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NHS National Services Scotland

Scottish Perinatal and Infant Mortality and Morbidity Report

2012

Evidence

NHS SCOTLAND

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CONTENTS

SUMMARY

1. Total births and deaths in 2012

Total births: 58,301, continuing the very slight decline in births in recent years.
656 deaths were notified to the Survey:

- 164 late fetal deaths
- 274 stillbirths
- 148 neonatal deaths
- 69 post-neonatal deaths

2. Rates of stillbirths, neonatal deaths and infant deaths among singleton and multiple births

	All deaths	Singleton birth deaths	Multiple birth deaths
Stillbirths[1]	4.7	4.5	10.8
Neonatal deaths[2]	2.6	2.1	16.7
Perinatal deaths[1]	6.5	6.1	19.9
Post-neonatal deaths[2]	1.2	1.2	1.7
Infant deaths[2]	3.7	3.3	18.4

1 Rate per 1000 total births (58301).
2 Rate per 1000 live births (58027).

The rates of stillbirths, perinatal deaths and infant deaths were the lowest ever recorded; the rates of neonatal and post-neonatal deaths equalled the lowest ever recorded. There has been a statistically significant decline in the rates of both stillbirths and neonatal deaths in the last decade.

3. Main causes of stillbirths and neonatal deaths among singleton pregnancies

Cause of death	Stillbirths (%)	Neonatal deaths (%)
Placental conditions	40.0	2.5
Antepartum haemorrhage	15.7	10.9
Congenital anomaly	11.0	26.9
Conditions associated with prematurity[1]	-	50.4

1 Babies born alive at <37 weeks gestation and with conditions particularly associated with prematurity

4. Other findings

- Advanced maternal age, obesity, deprivation, smoking, alcohol consumption, substance misuse and lack of maternal employment are all associated with an increased probability of fetal and infant deaths.
- The single biggest risk factor for stillbirth and neonatal death is multiple pregnancy though the number of deaths from multiple pregnancies (19 stillbirths and 29 neonatal deaths in 2012) is very much less than from singleton pregnancies (255 stillbirths and 119 neonatal deaths).

- Low birthweight and prematurity continue to be associated with the highest rates of stillbirth and neonatal mortality.
- Rates of postmortem examination and of placental histology are good, especially for stillbirths.
- The majority of all deaths were discussed at a perinatal mortality forum though a root cause analysis of each death was much less often performed.

5. Congenital anomalies

- Most anomalies are of the heart and circulatory system.
- Antenatal screening provides an opportunity to reduce the rates of neural tube defects and Down's syndrome at birth.

6. NHS board variations

Within one NHS board area, mortality rates of stillbirth and neonatal deaths have been higher than the rest of Scotland in recent years. In the absence of an obvious explanation, this NHS board will investigate these rates further.

7. Commentary

Commentary is provided on the declining stillbirth rate, on factors associated with deaths, on regional variations and on opportunities for further improvement.

PREVIOUS RECOMMENDATIONS and FUTURE REPORTS

In recent years the annual Scottish Perinatal Infant Mortality and Morbidity Report (SPIMMR) has produced recommendations for research and clinical practice based on the findings. As this is the last such report, new recommendations are not included. Many of the previous reports' recommendations have been implemented. In particular, it is encouraging that the rate of postmortem examinations is rising after a long steady decline and also that the histological examination of the placenta after a stillbirth is now almost universal. Below are some recent recommendations which are worth reiterating considering the findings in this report and the new systems of data collection and reporting:

1. The benefits of a postmortem examination carried out by a perinatal pathologist should be explained to all parents whose baby is either stillborn or a neonatal death.

2. A resource should be provided within each maternity and neonatal unit to ensure that full details of every death relevant to the enquiry are completed and logged within the appropriate national system.

3. A standard method of reviewing all perinatal deaths at each maternity unit should be established.

4. There should be dissemination of each annual report throughout the relevant clinical community who should discuss its relevance and implications for their own unit or working environment.

Data collection and reporting from 2013

This 2012 SPIMMR is the last to be produced in this format. In January 2013, the Scottish Stillbirth and Infant Death Survey was replaced by a revised UK survey, MBRRACE-UK[1] (Mothers and Babies Reducing Risk through Audit and Confidential Enquiries across the UK). This new collaboration was appointed by the Healthcare Quality Improvement Partnership (HQIP) for the national programme of work investigating maternal deaths, stillbirths and infant deaths. Funding is provided by the four UK departments of health.

The MBRRACE-UK programme of work will include surveillance of late fetal losses, stillbirths and some infant deaths together with a rolling programme of topic specific confidential case reviews of stillbirths and mortality and morbidity cases. The first themed topic is congenital diaphragmatic hernia. Annual reports will be produced with the first report anticipated in 2015. All units in Scotland are now registered for the web based data collection process. It is planned that Scottish data will be separately analysed in addition to the UK report and will be used to inform the patient safety programme in maternity services - Maternity and Children Quality Improvement Collaborative[2] (MCQIC) and the Early Years Collaborative which were launched in March 2013.

Deaths occurring in the last few days of each year are often not registered with National Records Scotland (NRS) until early in the following year. This makes a negligible practical difference to the data, particularly as each year of registered deaths also includes a small

number of deaths from late in the previous year. For this reason, however, there is always a slight difference between the number of deaths registered in and the number of deaths occurring in any given year. SPIMMR has always reported on deaths in the year of registration for compatibility with NRS deaths. MBRRACE will, however, publish reports based on the year of death rather than of registration. In order to allow accurate comparison between MBRRACE reports in the future and recent SPIMMR data, Table 12.3.1 in Appendix 12.3 shows the numbers and rates of deaths based on the year of death from 2007 to 2012.

1 Introduction and methods

Annual reports on perinatal mortality in Scotland have been produced since 1977. The report now also includes information on late fetal deaths (losses from 20 to 23^{+6} weeks gestation), late neonatal (7-28 days of age), and post-neonatal infant deaths (28 days to one year). In recent years, information on certain congenital anomalies occurring in live births, stillbirths, miscarriages and terminations has also been included. This is the second annual report based on information from a new data collection form and using a new classification system for deaths, which was instigated in 2011.

The Scottish Stillbirth and Infant Death Survey (SSBIDS) and the production of the report are managed jointly by the Reproductive Health Programme of Healthcare Improvement Scotland and the Information Services Division (ISD) of NHS National Services Scotland with collaboration from the National Records of Scotland (NRS). Registered deaths (stillbirths, neonatal and post-neonatal deaths) were identified through NRS[3] and detailed information for each case was obtained from designated co-ordinators in each maternity unit and associated neonatal or paediatric unit. Late fetal deaths are not registered and the survey was dependent on the recognition and reporting of these by the maternity and neonatal unit co-ordinators. The co-ordinators are listed in Appendix 12.6; the survey was completely dependent on their assistance and co-operation.

The data collection form for each death was scrutinised for completeness and accuracy by Reproductive Health Programme staff with the cause of death receiving a final classification by the clinical advisor. Data were initially entered into an access data base and then onto an SPSS database and quality assured by Reproductive Health Programme (RHP) staff. Further data checking was carried out by ISD staff who then produced tables and carried out appropriate statistical analyses. The Chi squared test (χ^2) for trend was used to test time series data for any significant increase or decrease and also to test data with ordered groupings (for example, alcohol use) for significant association between variables. Funnel plots have been used to present data by NHS board. As perinatal reports for England and Wales (combined) have not been produced since 2009, no in depth comparisons with other UK countries can be made though basic rates were obtained from the Office of National Statistics (ONS)[4].

The main body of this report describes the findings and includes key tables and figures. Most of the detailed tables are provided in Appendix 12.2. An “A” in front of a table number referred to in the text indicates that the table can be found in that appendix (e.g. Table A5).

Where comparisons are made between information about women experiencing a stillbirth or infant death and all women giving birth in Scotland, data for all women uses births from 1st April 2011 to March 31st 2012 as information for the calendar year 2012 was incomplete at the time of this publication. Footnotes to the relevant tables and figures indicate when this is the case.

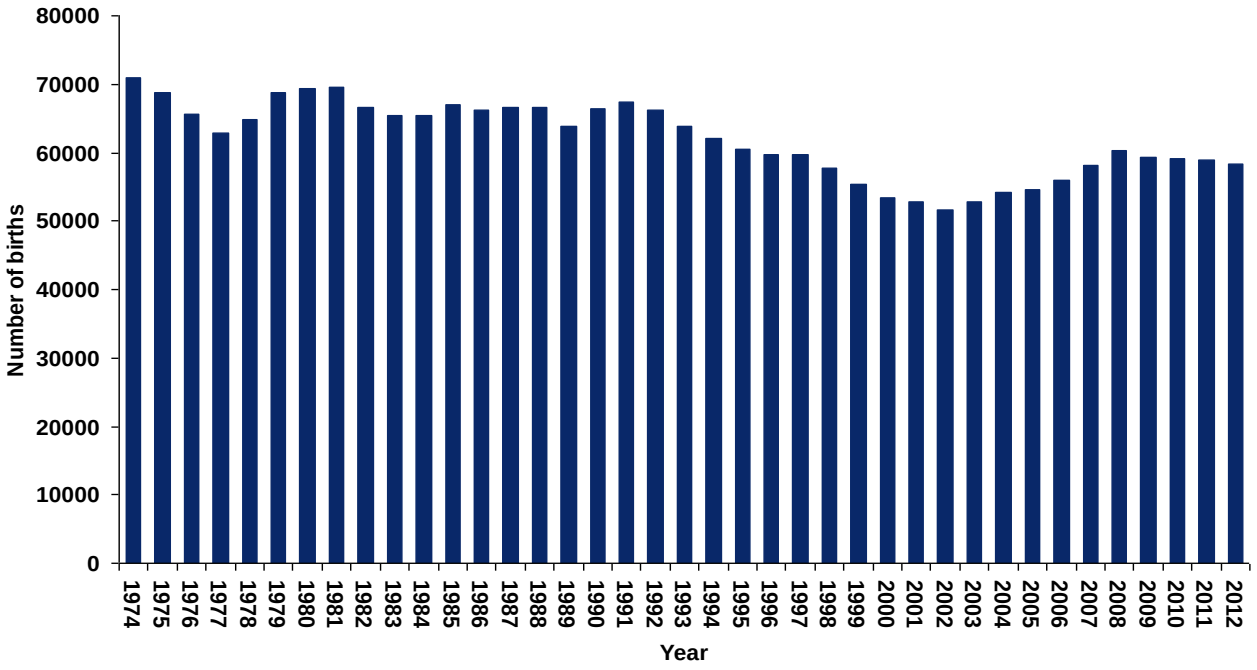
2 Trends over time

2.1 Total births

There were 58,301 live and stillbirths registered in Scotland in 2012. This is 588 fewer than were registered in 2011 and continues the slight decline in births since the recent peak of 60,366 in 2008. The lowest number of recorded births since accurate birth registration was 51,548 births in 2002. By contrast, the increase in the number of births in England and Wales since 2001 continues with a rise of 0.8% in 2012[4].

The trend in total births in Scotland over the last 39 years is illustrated in Figure 2.1.

Figure 2.1 Total births in Scotland: 1974 - 2012



Source: NRS.

2.2 Stillbirths and infant deaths

The stillbirth rate in 2012 was, at 4.7 per 1000 births, the lowest ever recorded in Scotland as were the early neonatal death (1.8 per 1000 live births) and the perinatal mortality (6.5 per 1000 births) rates. Other rates equalled the lowest recorded with the exception of the rate for late neonatal deaths which was only bettered in 2010. The steady decline in the rates of stillbirths, neonatal deaths and post neonatal deaths in recent years is statistically significant (for stillbirths, χ^2=8.1, p=0.004; for neonatal deaths, χ^2= 15.1 p<0.001; and for post neonatal deaths, χ^2= 15.1 p<0.001 for the decline from 2003 to 2012). The stillbirth rate in Scotland has been the lowest in the United Kingdom for the past two years.

Historically, this has not been the case. In 2012, England and Wales recorded a stillbirth rate of 4.9 per 1000 births and a perinatal mortality rate of 7.1 per 1000 live births[4].

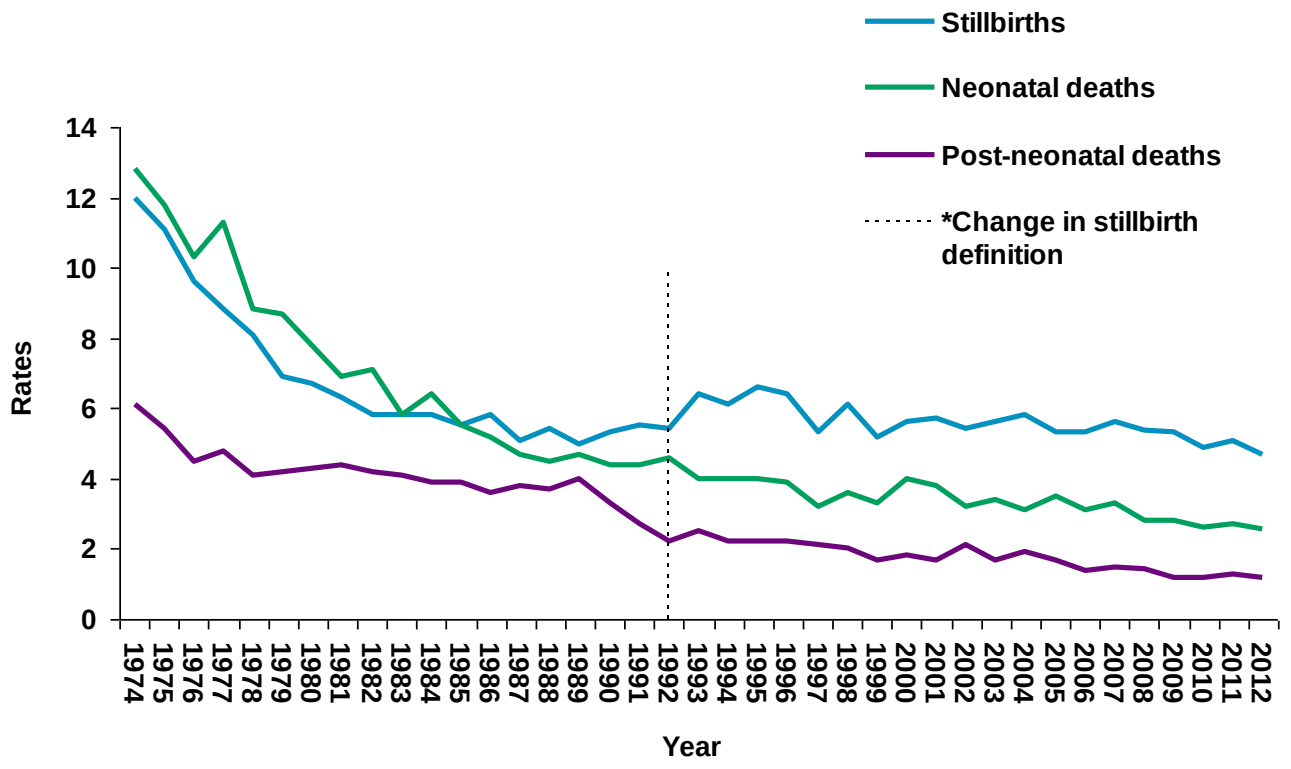
The numbers and rates of stillbirths and of perinatal, neonatal and infant deaths for the last six years are shown in Table 2.2. Figure 2.2 summarises rates of stillbirth, neonatal death and post-neonatal death in Scotland over the last 39 years. The improvement in recent years is more clearly seen in Figure 2.2a which shows the rates since 1993 on a more appropriate scale for this time period. The gestational age at which a stillbirth is registered was lowered by legislation from 28 weeks to 24 weeks in October 1992.

