaluation of individual perinatal mortality reports for 2006

Methods

During dissemination of the individual perinatal mortality reports for 2006, an electronic feedback form was sent to report recipients in order to obtain feedback from NHS Trusts, Neonatal Networks and Strategic Health Authorities.

Findings

A total of sixty six completed questionnaires were returned, with the majority of these being from NHS Trusts.

Ninety four percent of respondents found the individual report 'useful' or 'very useful'. The other six percent of respondents (four respondents) found the report 'somewhat useful'. Ninety four percent of respondents stated that they planned to discuss the findings of their individual report within their organisation.

Every section of the 2006 individual reports was considered 'very useful' or 'useful' by at least 84% of all respondents, compared to 54% of respondents for the 2005 report. The funnel plots showing adjusted mortality rates for each NHS Trust compared to the average Trust rate was considered particularly useful (92% of respondents).

A quarter of the 66 respondents suggested some areas for future development of the reports, and 35% gave additional comments. These included:

- Providing details of post mortem findings when available and whether the results had changed the cause of death
- Accounting for population socio-demographic factors when calculating mortality rates e.g. comparing Trusts serving similar populations
- Presenting gestational age distribution of singleton stillbirths compared to the median distribution of stillbirths for England, Wales and Northern Ireland
- Adjusting for ethnicity and smoking when presenting overall mortality rates.

This feedback will be used to further develop the analytic framework and enhance the presentation of future reports.

10.3 Summary and next steps

Overall, the feedback shows that individualised perinatal mortality reports have been well received and are being used locally to discuss and review perinatal deaths. Many of the suggestions for development have been incorporated for the 2007 reports.

Trusts, Neonatal Networks and SHAs have been invited to give feedback on the 2007 individual reports, and this will be helpful in developing the individual reports so that they continue to be useful and locally relevant.

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The following symbols have been used in the tables:

- .. Not available/not applicable
- Nil
- 0.0 Negligible

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CEMACH - Confidential Enquiry into Maternal and Child Health - 2007 Perinatal Death Notification		Survey Number Office use only											
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16. Actual place of delivery <table border="1" style="display: inline-table; width: 60px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Name of unit/place _____ office use only Consultant led unit <input type="checkbox"/> Midwifery led unit <input type="checkbox"/> Other <input type="checkbox"/> N/K <input type="checkbox"/>				33. When did death occur? - Stillbirths only Antepartum <input type="checkbox"/> Intrapartum <input type="checkbox"/> N/K <input type="checkbox"/>									
17. Date and time of delivery / birth <table border="1" style="display: inline-table; width: 60px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Time N/K <input type="checkbox"/> <small>Day Month Year</small> <table border="1" style="display: inline-table; width: 40px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 24hr clock Date & time N/K <input type="checkbox"/>						34. Place of death - Live births only <table border="1" style="display: inline-table; width: 60px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> Name of unit/place _____ office use only N/K <input type="checkbox"/>							
18. Mode of delivery Spontaneous 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"/>	35. Date and time of death - Live births only Time N/K <input type="checkbox"/> <table border="1" style="display: inline-table; width: 60px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> <table border="1" style="display: inline-table; width: 60px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 24hr clock Date & time N/K <input type="checkbox"/>												
19. Was this a breech presentation? (immediately prior to delivery) Yes <input type="checkbox"/> No <input type="checkbox"/> N/K <input type="checkbox"/>	36. 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 _____												
Please give the details of the person who completed this form Name: _____ Position: _____ Contact address: _____ Tel. number/email address: _____	37. Extended Wigglesworth classification (see guidelines) <input type="checkbox"/> 38. Fetal and Infant classification (see guidelines) <table border="1" style="display: inline-table; width: 40px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 39. Obstetric (Aberdeen) classification (see guidelines) <table border="1" style="display: inline-table; width: 40px;"><tr><td style="width: 20px; height: 20px;"></td><td style="width: 20px; height: 20px;"></td></tr></table> 40. Postmortem / autopsy Held / being arranged <input type="checkbox"/> Not offered <input type="checkbox"/> Parent or guardian refused permission <input type="checkbox"/> Coroner's postmortem <input type="checkbox"/> Consent given but postmortem not performed <input type="checkbox"/> N/K <input type="checkbox"/>												

Appendix B

Table B1

Stillbirth, perinatal and neonatal mortality rates for all multiples; United Kingdom: 2000-2007