Table 2.2 Stillbirths and deaths in the first year of life (numbers and rates): 2007 - 2012

	2007	2008	2009	2010	2011	2012	
Live births	57781	60041	59046	58791	58590	58027	
Stillbirths	327	325	317	291	299	274	
Early NND	129	122	120	118	109	106[3]	
Perinatal deaths	456	447	437	409	408	380	
Late NND	59	46	45	32	50	42[3]	
NND	188	168	165	150	159	148	
PNND	84	85	70	68	78	69	
Infant deaths	272	253	235	218	237	217	
	Rates						**95% CI[4]**
Stillbirth [1]	5.6	5.4	5.3	4.9	5.1	4.7	4.16,5.29
Early neonatal [2]	2.2	2.0	2.0	2.0	1.9	1.8	1.50,2.21
Perinatal [1]	7.8	7.4	7.4	6.9	6.9	6.5	5.88,7.21
Late neonatal [2]	1.0	0.8	0.8	0.5	0.9	0.7	0.52,0.98
Neonatal [2]	3.3	2.8	2.8	2.6	2.7	2.6	2.16,3.00
Post-neonatal [2]	1.5	1.4	1.2	1.2	1.3	1.2	0.93,1.51
Infant [2]	4.7	4.2	4.0	3.7	4.0	3.7	3.26,4.27

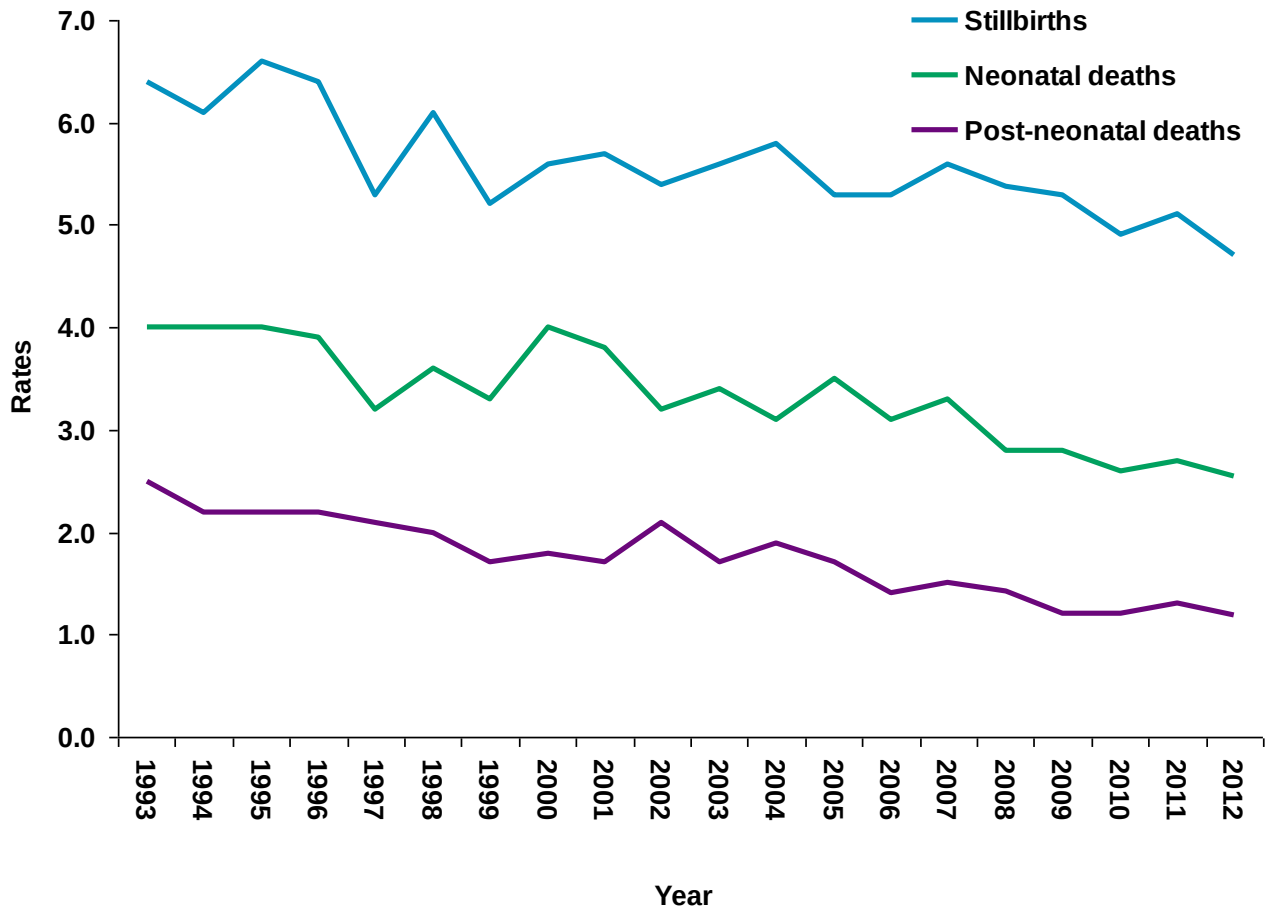
1 Rate per 1000 total births.
2 Rate per 1000 live births.
3 NRS register has 105 early and 43 late neonatal deaths. Examination of the detail of one case showed it to be an early rather than late NND.
4 95% confidence intervals shown apply to 2012. Confidence intervals for other years are shown in the appropriate annual SPIMMR.
Source: NRS (for live births and for calculating rates) and Survey (numbers of deaths).

Figure 2.2 Stillbirth[1], neonatal[2] and post-neonatal[2] mortality rates: 1974 - 2012



1 Rate per 1000 total births.
2 Rate per 1000 live births.
* The gestational age for stillbirth registration was lowered from 28 to 24 weeks on October 1st 1992.
Source: NRS.

Figure 2.2a Stillbirth[1], neonatal[2] and post-neonatal[2] mortality rates: 1993 - 2012



1 Rate per 1000 total births.
2 Rate per 1000 live births.
Source: NRS.

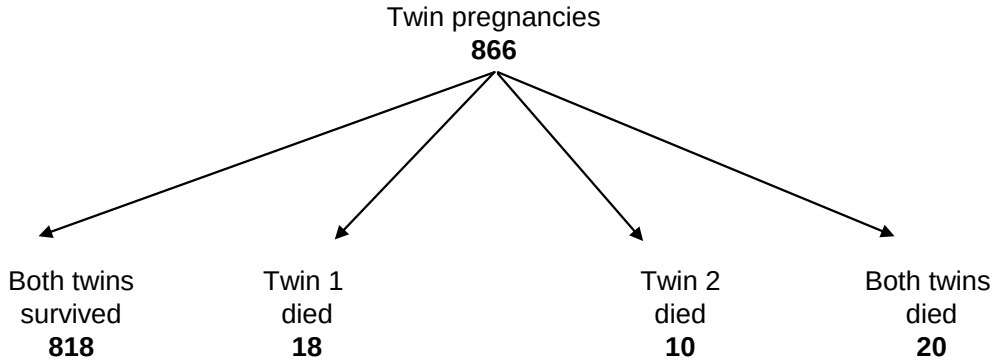
2.3 FIGO mortality rates

For the purpose of international comparison and to evaluate the effectiveness of care, the International Federation of Obstetrics and Gynaecology (FIGO) advocates the presentation of perinatal mortality data for infants weighing 1000g or more (roughly equivalent to 28 weeks gestation) and without major congenital anomaly[5]. The rates in Scotland over the last 6 years are presented in Table A1. Using the FIGO criteria, the stillbirth rate in 2012 was 3.0 per 1000 births, the neonatal mortality rate 0.8 per 1000 live births and the perinatal mortality rate 3.7 per 1000 births. These rates are lower than all previous years except for 2010.

2.4 Single and multiple births

In 2012, there were 56,545 singleton births, 866 registered sets of twins and eight sets of triplets registered with NRS. The rate of twin births was, at 15.1 per 1000 registered maternities, similar to recent years (see Table A2). The outcomes for twin pregnancies with a registered birth are shown in Figure 2.3.

Figure 2.3 Outcome for registered twin pregnancies: 2012

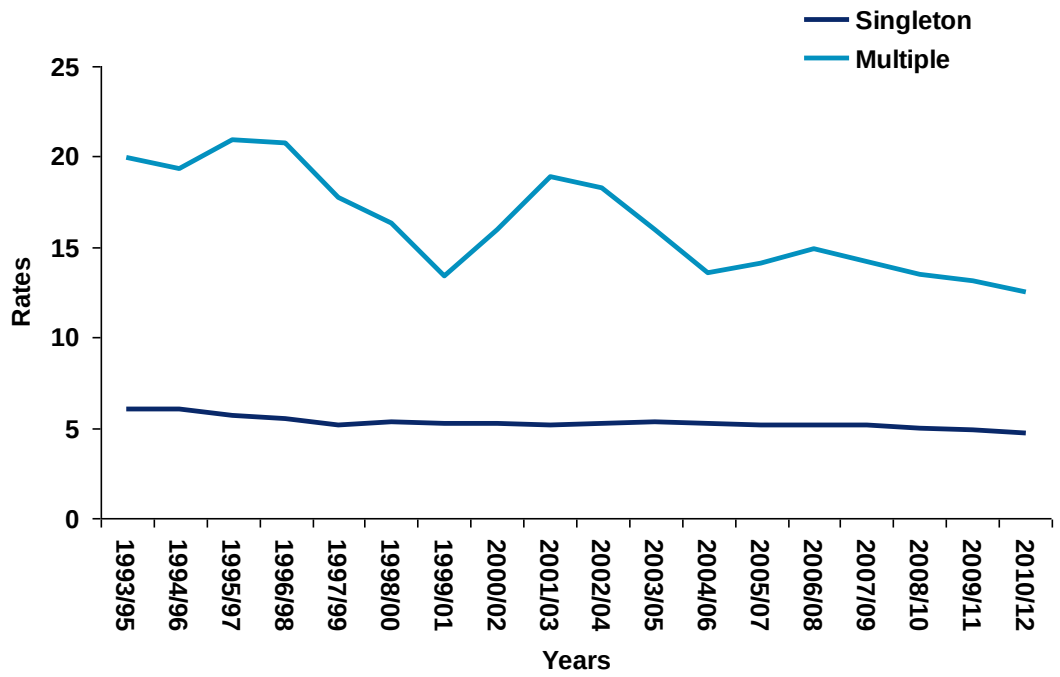


Source: Survey.

Single and multiple births each year for the past six years are shown in Appendix 12.2 Table A2.

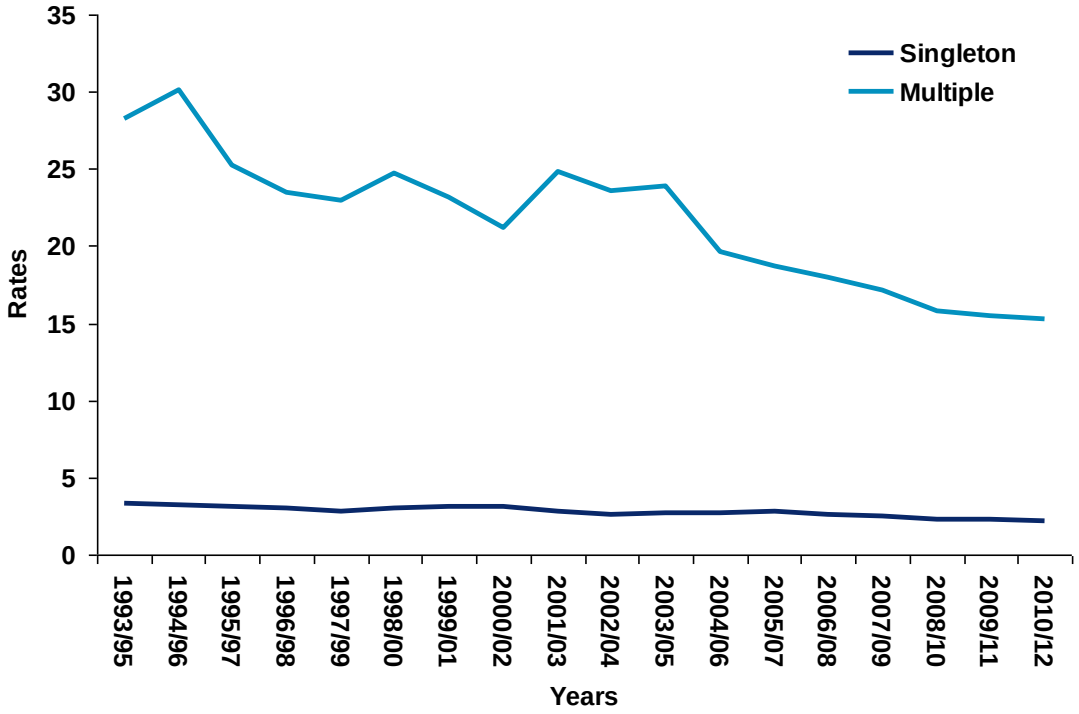
In 2012, the stillbirth rate was 4.5 per 1000 singleton births and 10.8 per 1000 multiple births. The neonatal mortality rates were 2.1 per 1000 singleton live births and 16.7 per 1000 multiple live births. Comparative numbers and rates for every year since 2007 are shown in Table A3. The rates over the past 20 years are shown in Figures 2.4 (comparing singleton and multiple stillbirth rates) and 2.5 (neonatal mortality rates). These figures are based on three year rolling averages to reduce isolated fluctuations because of the relatively small number of multiple pregnancies and start from 1993, the first full year since the definition of fetal viability was legally changed in 1992. While all rates are declining, those for multiple births are improving at a faster rate than for singletons.

Figure 2.4 Three year rolling averages for singleton and multiple stillbirth rates[1]: 1993/95 - 2010/12



1 Stillbirths per 1000 singleton and multiple births respectively.
Source: Survey and NRS.

Figure 2.5 Three year rolling averages for singleton and multiple neonatal mortality rates[1]: 1993/95 - 2010/12



1 Neonatal deaths per 1000 singleton and multiple live births respectively.
Source: Survey and NRS.

3 Causes of stillbirths and neonatal deaths

3.1 Cause of death in singleton and multiple births

A revised classification system for causes of death was introduced in 2011. Based on information received for each death, the clinical advisor for the Reproductive Health Programme assigned a cause of death. Obstetric factors were considered for all deaths except post-neonatal deaths. Postnatal infant conditions were also considered for neonatal and infant deaths. The classification options as they appear on the data collection form are shown in Appendix 12.12. There are 11 main obstetric factors with a number of subsidiaries and nine main postnatal infant factors, also with subsidiaries. Both groups had an additional possible assignation of “unable to classify because of inadequate information”.

Details of the causes of death for singleton and multiple births are shown in Tables A4 to A7. The main causes of death for singleton births are illustrated in Figures 3.1. These are considered in more detail than multiple births as the numbers of deaths from multiple pregnancies are small and particular factors, especially prematurity, differentiate them from singleton pregnancies.

The distribution of causes is similar to that in 2011, the first year of the revised classification system. The most notable change is in the reduction of the proportion of cases where a cause of death could not be assigned because of inadequate information. This applied to 8.3% of singleton stillbirths in 2011, but only 1.6% in 2012. Particular effort was made in this, the last year of a SPIMMR report, to collect information for every death.

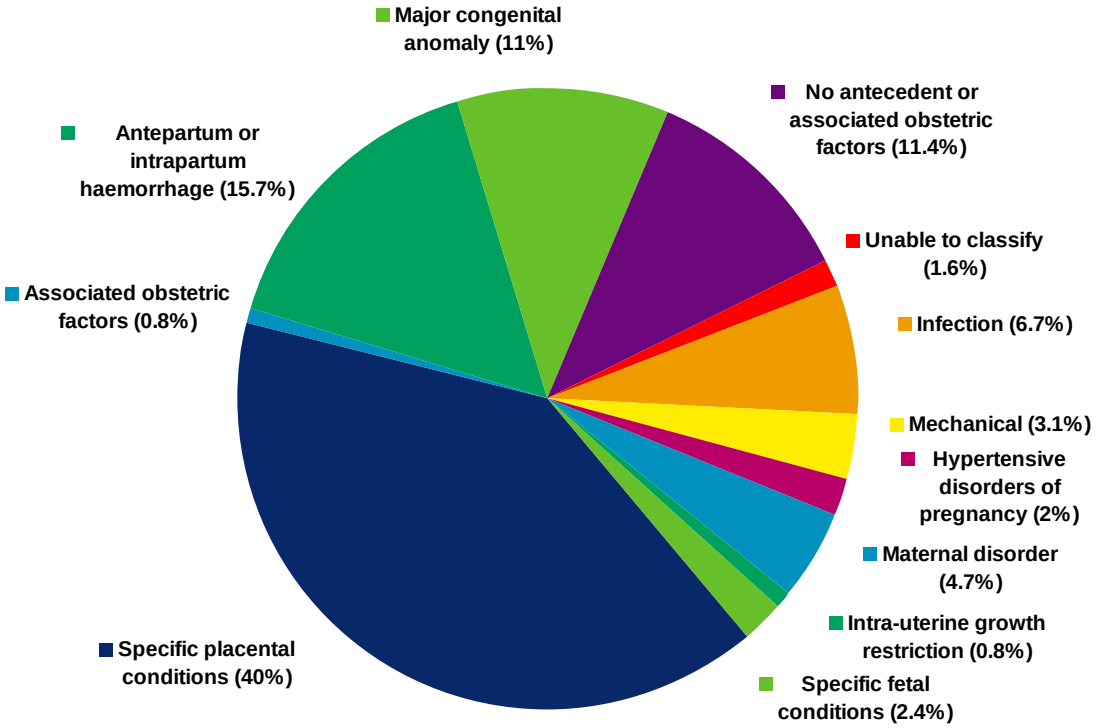
In 2012, placental conditions accounted for 40.0% of singleton stillbirths. Although fetal growth restriction (referred to as intrauterine growth restriction (IUGR) in previous SPIMMR and, for consistency, hereafter also within this SPIMMR) is frequently present among stillbirths, it is usually associated with a placental disorder which is considered to be the primary cause of death. Thus, IUGR was considered the sole main cause of death in less than 1% of singleton stillbirths. Further consideration of IUGR is discussed in section 3.4 below. The proportion of singleton stillbirths associated with antepartum haemorrhage (15.7%) and with congenital anomaly (11.0%) was similar to previous years. Despite adequate information, no cause could be assigned to 11.4% of singleton stillbirths, similar to the proportion in 2011, but much lower than the proportion so assigned under the previous classification system (64% in 2010[6]).

The predominant factors associated with singleton neonatal deaths were congenital anomalies (26.9%) and either extreme immaturity of less than 24 weeks gestation (20.2%) or factors frequently associated with lesser degrees of prematurity, such as most of the respiratory (16.0%) and neurological (11.8%) disorders and infections (15.1%). If babies born at <37 weeks gestation and dying with any of these conditions are considered, they accounted for 60 of the 119 singleton neonatal deaths (50.4%). Additional detail of the subsidiary causes are shown in the appendix Tables A4 and A5.

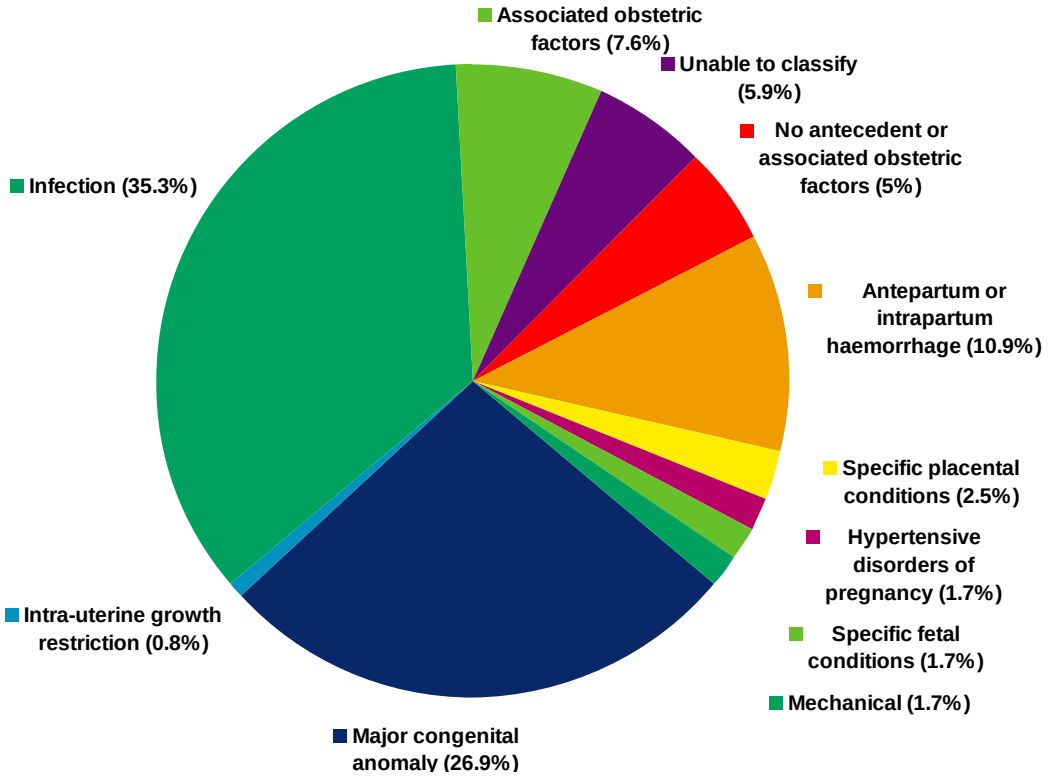
The obstetric and neonatal causes of death among multiple pregnancies are shown in Tables A6 and A7. Although the numbers are small (19 stillbirths and 29 neonatal deaths), the distribution of causes differs from singleton pregnancies. Fifteen deaths among multiple pregnancies (31.3%) were caused by congenital anomaly and 18 (37.5%) by conditions related to prematurity. A unique factor in multiple pregnancy deaths is twin to twin transfusion which accounted for five stillbirths and three neonatal deaths (16.7% of all deaths among multiple pregnancies).

Figures 3.1 Percentage distribution of cause of death; singleton births: 2012

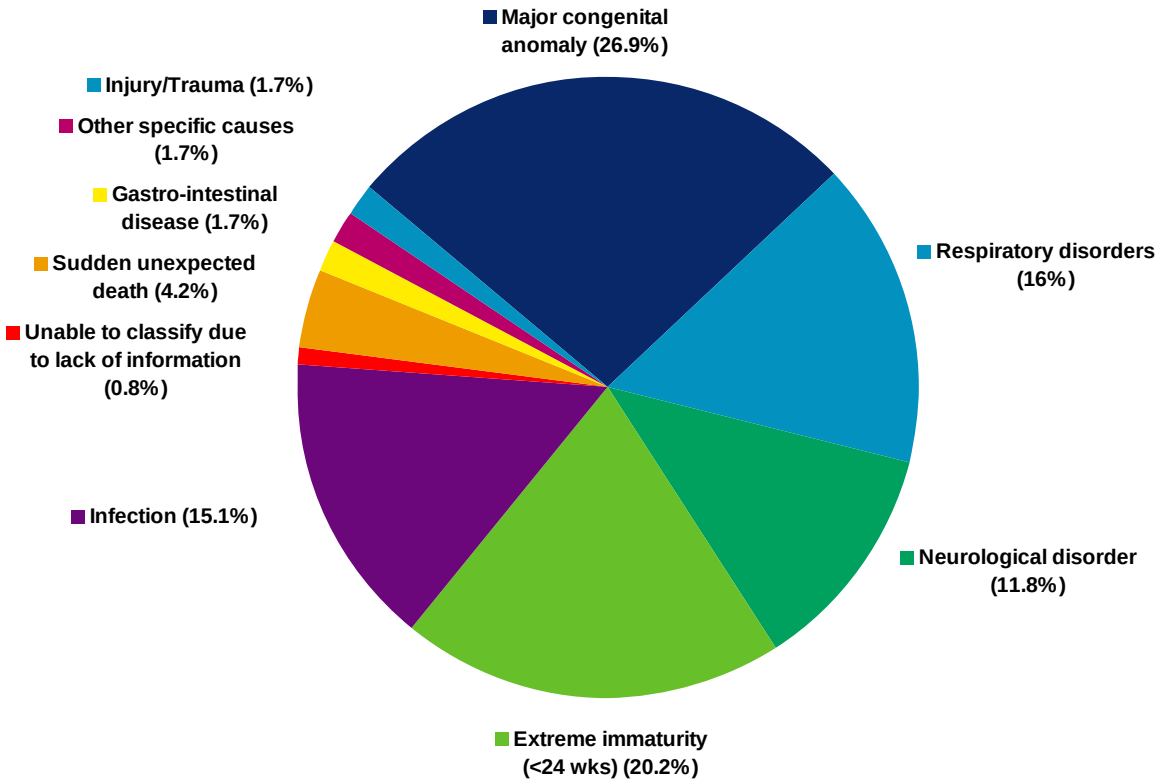
(a) Main obstetric factors causing death in 255 singleton stillbirths



(b) Main obstetric factors causing death in 119 singleton neonatal deaths



(c) Main neonatal factors causing death in 119 singleton neonatal deaths



Source: Survey.

3.2 Postmortem examinations and placental histology

An important contribution to the assignation of a cause of death is made by a postmortem examination of the fetus or infant and by histological examination of the placenta. More information than in previous years has been sought on both of these in the data collection form since 2011 and comparisons with earlier years are not entirely valid.

Table A8 shows postmortem rates for stillbirths, neonatal deaths and late fetal deaths for all of Scotland and for individual hospitals in the same way as it has been reported before 2011, i.e. full postmortems as a proportion of all deaths in that category. A full postmortem was performed on 57.7% of stillbirths, 34.5% of neonatal deaths and 46.3% of late fetal deaths. With the exception of late fetal deaths, these rates are higher than in 2011 and are comparable with most recent years. For many years, the rate of postmortem examinations in Scotland has been consistently higher than the rest of the UK. A postmortem was offered in virtually all instances of stillbirth (99.3%) and of late fetal death (98.1%), but slightly less frequently when a neonatal death occurred. A postmortem was authorised for 65.2% of stillbirths but not always for a full postmortem. Details are shown in Table 12.1.14.

Histological examination of the placenta is of greatest importance for stillbirths; disorders of the placenta have already been shown to be the most frequent primary cause of death in this group. In 2012, the RHP received evidence of histological examination of the placenta in 267 (97.4%) stillbirths.

3.3 Birthweight and gestation specific mortality rates

Tables A9a and b show the distribution of singleton stillbirths and neonatal deaths by birthweight and gestation at birth compared to singleton live births. Although the SMR02 data for live births is not quite complete at the time of this publication, missing data for 2.0% of live births is very unlikely to be of significance.

Among singleton births in 2012, 5.7% of all live births were born before 37 weeks gestation compared to 65.9% of stillbirths and 74.0% of neonatal deaths; 25.2% of neonatal deaths were born before 24 weeks gestation. When birthweight is considered, 5.0% of all singleton live births weighed <2500g at births, compared to 66.7% of stillbirths and 73.1% of neonatal deaths.

Excluding babies with congenital anomalies gives a more refined picture of the impact of gestation and birthweight (Tables A10 and 11). Rates have changed little in recent years and it does not appear that any particular birthweight or gestational age has been the main beneficiary of any improvement.

Prematurity is a particular risk for multiple pregnancies; all but five of the 48 babies of twin pregnancies who were stillborn or died in the neonatal period were born at less than 37 weeks gestation. The details are in Table A12.

3.4 Intrauterine growth restriction, small for gestational age and placental histology

A relationship between poor fetal growth, having a birthweight below the 5th centile for gestational age and abnormal placental pathology might be expected. These factors were explored for stillbirths registered in 2012.

Among all 274 stillbirths, 51 (19%) were small for gestational age (SGA; birthweight below 5th centile). Information about IUGR was recorded for 193 stillbirths; of these, 72 (37%) had IUGR suspected antenatally or observed at birth or at postmortem examination. The latter is the best objective evidence of IUGR and was found in 43 of the 72 cases. Just 14 (33%) of these 43 cases were SGA.

Although many stillbirths did not have a postmortem examination, placental histological examination was almost universal. Thirty nine of the 72 stillbirths (54%) with suspected or observed IUGR had abnormal placental histology while 43 of the 121 (36%) stillbirths where IUGR was not suspected or observed had abnormal placental histology. Further information is provided in Appendix 12.1, section 12.1.16.

Previous SPIMMRs have described the proportion of normally-formed singleton antepartum stillbirths, intrapartum stillbirths and neonatal deaths who are SGA. This information is presented in Table A13. As in previous years, the proportion of antepartum stillbirths SGA (17.1%) is higher than among intrapartum stillbirths and neonatal deaths (6.0%). Of the 36 antepartum stillbirths who were small for gestational age, 23 (63.8%) had a specific placental disorder.

3.5 Gender differences

Gender specific mortality rates for different causes of death are compared in Table A14. In 2012, as in previous years, there was little difference between the singleton stillbirth rate among females (4.7 per 1000 births) and males (4.3 per 1000). The neonatal mortality rate was 1.9 per 1000 for females and 2.4 per 1000 live births for males. The distribution of causes of death was also similar between the genders.

4 Late fetal deaths

Information on late fetal deaths (deaths at 20 - 23^{+6} weeks gestation, or earlier in pregnancy if the birthweight is ≥ 500g) has been collected since 1991 and contributes to the overall picture of reproductive outcome in Scotland. These deaths are not registered with NRS and were identified by information volunteered by local hospital co-ordinators and from SMR02 returns. In addition, some postmortem reports on such fetuses were sent directly by pathologists to the Reproductive Health Programme. Data on these fetal deaths are, nonetheless, less robust than those on stillbirths and neonatal deaths, and are not complete, fluctuating from year to year dependent on the level of case ascertainment.

In 2012, 164 late fetal deaths were identified. The mode of loss was recorded for 162 of them. Ninety-six miscarried spontaneously and in 66 cases (40.7%) the pregnancy was terminated, mainly because of fetal anomaly. Nineteen of the late fetal deaths (11.7%) occurred in multiple pregnancies. This is considerably higher than the proportion of multiple pregnancies among all registered births (1.5% in 2012) and also higher than the rate of multiple pregnancies among all stillbirths (6.9%). As in previous years, the vulnerability of multiple pregnancies is clearly demonstrated.

The cause of late fetal deaths among singleton and multiple pregnancies is shown in Tables A15 and A16 where comparison is made with registered stillbirths. Sixty five of the late fetal deaths (40.1%) had a congenital anomaly. Most of these pregnancies were terminated therapeutically. The congenital anomaly rate among all stillbirths was 11.7%.

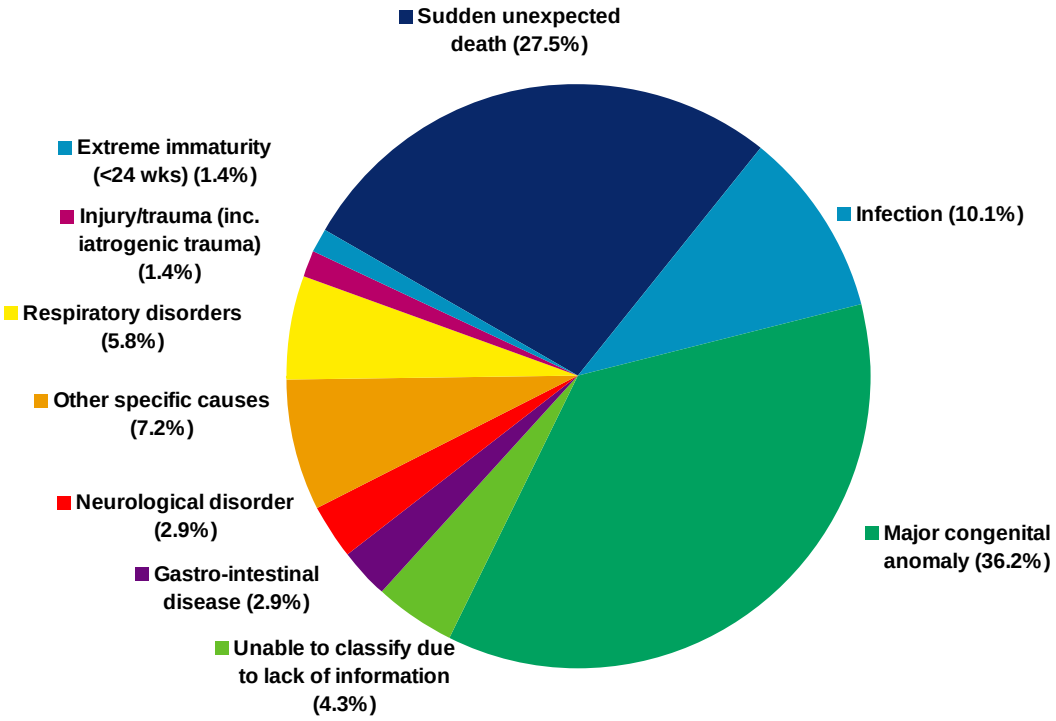
Antepartum haemorrhage and infection were the main causes of spontaneous late fetal deaths. The infection was generally chorioamnionitis following rupture of the membranes. In contrast to stillbirths, specific placental conditions are infrequently associated with late fetal death.

The distribution of gestation and birthweights of the late fetal deaths is shown in Table A17.

5 Post-neonatal deaths

In 2012, there were 69 post-neonatal infant deaths (occurring after the first four weeks but within one year of age), a rate of 1.19 per 1000 live births. The downward trend since 2003 is statistically significant ($p<0.001$). Congenital anomalies (25 deaths) and Sudden Unexpected Death (19) accounted for most of the deaths, as has been the case in all recent years. More information was collected than in any previous year and in only three cases did the Survey receive insufficient information to allocate a cause of death. Details of causes of death, age, place of death and postmortem examinations are provided in Tables A18 - 21 and the proportions of deaths attributed to the various causes are presented graphically in Figure 5.

Figure 5 Causes of 69 post-neonatal deaths: 2012



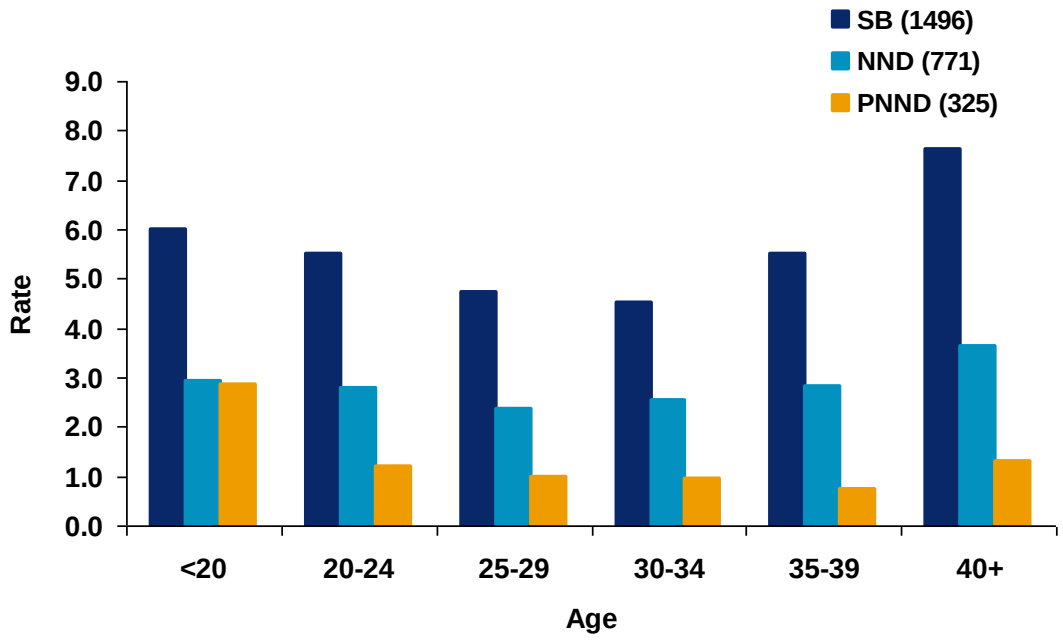
Source: Survey.

6 Maternal age and sociodemographic data

6.1 Maternal age

The rates of stillbirth and of neonatal death by maternal age bands for the five years 2008 - 2012 combined are shown in Figure 6 (numbers and rates available in Table 12.4.1 in Appendix 12.4). When the rates are subjected to statistical analysis, there are two significant findings. Those aged 40 years or older were significantly more likely to give birth to a stillborn baby when compared to mothers aged 25-34 years (χ^2 =19.7, p<0.001) and those aged 20 years or less were significantly more likely to experience a post-neonatal death than mothers aged 25-34 years of age (χ^2=48.4, p<0.001).