Year	Stillbirth rate ^a for all multiples	Perinatal mortality rate ^a for all multiples	Neonatal mortality rate ^b for all multiples
2000	17.0	35.1	23.1
2001	18.3	36.6	23.5
2002	18.8	34.5	20.3
2003	20.0	36.6	21.4
2004	16.9	32.3	20.0
2005	13.6	30.5	21.6
2006	12.3	27.4	20.0
2007	12.3	25.9	18.4

^a Rate is number of deaths per 1,000 total births

^b Rate is number of deaths per 1,000 live births

Sources: CEMACH, ONS,
NISRA-GRO, GROS and SSBID Survey

Appendix C

Table C1

Live births, total births, stillbirths, perinatal and neonatal deaths by nation: 2007

	Live births	Total births	Stillbirths ^a	Early neonatal deaths ^a	Late neonatal deaths ^a
England	655,357	658,777	2,565	986	311
Northern Ireland	24,500	24,602	77	24	3
Scotland	57,781	58,108	269	73	46
Wales	34,414	34,584	126	60	23
Crown Dependencies	2,477	2,488	9	4	1

^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams

Sources: CEMACH, ONS, NISRA-GRO, GROS and SSBID Survey

Table D1
Live births, total births, stillbirths, perinatal and neonatal deaths by SHA; England: 2007

	2005					2006					2007				
	Live births	Total births	Stillbirths ^a	Early neonatal deaths ^a	Late neonatal deaths ^a	Live births	Total births	Stillbirths ^a	Early neonatal deaths ^a	Late neonatal deaths ^a	Live births	Total births	Stillbirths ^a	Early neonatal deaths ^a	Late neonatal deaths ^a
East Midlands	49,080	49,322	196	80	27	50,717	50,999	223	88	42	52,482	52,713	183	83	25
East of England	64,687	64,963	210	84	22	66,870	67,167	225	87	35	69,311	69,620	238	100	18
London	116,019	116,739	548	190	78	120,898	121,672	570	214	74	125,505	126,278	555	189	71
North East	28,249	28,411	126	44	14	29,184	29,344	132	62	20	29,582	29,729	109	46	9
North West	81,722	82,174	352	121	70	84,155	84,597	349	155	53	85,947	86,430	348	114	44
South Central	46,993	47,243	191	59	22	49,403	49,649	184	62	14	50,785	51,019	180	66	22
South East Coast	46,928	47,127	153	64	18	49,163	49,392	171	59	28	50,453	50,701	180	62	18
South West	52,729	52,953	174	67	32	54,715	54,960	202	75	27	57,003	57,248	194	73	29
West Midlands	65,956	66,354	308	134	41	67,688	68,073	272	122	47	70,098	70,478	279	143	33
Yorkshire and the Humber	60,665	61,045	295	106	30	62,955	63,301	273	131	42	64,191	64,561	299	110	42

^a Excluding terminations of pregnancy, lethal congenital anomalies, all babies <22 weeks' gestation, birth weight <500 grams

Sources: CEMACH, ONS

Appendix E

Table E1

Proportions of congenital anomalies and gestation less than 22 weeks by Neonatal Network; England: 2007

Neonatal Network	Congenital anomalies ^a	Gestation <22 weeks ^b
Beds and Herts Neonatal Network	32 (22%)	7 (15%)
Central Newborn Network	48 (17%)	20 (20%)
Central South Coast Neonatal Network	26 (15%)	7 (12%)
Cheshire and Merseyside Neonatal Network	55 (23%)	9 (14%)
Essex Neonatal Network	20 (17%)	5 (15%)
Greater Manchester Neonatal Network	69 (20%)	11 (11%)
Kent and Medway Perinatal Network	21 (14%)	2 (5%)
Lancashire and South Cumbria Neonatal Network	28 (20%)	7 (18%)
Norfolk, Suffolk and Cambridgeshire Neonatal Network	37 (18%)	12 (14%)
North Central London Neonatal Network	30 (25%)	3 (8%)
North East London and North Middlesex Perinatal Network	58 (17%)	3 (4%)
North Trent Neonatal Network	29 (14%)	-
North West London Perinatal Network	64 (22%)	1 (1%)
Northern Neonatal Network	51 (19%)	3 (3%)
South East London Neonatal Network	72 (22%)	10 (11%)
South West London Neonatal Network	20 (14%)	7 (16%)
South West Peninsula Neonatal Care Managed Clinical Network	13 (10%)	10 (25%)
Southern West Midlands Newborn Network	82 (24%)	31 (23%)
Staffordshire, Shropshire and Black Country Managed Neonatal Network	41 (17%)	10 (11%)
Surrey and Sussex Perinatal Network	37 (19%)	7 (16%)
Thames Valley Perinatal Network	41 (17%)	5 (8%)
Trent Perinatal Network	36 (20%)	5 (9%)
Western Neonatal Network	41 (19%)	10 (17%)
Yorkshire Neonatal Network	87 (21%)	18 (15%)

^a The percentage is of the total (stillbirths and neonatal deaths)

^b The percentage is of the number of early neonatal deaths

Sources: CEMACH

Appendix F

Table F1

Causes of stillbirths using the Wigglesworth and Obstetric classifications; England, Wales, Northern Ireland, Channel Islands and the Isle of Man: 2007

Wigglesworth classification	Obstetric classification	Proportions ^a of stillbirths within each Wigglesworth category
Congenital defect/malformation (lethal or severe)	Congenital anomaly	98.5
	Pre-eclampsia	0.4
	Maternal disorder	0.8
	Miscellaneous	0.4
Unexplained antepartum fetal death	Congenital anomaly	0.1
	Pre-eclampsia	4.9
	Antepartum haemorrhage	10.7
	Mechanical	1.5
	Maternal disorder	8.1
	Miscellaneous	0.2
Death from intrapartum 'asphyxia', 'anoxia' or 'trauma'	Unexplained	74.4
	Pre-eclampsia	2.4
	Antepartum haemorrhage	22.0
	Mechanical	13.7
	Maternal disorder	7.8
	Miscellaneous	0.5
Infection	Unexplained	53.7
	Antepartum haemorrhage	0.9
	Maternal disorder	93.8
	Miscellaneous	0.9
Other specific causes	Unexplained	4.4
	Congenital anomaly	1.3
	Isoimmunisation	2.5
	Pre-eclampsia	1.9
	Antepartum haemorrhage	12.6
	Mechanical	2.5
Accident or non-intrapartum causes	Maternal disorder	8.2
	Miscellaneous	66.0
	Unexplained	5.0
Unclassifiable	Antepartum haemorrhage	40.0
	Maternal disorder	40.0
	Unexplained	20.0
Unclassifiable	Antepartum haemorrhage	20.0
	Maternal disorder	10.0
	Unexplained	70.0

^a Percentages are calculated removing not known

Source: CEMACH

Appendix G

Table G1

Number of post mortem examinations among stillbirths; England, Wales, Northern Ireland, Channel Islands and the Isle of Man: 2000-2007

Year	Held/being arranged	Coroner's PM	Parent or guardian refused permission	Not offered	Consent given but PM not performed
2000	1,762	20	1,066	360	14
2001	1,560	17	1,126	482	14
2002	1,527	21	1,143	680	26
2003	1,559	24	1,259	582	16
2004	1,614	24	1,307	659	22
2005	1,530	15	1,254	637	14
2006	1,445	16	1,638	255	33
2007	1,609	14	1,683	245	26

Sources: CEMACH

Table G2

Number of post mortem examinations among neonatal deaths; England, Wales, Northern Ireland, Channel Islands and the Isle of Man: 2000-2007

Year	Held/being arranged	Coroner's PM	Parent or guardian refused permission	Not offered	Consent given but PM not performed
2000	640	176	926	517	8
2001	455	179	871	573	9
2002	439	188	819	596	14
2003	452	180	867	583	2
2004	433	185	861	614	5
2005	438	199	909	655	11
2006	425	145	1,056	357	14
2007	447	176	1,096	388	16

Sources: CEMACH



Point of note

Regarding Section 7.5 Antenatal care: booking by 12 weeks' gestation (page 37 of this report), it should be noted that while the Maternity Care Pathway in the Department of Health 'Maternity Matters' Report (April 2007) states that women should access maternity care at 6-8 weeks' gestation and book for antenatal care by 10-12 weeks' gestation, it is not a national target and there will be no national measurement of this. The Department of Health recommends that women should access maternity services as soon as pregnancy is confirmed.



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