Figure 6 Stillbirth, neonatal death rates and post-neonatal death rates[1] by mothers' age[2]: 2008 - 2012

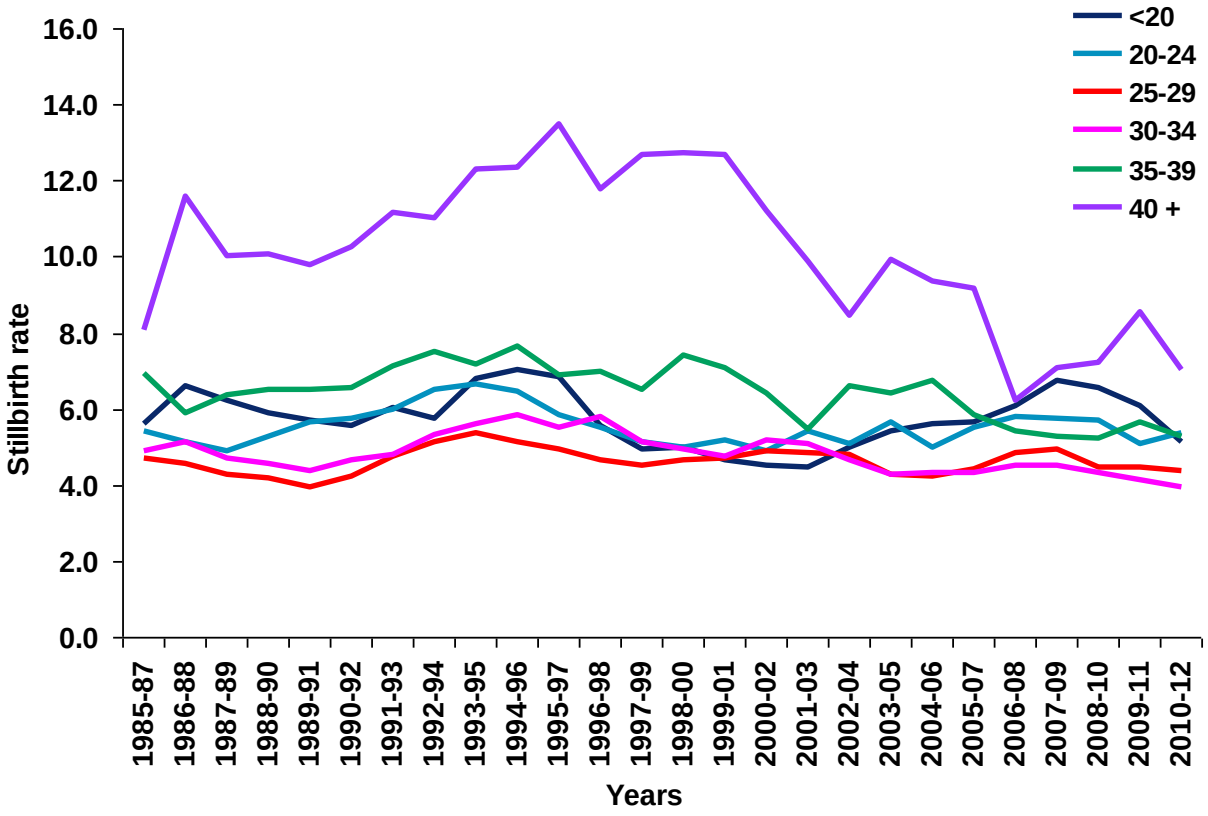


1 Rates per 1000 women who gave birth in 2008 - 2012 per age group.
2 Excludes records where age was unknown.
Source: Survey and NRS Live Births, Stillbirths and Maternities, 2008 - 2012.

The increased risk of stillbirth among women over 40 years of age has been consistent for many years but has assumed greater importance as more women in this age group have given birth in recent years. This rising trend is shown in Figure 12.4.2 in Appendix 12.4.

There has been an improvement in the stillbirth rate among women in this older age group as is shown in Figure 6a, which gives the rates for each age group in three year rolling averages since 1985/87. Despite the improvement, the stillbirth rate for women giving birth over 40 in 2010-12 was 7.0 per 1000 births compared to the lowest rate (3.9 per 1000 births) which was among women aged 30-34. When the stillbirth rates among multiparous and nulliparous women over 40 were compared, no significant difference was found (data not shown in this report).

Figure 6a Singleton stillbirth rates[1] by maternal age: 1985/87 - 2010/12



1 Rates per 1000 total singleton births.
Source: Survey and SMR02.

6.2 Deprivation, smoking and obesity

An increased risk of stillbirth and of infant death is known to be associated with increased levels of deprivation, with smoking and with a raised body mass index (BMI). In Table 6.2, the distribution of all women with these factors giving birth in Scotland in 2012 is compared with those experiencing a stillbirth or infant death. Information on deprivation is known in most cases as the postal code was almost always recorded but the BMI and smoking data were less complete. The association between stillbirth and infant death and each of the known risk factors is confirmed.

Tables 6.2a, b, c Percentage rates of mother's Scottish index of multiple deprivation (SIMD), body mass index and smoking status among all women giving birth[1], stillbirths and infant deaths: 2012[2]

Table 6.2a Mother's SIMD (percentages) 2012

	1 - Most deprived	2	3	4	5 - Least deprived
All mothers[1] (56906)	26.6	21.3	18.8	17.5	15.7
Stillbirths (271)	28.4	23.6	12.9	21.0	14.0
Infant deaths (210)	26.2	27.6	21.9	12.9	11.4

Table 6.2b Mother's BMI[3] (percentages) 2012

	Under-weight	Normal	Over-weight	Obese
All mothers[1] (47875)	2.7	48.6	27.6	21.0
Stillbirths (259)	1.5	36.7	29.7	32.0
Infant deaths[4](112)	1.8	40.2	33.9	24.1

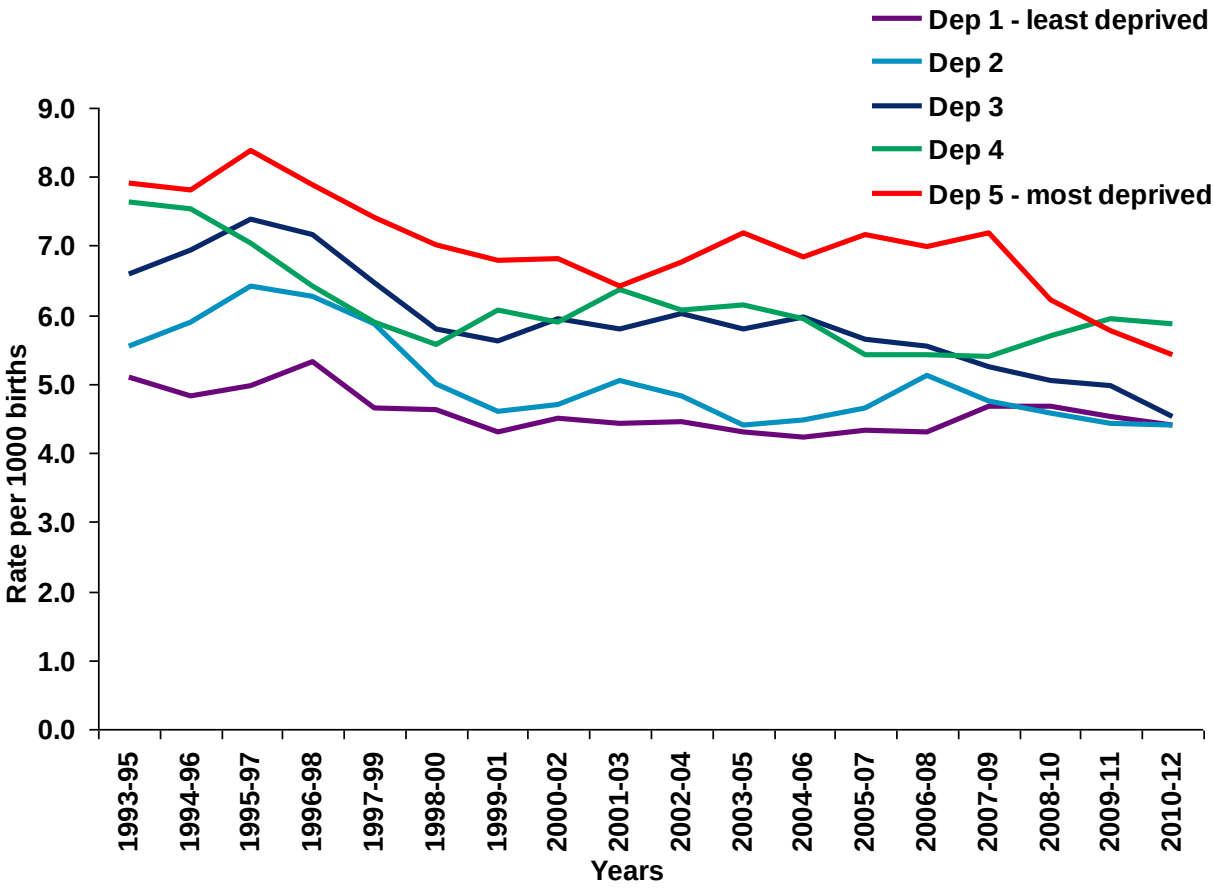
Table 6.2c Mother's smoking status[5] (percentages) 2012

	Current smoker	Former / never smoked
All mothers[1] (54174)	20.4	79.6
Stillbirths (258)	29.1	70.9
Infant deaths (161)	32.9	67.1

1 Women giving birth between Apr 2011 and Mar 2012.
2 Numbers in brackets indicate the number of women in each category for whom the relevant information was available.
3 WHO Classification: Underweight <18.50; Normal range 18.50-24.99; Overweight 25.00-29.99; Obese ≥ 30.00.
4 Only available for neonatal deaths; excludes post-neonatal deaths.
5 SMR02 data is taken from smoking history at booking.
Source: Survey and SMR02.

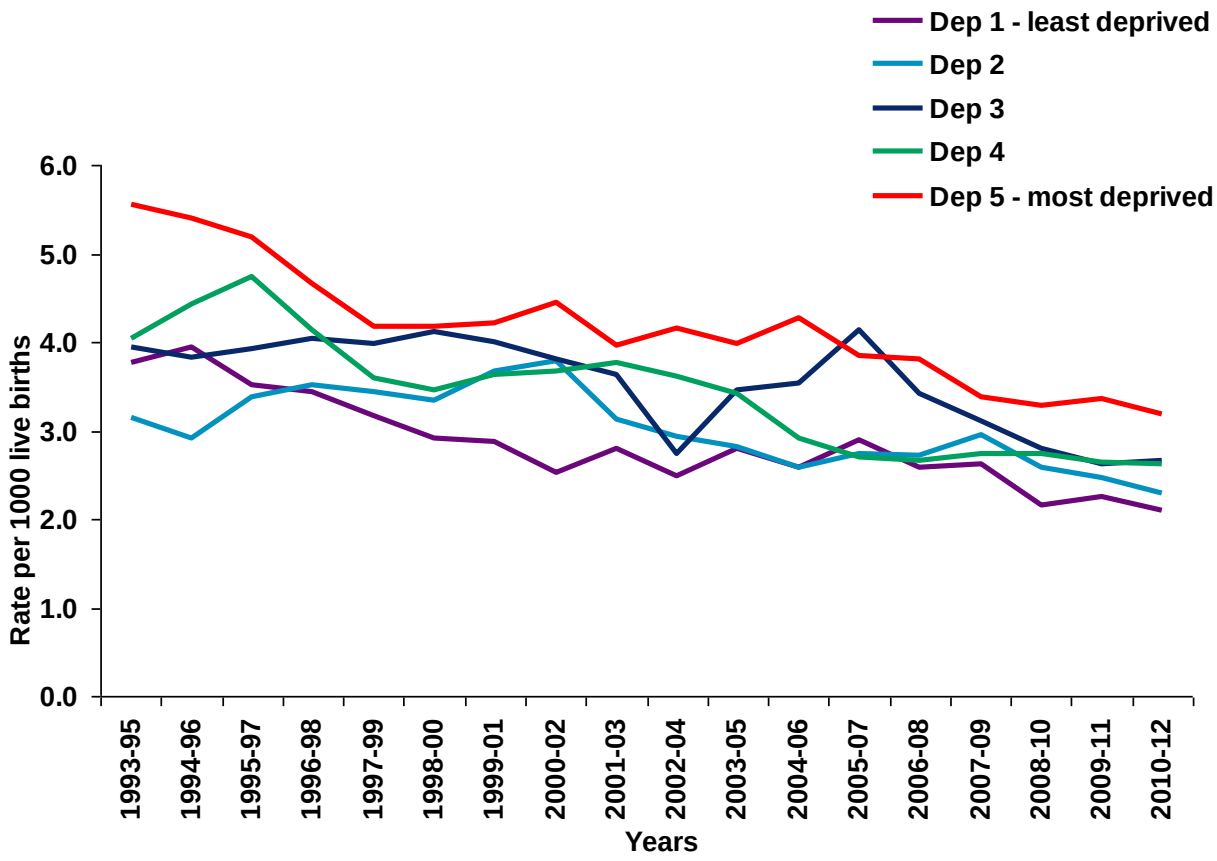
Figures 6.2a and b show the cumulative data for stillbirth and neonatal mortality rates by deprivation category since 1993 in three year rolling averages. This demonstrates that women from all deprivation groups have benefited from the fall in mortality rates. The particularly marked improvement in the rate of stillbirth in the most deprived cohort between 2007/9 and 2010/12 is significant (χ^2=10.9, p=0.001). Note that, while Table 6.2a uses the Scottish index of multiple deprivation (SIMD), Figure 6.2a uses Carstairs indices as SIMD categories are not available for the earlier part of the time period. The numbers used to denote the degree of deprivation (1-5) are reversed between the SIMD and Carstairs indices.

Figure 6.2a Stillbirth rates[1] by deprivation category[2]: 1993/95 - 2010/12



1 Rates per 1000 births.
2 Carstairs 1991 is used for the period 1993-1996 and Carstairs 2001 for 1997 onwards.
Further information on the Carstairs index is available at: http://www.isdscotland.org/Products-and-Services/GPD-Support/Deprivation/Carstairs/
Source: Survey and SMR02.

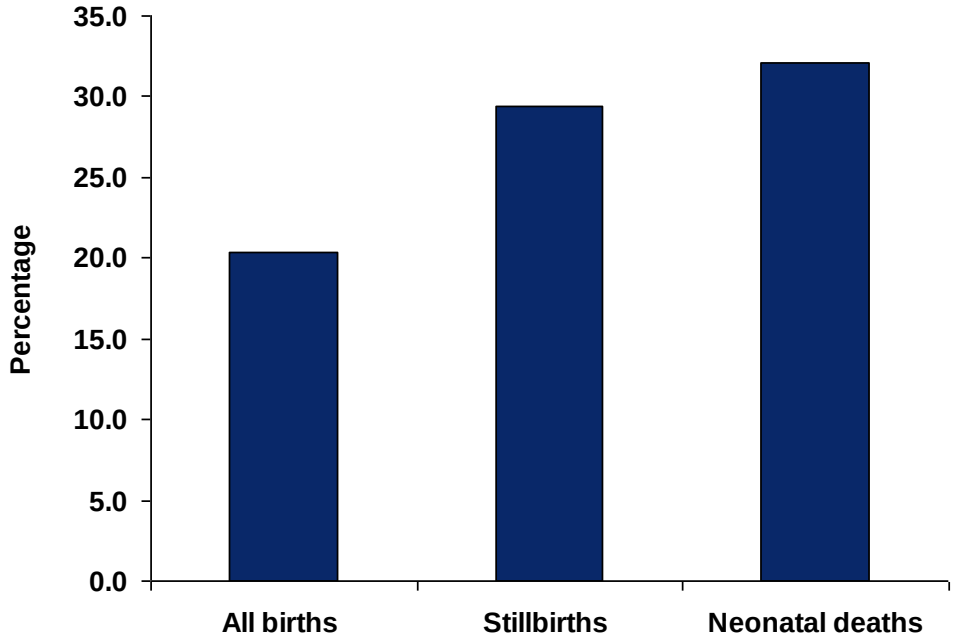
Figure 6.2b Neonatal mortality rates[1] by deprivation category[2]: 1993/95 - 2010/12



1 Rate per 1000 live births.
2 Carstairs 1991 is used for the period 1993-1996 and Carstairs 2001 for 1997 onwards.
Further information on the Carstairs index is available at: http://www.isdscotland.org/Products-and-Services/GPD-Support/Deprivation/Carstairs/
Source: Survey and SMR02.

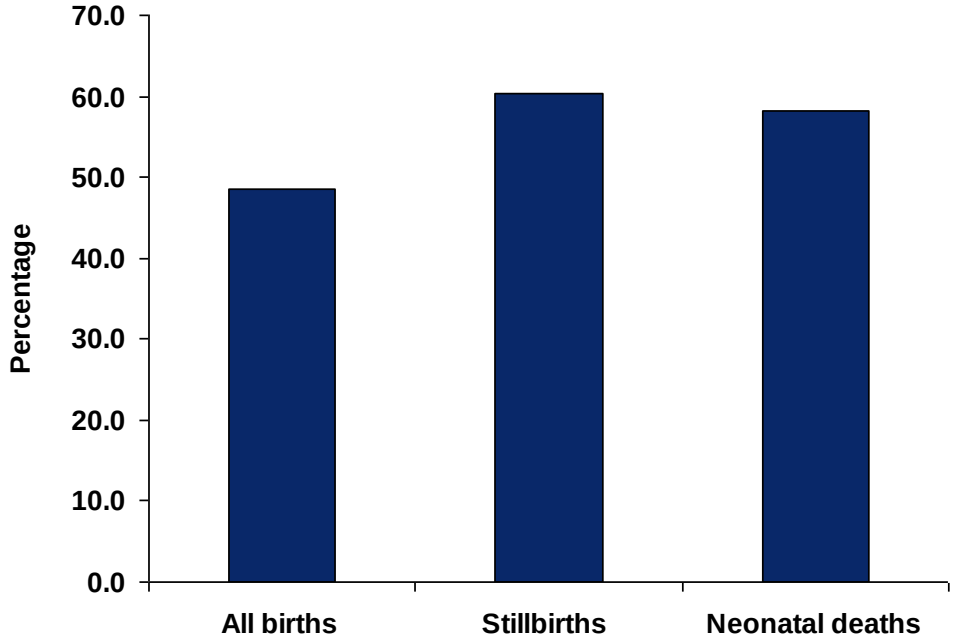
Sufficient information on smoking and BMI is only available for 2011 and 2012. Among all births, stillbirths and infant deaths for these years combined the percentage of smokers is compared in Figure 6.3a and the percentage of women with a BMI>25 (overweight or obese) in Figure 6.3b. Information on BMI was not recorded for post-neonatal deaths. In both cases, the increased proportion of deaths is significant. Among smokers, $p<0.001$ ($\chi^2=26.5$), for the percentage of smokers among stillbirths compared to all births (29.4% v 20.3%) and $p<0.001$ ($\chi^2=27.6$) for infant deaths (32.1% v 20.3%). The proportion of overweight and obese women giving birth to a stillbirth (60.3%) or a neonatal death (58.2%) is also significantly greater than the proportion among all women giving birth (48.6%); for stillbirths, $\chi^2=28.3$, $p<0.001$; for neonatal deaths, $\chi^2=8.1$, $p=0.004$.

Figure 6.3a Percentage of women who smoked; stillbirths, infant deaths and all women giving birth: 2011 - 2012



1 All births are derived from SMR02 for financial years 2010/11 and 2011/12 combined.
Source: Survey and SMR02.

Figure 6.3b Percentage of overweight and obese women; stillbirths, neonatal deaths[1] and all women giving birth: 2011 - 2012



1 Information not available for post-neonatal deaths.
2 All births are derived from SMR02 for financial years 2010/11 and 2011/12 combined.
Source: Survey and SMR02.

7 Other factors associated with deaths

Since the introduction of a new data collection system in 2011, much more detail than previously has been obtained about the mother and the circumstances surrounding each death. Appendix 12.1 provides a detailed summary of this. The features of most interest are briefly described here with further discussion in the commentary. Unless otherwise stated, the information in this summary applies to all categories of death. Reference is made to the relevant appendix section for more detailed information.

- Mothers who experienced a fetal or infant death were significantly less likely to be in employment than all women giving birth ($p<0.001$ for years 2011 and 2012 combined) (Appendix section 12.1.1b).

- Mothers experiencing deaths were significantly more likely than all mothers to have high levels of alcohol consumption and substance misuse (for 2011 and 2012 combined, $p<0.001$ for alcohol consumption and $p<0.001$ for substance misuse) (Appendix 12.1.2a and b).

- Previous experience of a stillbirth or a neonatal death increased the probability of a similar loss in a subsequent pregnancy (Appendix 12.1.5).

- Assisted conception may be associated with a higher likelihood of stillbirth, neonatal death or late fetal death (Appendix 12.1.6).

- In 2011 and 2012, stillbirths and neonatal deaths were no more frequent than expected at night but there was a significantly higher proportion of stillbirths (30.4% of all stillbirths) than of all births (24.6% of all births) during weekends ($p=0.002$) (Appendix 12.1.9d and e).

- Over 90% of all deaths were offered a postmortem examination and placental histology was performed on over 90% of all deaths. Among stillbirths a postmortem examination was used to assign a cause of death in 62.8% of cases and placental histology in 90.1% (Appendix 12.1.14 and 12.1.15).

- A question on fetal intrauterine growth restriction (IUGR) was often not adequately answered but where IUGR was reported as diagnosed (72 stillbirths), it was suspected antenatally in 25 cases (34.7%) (Appendix 12.1.16).

- The majority of all deaths were discussed at a perinatal mortality forum, varying from 84.6% of stillbirths to 52.3% of late fetal deaths. A root cause analysis of each death was much less often performed (Appendix 12.1.17).

8 Congenital anomalies

The annual SPIMMR has, for a number of years, reported data on selected congenital anomalies among stillbirths, infants up to one year of age and pregnancies terminated as a consequence of prenatal diagnosis. Information on birth prevalences among singleton pregnancies of neural tube defects, cardiovascular anomalies, orofacial clefts, and trisomies 13, 18 and 21 is presented in Tables A22 and A23a, with the addition of terminated pregnancies in Table A23b. As it takes considerably longer to gather this anomaly data than mortality data, the information is always one year behind the rest of the report and includes the five years up to 2011.

The difference between the rates in Tables A23a and A23b appears to reflect the effect of prenatal screening, particularly for neural tube defects and the specified chromosomal anomalies. The rates of neural tube defects reported at birth are consistently about half of the total rate reported when terminated pregnancies are included (0.47 per 1000 births and 0.88 per 1000 births respectively in 2011). The reduction in births with Down's syndrome is about a third (1.09 per 1000 at birth and 1.69 per 1000 including terminated pregnancies in 2011). Spontaneous miscarriages (which probably occur frequently when anomalies are present) are not included in these data.

The most common congenital anomalies are those of the heart and circulatory system. Many of these anomalies may not be detected antenatally and/or may be of minor significance and are not incompatible with normal life. There are, therefore, very few pregnancies terminated for anomalies in this group.

9 NHS board statistics

9.1 Stillbirths and neonatal deaths

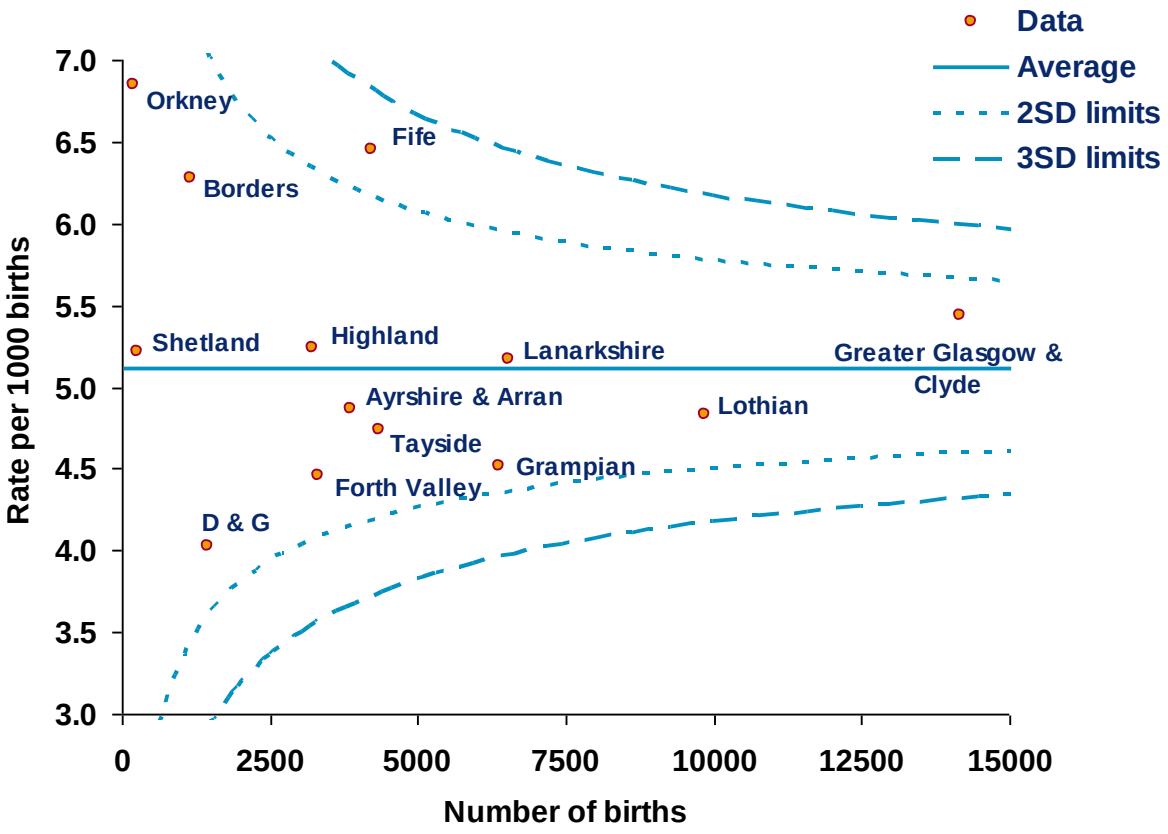
Much of the information presented for all deaths in Scotland included in this report is shown by individual NHS board in Tables A24 - A27. The relatively small numbers of stillbirths and neonatal deaths in one year in individual NHS board areas (especially in the smaller NHS boards) mean that variations from year to year are heavily influenced by the effect of chance and are therefore generally not statistically significant. This effect is mitigated to some extent by aggregating years and Figures 9.1a and 9.1b show the stillbirth and neonatal mortality rates for individual NHS boards based on aggregated data for the past five years. Funnel plots have been used to present data by NHS board. The range of expected variation is indicated on the funnel plot using dotted lines to show the different limits. These limits are calculated from the standard deviation (SD) of the data which measures how much variation from the average exists. If a data point for a particular NHS board sits outside the ±3SD limit it is 99.8% certain that it lies out with the range of variation normally expected across Scotland.

There are variations in practice among NHS boards over the registration of very preterm births and in order to take this into account, only neonatal deaths born at 24 weeks gestation or more are shown in Figure 9.1b.

With small overall numbers, even when aggregating, an unusually high number of deaths in individual years can have an important influence. Thus, particularly high rates of stillbirth in 2008 and 2010 place the aggregated rate for the NHS Fife geographical area more than 2 standard deviations above the mean. However, the neonatal mortality rate for births over 24 weeks gestation in Fife is also more than 2 standard deviations above the mean and both rates have been above the Scottish mean rate for each of the past five years. The funnel plots in appendix Figures A28a and b show the five year aggregated rates by NHS board using the FIGO classification which only includes normally formed babies ≥ 1000g birthweight. The overall pattern for most NHS boards is similar and the rates for Fife remain more than 2 standard deviations above the mean for neonatal deaths though on two standard deviations above the mean for stillbirths.

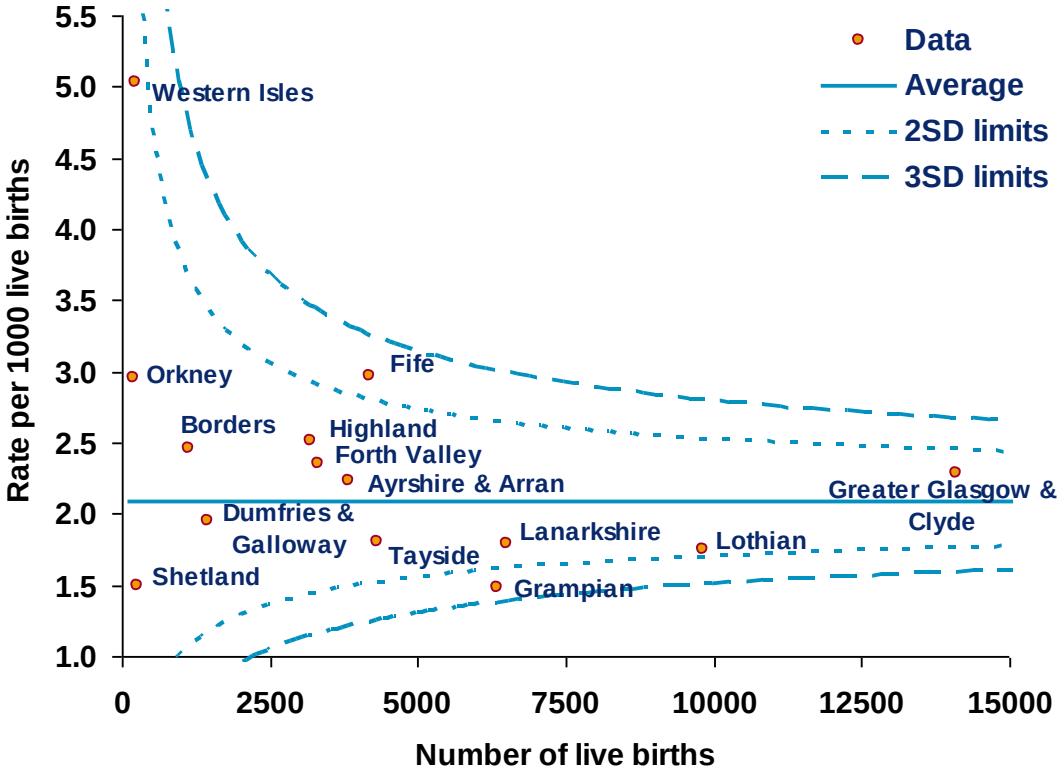
As well as small numbers resulting in fluctuating rates from year to year in individual NHS boards, variations in reproductive outcomes are also likely to be related to population differences with areas of greater socioeconomic deprivation experiencing higher mortality rates.

Figure 9.1a Stillbirth rates[1] by NHS board of residence[2]: 2008 - 2012



1 Rate per 1000 total births.
2 Records that could not be aligned to an NHS board via their postcode have been assigned to the board of the hospital of occurrence.
Source: NRS and Survey.
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

Figure 9.1b Neonatal mortality rates from 24 weeks gestation[1] by NHS board of residence[2]: 2008 - 2012

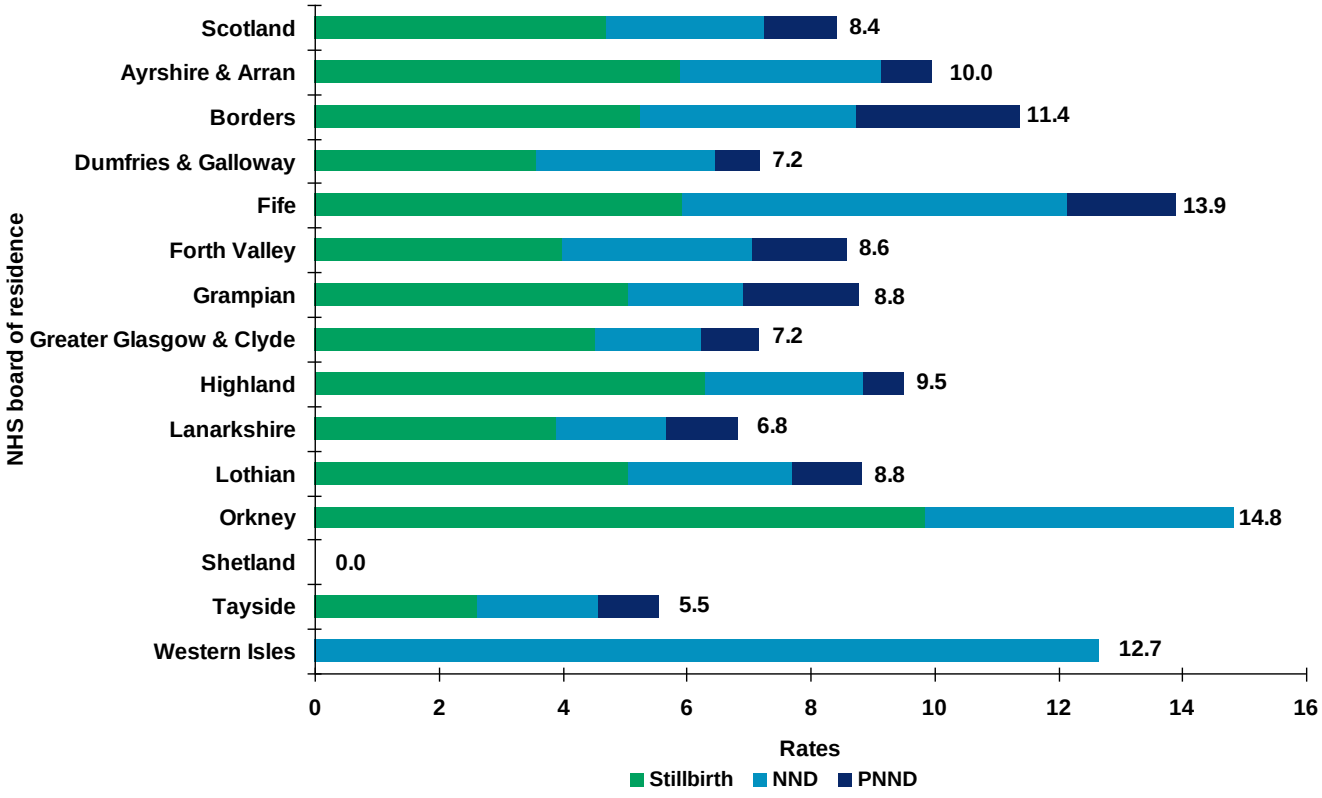


1 Rate per 1000 live births.
2 Five NND could not be allocated to an NHS board.
Source: NRS and Survey.
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

9.2 Extended mortality rates

All of the deaths in different NHS board areas described in this report (late fetal deaths, stillbirths, neonatal deaths and post-neonatal deaths) are summarised in Tables A27a and b which provide an overview of all reproductive losses from mid-pregnancy to the end of the first year of life. For Scotland as a whole, the mortality rate for this group was 11.2 per 1000 total births (95% CI, 10.36, 12.10). This is similar to recent years but is not entirely accurate because of the variable reporting of late fetal deaths. The stillbirth, neonatal death and post-neonatal death rates (all of which are registered and, therefore, complete and accurate) for each NHS board are summarised graphically in Figure 9.2 which excludes late fetal deaths. The aim of combining rates in this way is to eliminate any variations among NHS boards caused by misclassification or by deferring death from one time period to another.

Figure 9.2 Registered stillbirth, neonatal[1] and post-neonatal mortality rates by NHS board of residence: 2012



1 Includes 3 neonatal deaths at less than 20 weeks gestation which were registered.
Source: NRS and Survey.

9.3 Congenital anomalies

The information on the selected congenital anomalies in Scotland discussed in Section 8 is shown by NHS boards for five years aggregated (2007 - 2011) in Tables A30, and rates are charted graphically for neural tube defects, Down's syndrome and heart and circulatory system anomalies in Figures A29. Although there is variation in the rates of neural tube defects and of Down's syndrome among different NHS board areas, all are within three standard deviations of the mean. There appears to be more marked variation among NHS boards in the prevalence of anomalies of the heart and circulatory system with NHS Highland particularly reporting a high rate and the rates for many NHS boards are more than three standard deviations either above or below the mean. This data is derived from various linked sources with variable diligence in recording. The high rate for NHS Highland is weighted heavily by Scottish Birth Record data and it is likely that their level of diligence in reporting is greater than most other NHS boards. When only acute admissions are considered, the rates are more uniform (Figure A29d) and the rate from NHS Highland in 2011 was very close to the Scottish mean.

Table 9.3 summarises the results of prenatal screening by each NHS board. Each NHS board area shows reductions in the incidence of neural tube defects and Down's syndrome at birth with very few pregnancies terminated for cardiovascular disorders. Few babies are stillborn or die as neonates with the latter disorders (Tables A4 and A5) indicating that most are not of major clinical significance.

Table 9.3 Rates of selected fetal anomalies among singletons with congenital anomalies by NHS board of residence: 2007 - 2011

NHS board of residence	Neural Tube defects		Down's Syndrome		Cardiac anomalies	
	1*	2**	1*	2**	1*	2**
Scotland	**1.02**	**0.55**	**1.65**	**1.11**	**9.86**	**9.75**
Ayrshire and Arran	1.33	0.80	1.49	1.33	11.68	11.58
Borders	1.15	0.38	1.91	1.34	6.31	6.12
Dumfries and Galloway	1.87	1.15	2.01	1.15	6.61	6.46
Fife	1.43	0.44	1.63	0.84	6.94	6.65
Forth Valley	0.94	0.75	1.07	1.07	6.72	6.72
Grampian	1.37	0.60	2.37	0.90	12.25	11.95
Greater Glasgow and Clyde	0.68	0.51	1.21	1.01	7.88	7.82
Highland	1.40	0.87	2.40	1.93	22.77	22.77
Lanarkshire	0.79	0.56	1.22	0.99	7.90	7.87
Lothian	0.79	0.35	2.00	1.36	12.67	12.59
Orkney	2.09	1.05	2.09	2.09	9.41	8.37
Shetland	0.00	0.00	1.65	0.00	13.23	13.23
Tayside	1.26	0.39	1.74	0.87	5.94	5.79
Western Isles	1.75	0.00	1.75	0.87	5.24	5.24

1* Rate per 1000 births of anomaly diagnosed prenatally with subsequent termination plus stillbirths plus live births up to one year of age.
2** Rate per 1000 births of the specified anomaly (i.e. excluding unregistered pre-viable births).
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).

10 Commentary

10.1 Declining deaths

In the past 10 years, there has been a statistically significant improvement in the numbers and rates of stillbirths and of infant deaths in Scotland. In 2004, there were 317 stillbirths, the highest number in the past decade, a rate of 5.8 per 1000 births. In 2012, there were 274 stillbirths, 4.7 per 1000 births. Similar falls occurred in neonatal deaths from 178 (3.4 per 1000 live births) in 2003 to 148 (2.6 per 1000) in 2012. Infant deaths (up to one year of age) fell from 266 in 2004 to 217 in 2012 and perinatal deaths from 439 to 380.

International comparisons are most often made between perinatal mortality and infant mortality rates. In the past decade in Scotland these rates have fallen from 8.1 to 6.5 and from 4.9 to 3.7 per 1000 births respectively. These represent the prevention of at least one stillbirth and one neonatal death for every 1000 births. While these rates are still not as low as some Scandinavian countries, they are now the lowest levels reported from any part of the UK. This improvement is a notable achievement considering the increase in obesity, multiple pregnancies and pregnancies in older women in the same period as well as a persistent level of smoking and of socioeconomic deprivation.

Some possible factors behind the improvement were raised in the 2010 SPIMMR[6] (the first year in which the stillbirth rate fell below 5.0 per 1000 births) and these, and others, are discussed here.

Awareness of the problem of stillbirths appears to have increased in recent years among the public[7], politicians and health professionals. The stillbirth rate declined substantially throughout the 1970's and 1980's (see Figure 2.2). Improvements in neonatal care in the past 20 years have seen a well recognised steady decline in neonatal mortality rates. The perception was that stillbirth rates, by contrast, had remained relatively static for at least 20 years but Figure 2.2a in this report shows that the decline in stillbirths has been similar to that seen among neonatal deaths with stillbirth rates falling from over 6 per 1000 births in the early 1990's to 5 or less per 1000 births in recent years.

The report "Trends in Perinatal Mortality in Scotland: A review over 30 years" published by NHS Quality Improvement Scotland in 2009[8] and petitions presented to all of the UK governments by SANDS (Stillbirth and Neonatal Death Society)[9] together with preceding publicity assisted in giving the issue more prominence. In addition, The Lancet stillbirth series, published in 2011[10], highlighted many of the factors behind stillbirths that are described in the present report.

In Scotland, the presentation of SPIMMR in 2010 was improved to enhance its accessibility and clinical relevance and recommendations for practice (based on information in the report) were added. Following the recommendations of the 30 year trend report[8] work was undertaken to improve the quality and completeness of data collection on stillbirths and neonatal deaths and on a new classification system for the causes of death. The new data collection forms and classification system were implemented in January 2011. Since 2009, presentations, based on the annual SPIMMR information and the 30 year trend report, have been undertaken at both national and local level. These have emphasised the risk factors for and causes of stillbirth as well as the importance of a postmortem and histological examination of the placenta.

The Scottish Government established a working group in 2011 to explore issues relevant to stillbirths. This group has (among other things) convened a national meeting in 2013 to promote awareness, and supported pending research (which will commence in April 2014) into maternal recognition of reduced fetal movements with guidelines for appropriate follow up and management.

In England and Wales, the number of births has continued to rise (in contrast to Scotland) and stillbirth rates in recent years have, for the first time, been consistently above Scotland's[4]. Compared to England and Wales, a higher proportion of stillbirths and neonatal deaths undergo postmortem examination in Scotland. A steady fall in the postmortem rate in Scotland has been reversed in recent years, possibly related to greater publicity and awareness among health professionals. In 2012, a postmortem (not always full) was authorised for 65% of stillbirths. The most recent equivalent figure for England and Wales is from 2009 and was 41%[11]. Awareness of the importance of the placenta in relation to stillbirths has also increased considerably in recent years. In 2012, the placenta from 97% of stillbirths in Scotland was examined histologically. The equivalent figure for England and Wales for 2009 was 78%[11].

Information from a postmortem and/or placental histology may help to prevent a future pregnancy loss. Four per cent of women giving birth to a stillborn baby in Scotland in 2012 had previously experienced a stillbirth.

Following the example set by the report on 30 year trends in perinatal mortality[8], this SPIMMR has examined trends in the rates of deaths among particular groups. This has shown that, in the last ten years, there have been particular declines in stillbirths among women in the most deprived socioeconomic group, women over the age of forty and also in the stillbirth and neonatal mortality rates among multiple pregnancies when compared to singleton pregnancies. These improvements in specific groups of at risk pregnancies suggest the value of recognition and appropriate management.

10.2 Improved data collection and classification of death

The introduction in 2011 of more comprehensive data collection and of a classification system reflecting current knowledge has improved the quality and completeness of the information published in SPIMMR. This has been achieved through dedicated work both by maternity unit staff and by the small Reproductive Health Programme team within Healthcare Improvement Scotland. In 2012 it was not possible to classify a cause of death for four stillbirths (1.3%) and nine neonatal deaths (6.1%) because of insufficient information. Prior to the introduction of the new system in 2011, this was the case in more than 10% of stillbirths and up to 20% of neonatal deaths[6]. The rich amount of information collected about every death is shown in the detail of Appendix 12.1.

The report makes clear the critical role of the placenta in the causation of stillbirth with specific histological abnormality of the placenta appearing to be the main factor in 40% of singleton stillbirths. That it contributes less to stillbirth in multiple pregnancy is partly because of particular conditions unique to multiple pregnancy, notably twin to twin transfusion which was associated with five stillbirths and three early neonatal deaths (22.9% of all multiple perinatal deaths).

10.3 Regional variations

For many years, the SPIMMR has published differential mortality rates and other information among different territorial NHS board areas. In general, differences have not been significant and have been largely explained by the differing socioeconomic background of the resident population and/or by very small populations in some NHS board areas. The practice in the last three reports of publishing each NHS board's aggregated five year rates in a funnel plot, which takes account of the size of the population and shows standard deviations from the mean, emphasises any differences. One NHS board has rates of both stillbirths and neonatal deaths more than two standard deviations above the mean. Part of this has been explained by that NHS board's practice of encouraging the registration of very early neonatal deaths (<24 weeks gestation) in circumstances where most other NHS boards would not do so. This is the reason for excluding all neonatal deaths below 24 weeks from the funnel plot at Figure 9.1b.

Despite this adjustment, the five year aggregated rates of both stillbirths and neonatal deaths in the NHS Fife geographical area remain more than two standard deviations above the mean. An exploration of possible reasons, including sociodemographic and pregnancy related factors (such as gestation or congenital anomaly), has taken place involving staff from NHS Fife, ISD and Healthcare Improvement Scotland. No obvious explanation was found. Since the issue was first identified (in the 2010 SPIMMR)[6], actions taken within NHS Fife include the distribution of leaflets about reduced fetal movement, action to reduce smoking in pregnancy, and increased support for women with a raised BMI. In addition, NHS Fife was participating in a system initiated in the West Midlands to review all perinatal deaths[12]. Funding for this was, however, withdrawn within West Midlands.

Provisional NRS data (Personal communication, Dixon, F National Records Scotland with Watson, L, Consultant in Public Health, NHS Fife) suggests that the rate of stillbirths in Fife was below the Scottish rate in 2013 and the previous years' higher rates may be due to unusual random variation. NHS Fife has, nonetheless, resolved to undertake epidemiological study of any groups within Fife with a particularly high perinatal mortality rate and also to consider external clinical review of the circumstances of perinatal deaths.

10.4 Opportunities for further improvement

The main factors contributing to stillbirths and neonatal deaths which have been identified in this report and which might be amenable to improvement include the following:

- Poor socioeconomic circumstances, including the misuse of drugs and of alcohol.
- Placental dysfunction contributing to stillbirths.
- Inadequate root cause analysis of the causes of each death.
- Poor recognition of intrapartum hypoxia.

It is beyond the scope of this publication to suggest recommendations concerning the first of these factors but it is important that future reports continue to publish data concerning these associations. This report has also highlighted the inconsistent relationships between fetal growth restriction, histological placental abnormality and babies who are small for gestational age. Although abnormal placental histology was more frequent when apparent fetal growth restriction was present, abnormal placental histology was often present with no evident growth restriction. The relationship between fetal growth restriction and being small for gestational age is even more tenuous. Further research in this area would be valuable.

Although the majority of all deaths were reported to have been discussed at a hospital mortality review forum (84.6% of stillbirths), most were not subjected to a root cause analysis which may have identified more accurately where different practice might have led to a different outcome. In 2012-13, some Scottish maternity units participated in a study of the use of a method for detailed root cause analysis of each stillbirth and neonatal death based on work by Gardosi et al[12] in the West Midlands. This has recently had to be halted because of funding issues in West Midlands. Such an approach may assist in the recognition of, and therefore prompt management of, intrapartum hypoxia. The difficulty in identifying how many such cases occur in Scotland is shown in this report. Eleven stillbirths were reported to be “intrapartum deaths” but 19 were said to have been “alive at the onset of professional care in labour”. An additional seven neonatal deaths were attributed to “intrapartum asphyxia”. It is thus possible that up to 26 “intrapartum deaths” might have been preventable.

This, the last SPIMMR to be produced entirely within Scotland as a collaboration between Healthcare Improvement Scotland, ISD, NRS and the clinical staff of maternity, neonatal and paediatric units, reports many encouraging improvements. The collection of detailed information is essential to measure and monitor changes over time. Support for and cooperation with MBRRACE-UK[1] will maintain Scotland’s recognised role as a leader in the reporting of robust health data and the MCQIC patient safety programme in maternity services[2] should prove a vehicle for further improvements.

11 References

1. Healthcare Quality Improvement Partnership. MBRRACE-UK appointed to conduct the National Maternal, Newborn and Infant Review Programme [online]. 2012 [cited 2014 March 9]; Available from: http://www.hqip.org.uk/hqip-appoint-mbrrace-uk-to-conduct-national-maternal-newborn-and-infant-clinical-outcome-review-programme/

2. MCQIC (Maternity & Children's Quality Improvement Collaborative). Scottish Patient Safety Programme [online]. 2013 [cited 2014 March 9]; Available from: http://www.scottishpatientsafetyprogramme.scot.nhs.uk/programme/mcqic-maternity-andamp-childrens-quality-improvem

3. General Register Office for Scotland. Births, deaths and other vital events - quarterly figures [online]. 2011 [cited 2012 Jan 16]; Available from: http://www.gro-scotland.gov.uk/statistics/theme/vital-events/general/bmd-quarterly/index.html

4. Office of National Statistics. Births in England and Wales, 2012. 2012 [cited 2013 Dec 9]; Available from: http://www.ons.gov.uk/ons/rel/vsob1/birth-summary-tables--england-and-wales/2012/stb-births-in-england-and-wales-2012.html

5. FIGO. Standing committee on perinatal mortality and morbidity. Report of committee following a workshop on monitoring and reporting perinatal mortality and morbidity. London: Chameleon Press Ltd; 1982. p12.

6. Healthcare Improvement Scotland. Scottish Perinatal Infant Mortality and Morbidity Report [online]. 2010 [cited?]; Available from: http://www.healthcareimprovementscotland.org/default.aspx?page=14046

7. Stillbirths and Infant Deaths drop to record low in Scotland. The Scotsman. 2012 Feb 1.

8. NHS National Services Scotland and NHS Quality Improvement Scotland. Trends in perinatal mortality in Scotland - a review over 30 years [online]. 2009 [cited 2012 Jan 9]; Available from: http://www.healthcareimprovementscotland.org/his/idoc.ashx?docid=b6c375e3-f074-4fcc-bae6-25e6221ac2ea&version=-1

9. MacDowel T. Scottish Parliament petition 1291: why 17? campaign: saving babies' lives in Scotland. 2009 [cited 2012 Jan 9]; Available from: http://archive.scottish.parliament.uk/business/petitions/docs//PE1291.htm

10. The Lancet stillbirths series [Online]. 2011 [cited 2013 Mar 21]; Available from: http://www.thelancet.com/series/stillbirth

11. Centre for Maternal and Child Enquiries (CMACE). Perinatal Mortality 2009. 2010 (cited 2012 Jan 9); Available from: http://hqip.org.uk/assets/NCAPOP-Library/CMACE-Reports/35.-March-2011-Perinatal Mortality-2009.pdf

12. Gardosi J, Madurasinghe V, Williams M, Malik A, Francis A. Maternal and fetal risk factors for stillbirth: population based study. BMJ 2013;346:f108.

13. Scottish government: National infertility report 2013. http://www.scotland.gov.uk/Publications/2013/05/1501/5

14. Kamphuis EI, Bhattacharya S, van der Veen F, Mol BWJ, Templeton A. Are we overusing IVF? BMJ 2014;348:g252.

12 Appendices

12.1 Information on additional associated factors

Additional information from the new data collection form used since 2011 is provided here. Full detailed tables are available from Healthcare Improvement Scotland on request.

The results are generally expressed as percentages of those deaths for which the information was available. Although there was a high level of completion of forms, not all questions were answered for every case and the relevant information was sometimes either not applicable or unknown. In these results, the number used as a denominator (i.e. the number of relevant cases for which the information was available) is generally given in brackets.

The total number of each category of deaths recorded was:
164 late fetal deaths (LFD) (20 - 23^{+6} weeks gestation)
274 stillbirths (SB)
106 early neonatal deaths (ENND) (up to 7 days)
42 late neonatal deaths (LNND) (8 - 28 days)
69 post-neonatal deaths (PNND) (29 days - 1 year).

Depending on the nature of the information, the results are described for all deaths combined or for the different categories of deaths separately with appropriate denominators.

12.1.1 Ethnicity and employment

Table 12.1.1a Ethnicity of mother (%)

Ethnicity of mother	All fetal and infant deaths(%)		Total births[1] (%)	
	2011 (592)	2012 (597)	2010/11 (31188)	2011/12 (37051)
British	85.5	83.6	84.4	85.3
Other European	5.6	5.7	8.5	7.4
South Asian (India/Pakistan)	4.1	4.9	2.1	3.6
Others	4.9	5.9	4.9	3.6

1 Women giving birth in Scotland.
Source: Survey and SMR02.

Table 12.1.1b Percentage of mothers and fathers in employment

Parent's in employment	All fetal and infant deaths (%)		Total births[1] (%)	
	2011	2012	2010/11	2011/12
Mother	68.2 (513)	69.7 (524)	82.0 (50583)	81.9 (53266)
Father	84.9 (484)	86.4 (492)	N/A[2]	N/A[2]

1 Women giving birth in Scotland; includes only singleton births with matching NRS records.
2 Father's occupation is not available on SMR02 or the linked NRS records.
Source: Survey, SMR02 and NRS.

Combining the information for 2011 and 2012, 68.9% of mothers of stillbirths and of infant deaths were in employment, compared to 81.9% of mothers of all births. This difference is statistically significant (χ^2=116.7, p<0.001).

12.1.2 Alcohol consumption and drug misuse

Table 12.1.2a Alcohol consumption

Number of units	All fetal and infant deaths (%)[1]		Total births (%)[2]	
	2011 (487)	2012 (491)	2010/11 (35807)	2011/12 (48867)
None	48.7	56.8	94.0	96.6
1-7	32.2	26.7	4.3	2.5
8-14	13.8	14.3	1.2	0.6
>14	5.3	2.2	0.5	0.3

1 Weekly alcohol consumption prior to pregnancy.
2 Women giving birth in Scotland and reporting the number of units of alcohol drunk "in an average week".
Source: Survey and SMR02.

Combining the information for 2011 and 2012, there is a statistically significant association between reported increasing alcohol consumption and fetal or infant death (χ^2=3964, p<0.001).

Table 12.1.2b Substance misuse

	All fetal and infant deaths (%)		Total births[1] (%)	
	2011 (603)	2012 (594)	2010/11 (39197)	2011/12 (49107)
Yes	6.5	4.9	3.0	2.2
No	93.5	95.1	97.0	97.8

1 Women giving birth and reporting drug misuse at any time during the pregnancy.
Source: Survey and SMR02.

Combining the information for 2011 and 2012, 5.7% of mothers of stillbirths and of infant deaths reported substance misuse, compared to 2.5% of mothers of all births. This difference is statistically significant (χ^2=44.7, p<0.001).

12.1.3 Medicinal drug use for those who experienced stillbirths

In 2012, 216 women experiencing a stillbirth (78.8%) reported no medicinal use (other than supplements or folic acid). The table shows the distribution of types of medication in 2011 and 2012.

Type of medication taken during pregnancy	Number of women 2011	Number of women 2012
None	230	216
Analgesics	5	4
Antibiotics	0	5
Anticoagulants	4	5
Anticonvulsants	1	2
Antidepressants	8	6
Antiemetics	2	4
Antihypertensives	5	4

Type of medication taken during pregnancy	Number of women 2011	Number of women 2012
Anxiolytics	0	3
Bronchodilators	8	9
Gastro-intestinal agents	5	5
Insulin	4	4
Iron	3	3
Methadone	2	0
Migraine medication	2	0
Nicotine patches	1	0
Oral hypoglycaemics	2	2
Progestogen	1	0
Steroids	4	2
Thyroid medication	3	3

Source: Survey.

12.1.4 Non obstetric disorders (medical or psychiatric)

Among the 586 women who experienced a stillbirth, neonatal death or late fetal death, 161 (27.5%) were reported to have at least one non obstetric disorder (medical or psychiatric). This is very similar to the proportion in 2011. The most frequent (also as in 2011) was a psychiatric disorder, which affected 28 women (4.8% of all deaths).

12.1.5 Previous pregnancy losses

Table 12.1.5 Percentage of previous pregnancy losses: 2012

Category of death[1]	Previous miscarriage (%)	Previous termination of pregnancy (%)	Previous stillbirth (%)	Previous neonatal death (%)
Stillbirth	26.6	7.2	4.0	1.0
Neonatal death	32.5	10.1	6.3	6.4
Late fetal death	37.1	7.6	4.4	3.5
Scotland[2]	22.7	8.1	0.7	0.4

1 Depending on the category and previous loss, information available was for the following numbers of cases: stillbirths 201 - 259, neonatal deaths 94 - 123, late fetal deaths 114 - 151.
2 Women delivering in 2011/12 (56958 - excludes records where NND unknown).
Source: Survey and SMR02.

12.1.6 Assisted conception

Among stillbirths, neonatal deaths and late fetal deaths, information was recorded for 469 pregnancies (82.6%) concerning the use of assisted conception. Twenty nine of the 469 pregnancies (6.2%) were so conceived. These comprised 4.4% of stillbirths, 6.7% of neonatal deaths and 8.7% of late fetal deaths. The most recent information on the rate of assisted conception among all births in Scotland is from 2010 when 1.8% of all births were conceived by in vitro fertilisation (IVF)[13]. A recent review reported that, in developed countries with public health systems, 2-3% of births each year are through in vitro fertilisation (IVF)[14]. The same review reports a perinatal mortality rate among singleton IVF pregnancies approximately twice the rate among those conceived naturally.

12.1.7 Booking for confinement, antenatal care and planning

Table 12.1.7a Percentage booking by end of 12th and 20th week of gestation: 2012

Category of death	Booking ≤ 12 weeks gestation (%)[2]	Booking ≤ 20 weeks gestation (%)
Stillbirths (250)	81.6	97.2
Early NND (83)	74.7	96.4
Late NND (24)	75.0	91.7
Late fetal deaths (154)	81.8	98.7
Scotland[1]	71.3	-

1 Women giving birth in Scotland 2011/12.
2 The Scottish HEAT (Health, Efficiency, Access and Treatment) target is for 80% of women to be booked for antenatal care by the 12th week of gestation.
Source: Survey and SMR02.

Table 12.1.7b Consultant antenatal care: 2012

Category of death	Received some antenatal care from consultant (%)
Stillbirths (260)	67.5
Early NND (93)	87.6
Late NND (28)	86.7
Late fetal deaths (149)	82.6

Source: Survey.

Birth planned at consultant unit:
Stillbirths (257): 89.5%
Early NNDs (100): 91.0%
Late NNDs (35): 91.4%
Late fetal deaths (155): 91.6%

Elective caesarean section planned:
Stillbirths (270): 10.4%
Early NNDs (100): 22.0%
Late NNDs (38): 21.1%
Late fetal deaths (146): 8.2%

Intrauterine transfers:
Stillbirths (266): 3.4%
Early NNDs (100): 14.0%
Late NNDs (38): 15.8%
Late fetal deaths (154): 2.6%

12.1.8 Labour

Table 12.1.8 Percentage of deaths by type of labour: 2012

Category of death	Spontaneous (%)	Induced (%)	No labour (%)
Stillbirths (269)	21.6	63.9	14.5
Early NND (99)	60.6	17.2	22.2
Late NND (39)	69.2	10.3	20.5
Late fetal deaths (151)	35.1	59.6	5.3
Scotland[1] (57836)	59.2	23.8	16.9

1 Women delivering in Scotland 2011/12.
Source: Survey and SMR02.

12.1.9 Delivery

Table 12.1.9a Place of birth for each category of death: 2012

Category of death	Consultant obstetric unit (%)	Alongside midwifery unit[1] (%)	Freestanding midwifery unit[2] (%)	Home (%)
Stillbirths (261)	92.3	2.7	0.4	2.7
Early NND (102)	93.1	2.0	2.0	1.0
Late NND (35)	91.4	5.7	0.0	2.9
Late fetal deaths (156)	92.9	3.8	0.0	1.9

1 Midwifery unit at same location as consultant unit.
2 Midwifery unit at location independent from consultant unit.
Source: Survey.

Table 12.1.9b Mode of birth for each category of death[1]: 2012

Category of death	Spontaneous vertex (%)	Prelabour caesarean section (%)	Labour caesarean section (%)
Stillbirths (271)	65.7	11.8	2.2
Early NND (101)	51.5	20.8	18.8
Late NND (38)	44.7	21.1	21.1
Late fetal deaths (143)	76.2	0.0	0.7
Scotland[2] (57911)	58.0	12.6	16.2

1 Excludes births which were not spontaneous vertex or caesarean section.
2 Women giving birth in Scotland 2011/12.
Source: Survey.

Urgent caesarean sections

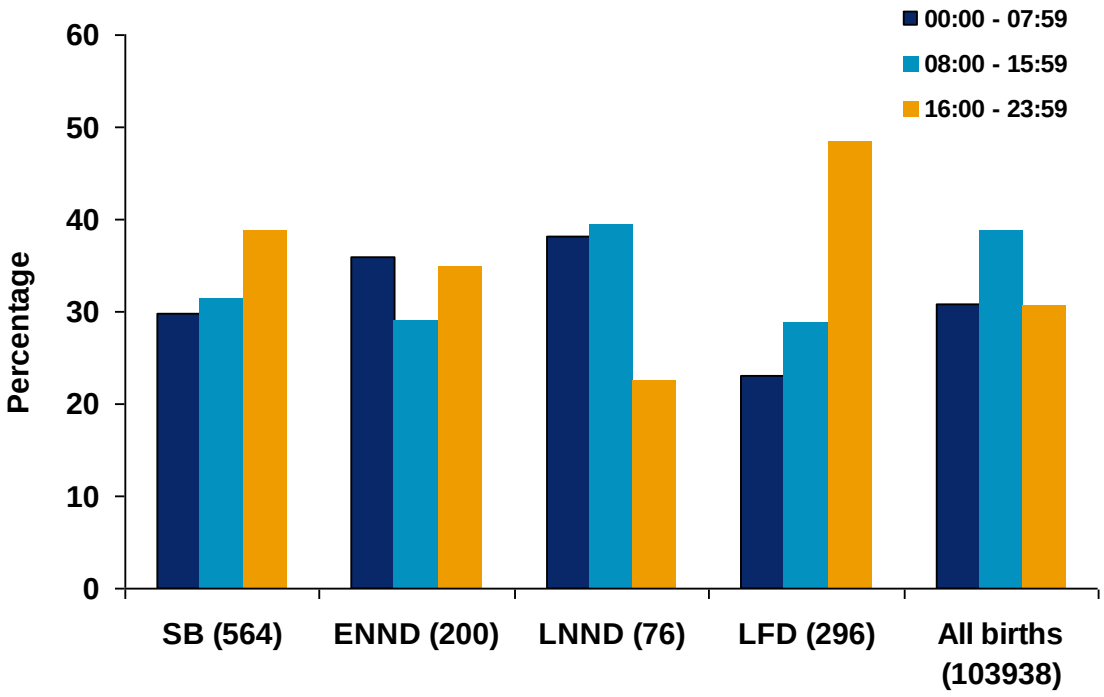
Percentage of caesarean section deliveries classified as urgent or emergency (number of caesarean sections in brackets):
Stillbirths (34): 67.6%
Early NNDs (39): 89.7%
Late NNDs (16): 93.8%

Table 12.1.9c Percentage of breech presentations at delivery and vaginal breech deliveries: 2012

Category of death[1]	Breech presentation at delivery (%)	Vaginal breech delivery (%)[2]
Stillbirths	21.3	16.6
Early NND	22.1	8.9
Late NND	27.8	10.5
Late fetal deaths	26.4	23.1

1 Denominators (cases with information available) for each column were: SB - 268 and 271; ENND - 95 and 101; LNND - 36 and 38; LFD - 140 and 143.
2 Assisted and extraction.
Source: Survey.

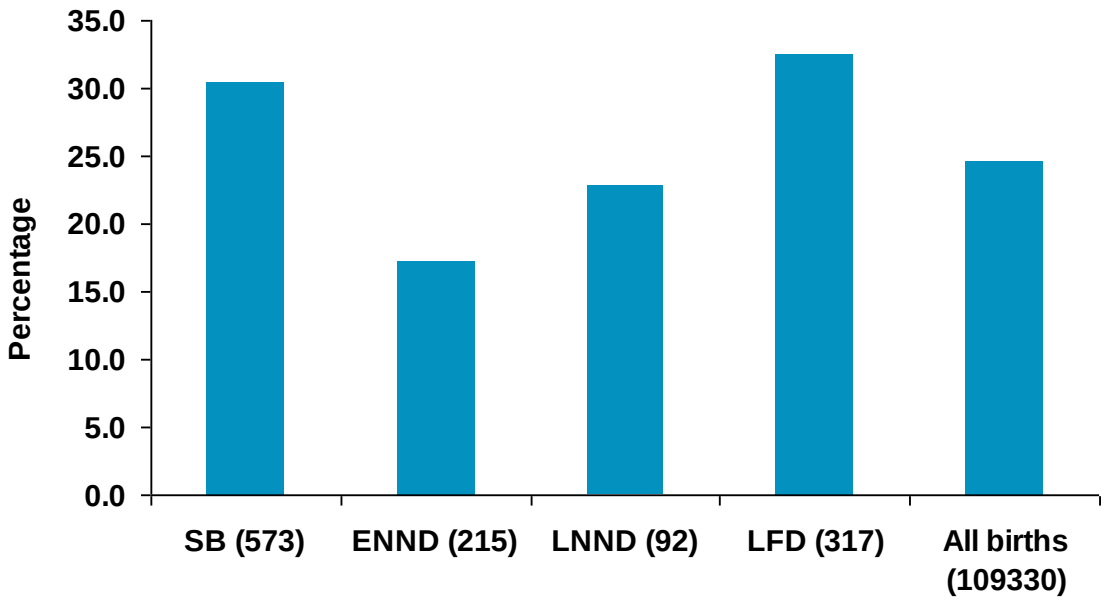
Figure 12.1.9d Percentage distribution of time of birth of stillbirths, early and late neonatal deaths, late fetal deaths[1] and deliveries in Scotland[2]: 2011 and 2012



1 Excludes records where time of birth was missing.
2 Singleton births between Apr 2010 and Mar 2012; linked with NRS record for time of birth.
Source: Survey, SMR02 and NRS.

Birth at the weekend

Figure 12.1.9e Percentage of births in each category of death and of all hospital births[1] occurring at a weekend (Saturday or Sunday): 2011 and 2012



1 Singleton births between Apr 2010 and March 2012.
Source: Survey and SMR02.

Combining 2011 and 2012, there was a significantly higher proportion of stillbirths (30.4% of all stillbirths) than of all births (24.6% of all births) during weekends (χ^2=9.735, p=0.002).

12.1.10 Terminations of pregnancy

Percentage of each category of death recorded as a termination of pregnancy:
Stillbirths (270): 6.7%
Early NNDs (106): 9.4%
Late fetal deaths (162): 40.7%

12.1.11 Multiple pregnancies

Most information about multiple pregnancies is included earlier in this report and in Appendix 12.2. Additional information is as follows:

"Lost" twins

Among stillbirths, 19 were recorded as multiple early in the pregnancy and there were 19 stillbirths from multiple pregnancies. There were, therefore, no "lost twins" among the stillbirths and although there were 20 twin pregnancies where both twins died, in only one pregnancy were both twins stillborn. One fetus papyraceous was reported.

Birth order

Overall, when all categories of death are combined, twins 1 and 2 were at similar risk, with 37 deaths among twin 1's and 32 among twin 2's. Early neonatal deaths showed the greatest discrepancy with 13 deaths for twin 1 but only 5 for twin 2.

Chorionicity

Among all deaths, 37 multiple pregnancies were dichorionic diamniotic, 24 were monochorionic diamniotic and 1 monochorionic monoamniotic. Chorionicity was not known for two late neonatal deaths.

12.1.12 Intrapartum deaths

Of the 251 stillbirths with the information reported, 11 (4.4%) were said to be "intrapartum deaths". However, of the 219 stillbirths who experienced labour under professional supervision, 19 (8.6%) were said to have "been alive at the onset of professional care in labour".

Of 98 early NNDs with the information recorded, 6 (6.1%) of deaths were attributed to "intrapartum asphyxia". One out of 36 late NNDs was so attributed, giving an overall rate of intrapartum asphyxia of 5.2% for all NNDs.

12.1.13 Neonatal deaths

Table 12.1.13a Apgar scores for neonatal deaths (percentage): 2012

	At 1 minute		At 5 minutes		At 10 minutes	
Apgar score	ENND (82)	LNND (34)	ENND (76)	LNND (34)	ENND (60)	LNND (21)
0 - 3	61	24	45	3	40	0
4 - 7	28	59	34	53	35	29
8 - 10	11	18	21	44	25	71

Source: Survey.

Cord blood gases

Among early neonatal deaths, cord blood was reported as not taken in 55 cases (68.8% of 80 with the information). The arterial pH was reported for 25 cases and was <7.2 in 12 (48.0%); the venous pH was reported for 23 cases and was <7.2 in 7 (30.4%).

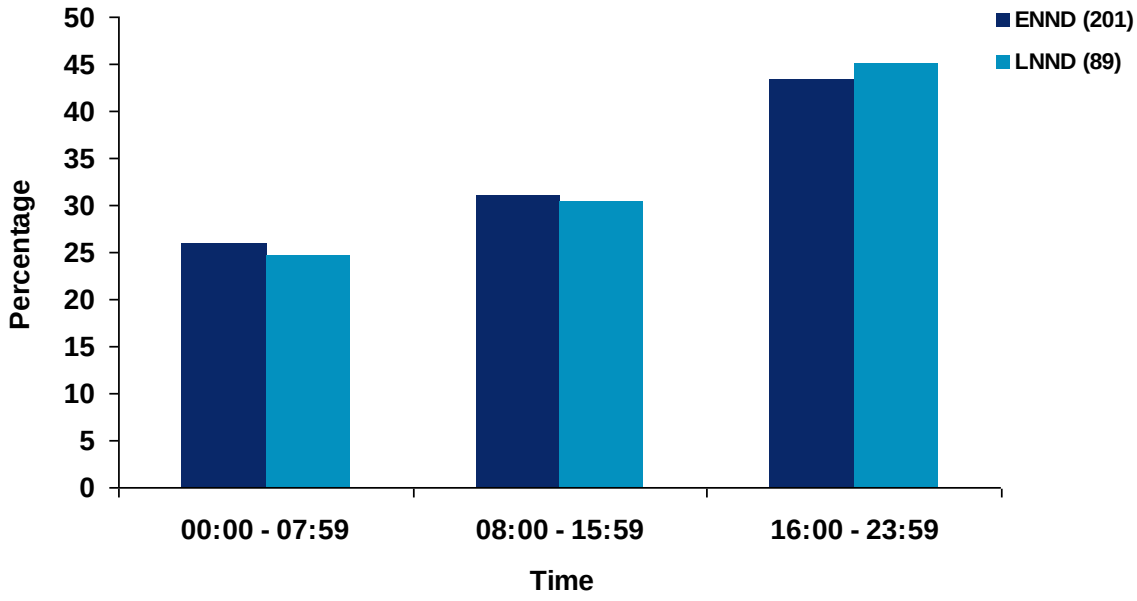
The equivalent reported figures for late NNDs were:
Not taken: 17 (60.7% of 28)
Arterial pH <7.2: 5 out of 11 (45.4%)
Venous pH <7.2: 2 out of 11 (18.2%)

Admissions to neonatal units and transfers after birth

Only 61.0% of early neonatal deaths were admitted to a neonatal unit (NNU), but this is almost certainly explained by the very early death of very ill or very premature babies. Thus, there were 41 early NNDs not admitted to a NNU and 40 early NNDs who died on a labour ward. By contrast, 95.1% of late NNDs were admitted to a NNU.

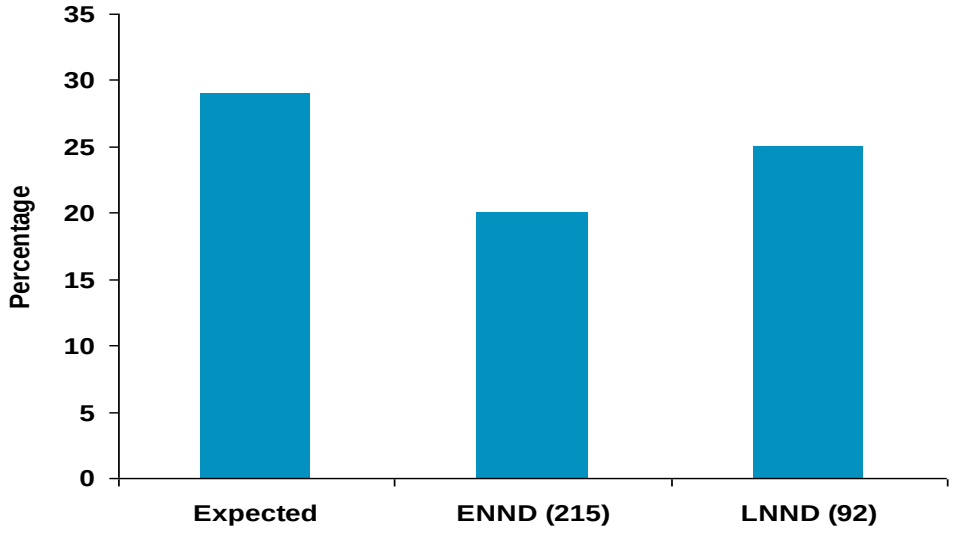
Information on postnatal transfer to other neonatal care was provided for 96 of the early NNDS. Of these, 7 (7.3%) were transferred. Nine out of 34 (26.4%) late NNDs with the information provided were transferred. These figures are very similar to those for 2011.

Figure 12.1.13b Percentage distribution of time of death for early and late neonatal deaths[1]: 2011 and 2012



1 Excludes records where time of birth was missing.
Source: Survey.

Figure 12.1.13c Percentage of neonatal deaths occurring at a weekend compared to expected (29%) if deaths evenly distributed throughout the week: 2011 and 2012



Source: Survey.

12.1.14 Postmortem (PM) examinations

Table 12.1.14 Postmortem (PM) examinations: 2012

Category of death	PM offered (%)	PM authorised (%)	Full PM authorised[1] (%)	PM report sent to RHP[1,2] (%)
Stillbirths (284)	99.3	65.2	89.8	99.4
Early NND (97)	94.1	40.4	95.0	97.5
Late NND (41)	92.3	35.9	92.9	92.9
Late fetal deaths (148)	98.1	55.8	87.4	96.6

1 Percentage is of all PMs authorised.
2 Reproductive Health Programme of Healthcare Improvement Scotland.
Source: Survey.

Staff offering PM (544 of all stillbirths, NNDs and late fetal deaths combined)
Consultant obstetrician or neonatologist: 78.1%
Other trained medical staff (associate specialist or staff grade): 1.5%
Trainee doctor: 10.7%
Midwife: 8.8%
Other: 0.9%

PM examination by Procurator Fiscal
Stillbirths, NNDs and late fetal deaths (545): 3.1%
Post-neonatal deaths (48): 50.0%

12.1.15 Histological examination of placenta completed

The recording of information on placental histology was inconsistent and the following data is based on concrete evidence seen by the RHP either by sight of a pathology report or a letter containing details of such a report. On this basis, placental histology was completed for:
Stillbirths: 97.4%
Early NNDs: 90.6%
Late NNDs: 90.5%
Late fetal deaths: 93.9%

Of 586 stillbirths, neonatal deaths, and late fetal deaths, no information from either a postmortem examination or placental histology for assigning a cause of death was available for 80 (13.7%).

Among the 274 stillbirths, a postmortem (either full or partial) was used to assign a cause of death in 172 cases (62.8%) and placental histology in 247 cases (90.1%).

12.1.16 Intrauterine growth restriction (IUGR)

The data collection form asked whether IUGR was diagnosed. The question was answered for 274 of the 422 deaths (64.9%).

Among these, the proportions reported with IUGR were as follows:
Stillbirths (72/193): 37.3%
Early NNDs (11/58): 19.0%

Late NNDs (7/23): 30.4%
A subsidiary question asked whether the diagnosis was made antenatally, at birth or at postmortem and was answered for 241 stillbirths (although only 193 answered the first question!). The numbers were as follows:
Antenatally: 25 cases suspected
At birth: 27 cases suspected
At postmortem: 41 cases diagnosed

Although the amount of missing data diminishes the strength of analysis, the proportion of stillbirths with IUGR (37.3%) is very close to the 40% of stillbirths with specific placental conditions (40%).

As IUGR is generally the result of other pathology, particularly placental dysfunction, it was very rarely considered the main single cause of death in the final classification. There were just three stillbirths where no other condition was identified. In 26 further stillbirths, IUGR was classified as an important subsidiary cause, meaning that it was an important factor in 10.6% of all 274 stillbirths.

The relationship between the suspected or observed presence of IUGR and placental histological abnormality is shown in the Table 12.1.16.

Table 12.1.16 Histological placental abnormality with suspected or observed IUGR: 2012

Type of placental abnormality[1]	IUGR suspected or observed (n)	IUGR not suspected or observed (n)
None	39	78
Placental infarction	24	18
Massive perivillous fibrin deposition	3	5
Deficient placental villus maturity	6	9
Chronic villitis	6	9
Fetal thrombotic vasculopathy	4	10
Cord hypercoiling	7	9
Cord hypocoiling	3	3
Chronic intervillositis	0	1
All stillbirths (with information recorded)	72	121

1 Some cases had more than one abnormality.

12.1.17 Perinatal mortality forum

Table 12.1.17 Reported percentage of cases discussed at perinatal mortality meeting and with root cause analysis performed: 2012

Category of death[1]	Discussed at perinatal mortality meeting (%)	Root cause analysis performed
Stillbirths (246 and 225)	84.6	14.6
Early NNDs (88 and 81)	72.7	11.1
Late NNDs (37 and 33)	70.2	3.0
Late fetal deaths (149 and 126)	52.3	3.9

1 Numbers in brackets are number of cases for each column for which information was recorded.

12.2 Appendix tables and figures

Table A1a FIGO tabulation (numbers): 2007 - 2012

	2007	2008 [1]	2009 [1]	2010 [1]	2011 [1]	2012 [1]
Registered Births	**58108**	**60354**	**59351**	**59082**	**58884**	**58291**
Less than 500g						
Total	**62**	**32**	**49**	**34**	**37**	**26**
Stillbirths	37	21	37	28	28	16
ENN Deaths	24	11	12	6	8	10
LNN Deaths	1	-	-	-	1	0
500g or over						
Total births	**58046**	**60322**	**59302**	**59048**	**58847**	**58265**
Stillbirths	288	304	279	262	270	258
ENN Deaths	102	95	92	99	92	85
LNN Deaths	58	44	45	30	48	42
of which with lethal malformations						
Total births	**63**	**75**	**79**	**60**	**74**	**69**
Stillbirths	21	34	39	28	35	31
ENN Deaths	30	31	26	27	25	25
LNN Deaths	12	10	14	5	14	13
1000g or over						
Total births	**57803**	**60062**	**59089**	**58814**	**58623**	**58046**
Stillbirths	220	239	212	189	203	195
ENN Deaths	59	59	65	56	61	59
LNN Deaths	34	34	27	18	26	20
of which with lethal malformations						
Total births	**49**	**62**	**61**	**47**	**57**	**53**
Stillbirths	11	25	24	16	22	19
ENN Deaths	26	28	23	26	22	23
LNN Deaths	12	9	14	5	13	11

Table A1b FIGO tabulation (rates): 2007 - 2012

Rates	2007	2008 [1]	2009 [1]	2010 [1]	2011 [1]	2012 [1]	95% CI
Excluding all births <500g							
Major Malformation rate	1.09	1.24	1.33	1.02	1.26	1.18	0.92-1.50
Stillbirth rate	4.96	5.04	4.70	4.44	4.59	4.43	3.90-5.00
Neonatal rate	2.77	2.32	2.32	2.19	2.39	2.19	1.83-2.61
Perinatal rate	6.72	6.61	6.26	6.11	6.15	5.89	5.28-6.54
Excluding all major malformations and other births <500g							
Stillbirth rate	4.6	4.48	4.05	3.97	4.00	3.90	3.41-4.44
Neonatal rate	2.04	1.63	1.64	1.65	1.73	1.54	1.23-1.89
Perinatal rate	5.85	5.54	5.17	5.19	5.14	4.93	4.38-5.54
Excluding all births <1000g							
Stillbirth rate	3.81	3.98	3.59	3.21	3.46	3.36	2.90-3.87
Neonatal rate	1.62	1.55	1.56	1.26	1.49	1.37	1.08-1.70
Perinatal rate	4.83	4.96	4.69	4.17	4.50	4.38	3.85-4.95
Excluding all major malformations and other births <1000g							
Stillbirth rate	3.62	3.57	3.18	2.94	3.09	3.03	2.60-3.52
Neonatal rate	0.96	0.94	0.93	0.73	0.89	0.78	0.57-1.04
Perinatal rate	4.19	4.08	3.90	3.45	3.76	3.66	3.18-4.18

1 Excludes any births < 22 wks gestation and unknown birthweight.
Source: Survey, SMR02 and NRS.

Table A2 Registered singleton and multiple pregnancies: 2007 - 2012

	2007	2008	2009	2010	2011	2012
Singleton pregnancies	56309	58433	57473	57208	57155	56545[2]
Twin pregnancies	882	953	922	919	852	866[2]
Triplet pregnancies	9	9	14	12	10	8
Quadruplet pregnancies	2	-	1	-	-	-
Quintuplet pregnancies	-	-	-	-	-	-
Twinning rate[1]	15.4	16.0	15.8	15.8	14.7	15.1

1 Rate per 1000 pregnancies resulting in registered births.
2 Four births were registered as singletons by NRS but identified by the survey as two multiple pregnancies; hence the discrepancy between singleton and multiple births in 2012 between Tables A2 and A3.
Source: NRS.

Table A3 Stillbirth and neonatal deaths for singleton and multiple births: 2007 - 2012

	2007	2008	2009	2010	2011	2012
Total Births	**58108**	**60366**	**59363**	**59082**	**58889**	**58301**
Singleton	56303	58427	57471	57204	57153	56541[3]
Multiple	1805	1939	1892	1878	1736	1760[3]
Stillbirths	**327**	**325**	**317**	**291**	**299**	**274**
Singleton	298	298	293	265	277	255
Multiple	29	27	24	26	22	19
Neonatal deaths	**188**	**168**	**165**	**150**	**159**	**148**
Singleton	156	137	133	124	133	119
Multiple	32	31	32	26	26	29
	Rates					
Stillbirth mortality rate [1]	**5.6**	**5.4**	**5.3**	**4.9**	**5.1**	**4.7**
Singleton	5.3	5.1	5.1	4.6	4.8	4.5
Multiple	16.1	13.9	12.7	13.8	12.7	10.8
Neonatal mortality rate [2]	**3.3**	**2.8**	**2.8**	**2.6**	**2.7**	**2.6**
Singleton	2.8	2.4	2.3	2.1	2.3	2.1
Multiple	18.0	16.2	17.1	14.0	15.2	16.7

1 Rate per 1000 singleton or multiple total births.
2 Rate per 1000 singleton or multiple live births.
3 Four births were registered as singletons by NRS but identified by the survey as two multiple pregnancies; hence the discrepancy between singleton and multiple births in 2012 between Tables A2 and A3.
Source: NRS and Survey.

Table A4 Obstetric causes of death for singleton stillbirths and neonatal deaths: 2012

Cause of death	Stillbirth	Early NND	Late NND
Total	**255**	**90**	**29**
Major congenital anomaly	**28**	**24**	**8**
Central nervous system	8	6	-
Cardiovascular system	2	4	5
Respiratory system	-	1	1
Gastro-intestinal system	-	-	-
Musculo-skeletal system	-	-	1
Multiple anomalies	2	4	-
Chromosomal disorders	13	3	1
Metabolic diseases	-	2	-
Urinary tract	3	4	-
Hypertensive disorders of pregnancy	**5**	**2**	**-**
Pregnancy induced hypertension	-	-	-
Pre-eclampsia	5	2	-
HELLP syndrome	-	-	-
Eclampsia	-	-	-
Antepartum or intrapartum haemorrhage	**40**	**10**	**3**
Placenta praevia	-	-	1
Placental abruption	37	9	2
AP/IP haemorrhage - other	3	1	-
Mechanical	**8**	**2**	**-**
Prolapse cord	1	-	-
Cord around neck	2	1	-
Other cord entanglement or knot	4	-	-
Mal-presentation - breech	1	-	-
Mal-presentation - other	-	1	-
Maternal disorder	**12**	**-**	**-**
Pre-existing hypertensive disease	-	-	-
Pre-existing diabetes	7	-	-
Gestational diabetes	-	-	-
Thrombophilias	4	-	-
Obstetric cholestasis	1	-	-
Maternal disorder - other	-	-	-
Infection	**17**	**32**	**10**
Maternal infection - other	2	1	-
Maternal infection - viral	-	-	-
Ascending infection - chorioamnionitis	15	31	10

Cause of death	Stillbirth	Early NND	Late NND
Specific fetal conditions	**6**	**2**	**-**
Twin-twin transfusion	-	-	-
Feto-maternal haemorrhage	3	-	-
Non immune hydrops	1	1	-
Iso-immunisation	1	1	-
Fetal condition - other	1	-	-
Specific placental conditions	**102**	**1**	**2**
Placental infarction	37	-	2
Cord hypercoiling	12	-	-
Massive perivillous fibrin deposition	6	-	-
Deficient placental villus maturation	16	-	-
Chronic intervillostitis	1	-	-
Fetal thrombotic vasculopathy	22	-	-
Placental condition - other	8	1	-
Intrauterine growth restriction	**2**	**-**	**1**
Associated obstetric factors	**2**	**7**	**2**
Intrapartum anoxia	2	4	-
Premature rupture of membranes	-	2	-
Spontaneous premature delivery	-	1	2
No antecedent or associated obstetric factors	**29**	**5**	**1**
Unable to classify	**4**	**5**	**2**

Source: Survey.

Table A5 Neonatal causes of death for singleton neonatal deaths: 2012

Cause of death	Early NND	Late NND
Total	**90**	**29**
Major congenital anomaly	**24**	**8**
Central nervous system	6	-
Cardiovascular system	4	5
Respiratory system	1	1
Gastro-intestinal system	-	-
Musculo-skeletal system	-	1
Multiple anomalies	4	-
Chromosomal disorders	3	1
Metabolic diseases	2	-
Urinary tract	4	-
Extreme immaturity (<24 wks)	**21**	**3**
<22 weeks gestation	8	-
22 to 24 weeks gestation	13	3
Respiratory disorders	**14**	**5**
Severe pulmonary immaturity	5	-
Surfactant deficiency lung disease	1	1
Pulmonary hypoplasia	6	-
Other (eg pulmonary haemorrhage, pneumonia, iatrogenic)	2	4
Gastro-intestinal disease	**1**	**1**
Necrotising enterocolitis (NEC)	1	1
Neurological disorder	**11**	**3**
Hypoxic-ischaemic encephalopathy (HIE)	9	1
Intraventricular / periventricular haemorrhage	2	2
Infection	**12**	**6**
Sepsis (generalised)	7	5
Pneumonia	4	1
Infection - other	1	-
Injury/Trauma	**1**	**1**
Other specific causes	**2**	**-**
Malignancies / tumours	-	-
Specific conditions	2	-
Sudden unexpected death	**4**	**1**
Sudden unexpected natural death (includes SIDS)	2	1
Neonatal death - cause not ascertained	2	-
Unable to classify due to lack of information	**-**	**1**

Source: Survey.

Table A6 Obstetric causes of death for multiple stillbirths and neonatal deaths: 2012

Cause of death	Stillbirth	Early NND	Late NND
Total	**19**	**16**	**13**
Major congenital anomaly	**4**	**6**	**5**
Central nervous system	1	3	1
Cardiovascular system	1	2	1
Respiratory system	-	-	-
Gastro-intestinal system	-	-	-
Musculo-skeletal system	-	1	-
Multiple anomalies	-	-	2
Chromosomal disorders	2	-	1
Metabolic diseases	-	-	-
Urinary tract	-	-	-
Hypertensive disorders of pregnancy	**-**	**-**	**-**
Pregnancy induced hypertension	-	-	-
Pre-eclampsia	-	-	-
HELLP syndrome	-	-	-
Antepartum or intrapartum haemorrhage	**-**	**1**	**-**
Placenta praevia	-	-	-
Placental abruption	-	1	-
AP/IP haemorrhage - other	-	-	-
Mechanical	**1**	**-**	**-**
Prolapse cord	-	-	-
Cord around neck	1	-	-
Other cord entanglement or knot	-	-	-
Mal-presentation - breech	-	-	-
Mal-presentation - other	-	-	-
Maternal disorder	**1**	**1**	**-**
Pre-existing hypertensive disease	-	-	-
Pre-existing diabetes	-	-	-
Gestational diabetes	1	-	-
Thrombophilias	-	-	-
Obstetric cholestasis	-	-	-
Maternal disorder - other	-	1	-
Infection	**-**	**1**	**1**
Maternal infection - other	**-**	**-**	**-**
Maternal infection - viral	-	-	-
Ascending infection - chorioamnionitis	-	1	1
Specific fetal conditions	**6**	**3**	**-**
Twin-twin transfusion	5	3	-
Feto-maternal haemorrhage	-	-	-
Non immune hydrops	-	-	-
Iso-immunisation	-	-	-
Fetal condition - other	1	-	-

Table A6 continued

Cause of death	Stillbirth	Early NND	Late NND
Specific placental conditions	**2**	**-**	**-**
Placental infarction	1	-	-
Cord hypercoiling	-	-	-
Massive perivillous fibrin deposition	-	-	-
Deficient placental villus maturation	1	-	-
Chronic intervillostitis	-	-	-
Fetal thrombotic vasculopathy	-	-	-
Placental condition - other	-	-	-
Intrauterine growth restriction	**1**	**-**	**-**
Associated obstetric factors	**-**	**3**	**4**
Intrapartum anoxia	-	-	-
Premature rupture of membranes	-	2	1
Spontaneous premature delivery	-	1	3
No antecedent or associated obstetric factors	**4**	**1**	**1**
Unable to classify	**-**	**-**	**2**

Source: Survey.

Table A7 Neonatal causes of death for multiple neonatal deaths: 2012

Cause of death	Early NND	Late NND
Total	**16**	**13**
Major congenital anomaly	**6**	**5**
Central nervous system	3	1
Cardiovascular system	2	1
Gastro-intestinal system	-	-
Musculo-skeletal system	1	-
Multiple anomalies	-	2
Chromosomal disorders	-	1
Metabolic diseases	-	-
Urinary tract	-	-
Extreme immaturity (<24 wks)	**3**	**-**
<22 weeks gestation	-	-
22 to 24 weeks gestation	3	-
Respiratory disorders	**2**	**1**
Severe pulmonary immaturity	-	-
Surfactant deficiency lung disease	-	-
Pulmonary hypoplasia	-	-
Other (eg pulmonary haemorrhage, pneumonia, iatrogenic)	2	1
Gastro-intestinal disease	**-**	**4**
Necrotising enterocolitis (NEC)	-	4
Neurological disorder	**5**	**1**
Hypoxic-ischaemic encephalopathy (HIE)	1	-
Intraventricular / periventricular haemorrhage	4	1
Infection	**-**	**2**
Sepsis (generalised)	-	2
Pneumonia	-	-
Infection - other	-	-
Injury/Trauma	**-**	**-**
Other specific causes	**-**	**-**
Malignancies / tumours	-	-
Specific conditions	-	-
Sudden unexpected death	**-**	**-**
Sudden unexpected natural death (includes SIDS)	-	-
Neonatal death - cause not ascertained	-	-
Unable to classify due to lack of information	**-**	**-**

Source: Survey.

Table A8 Full postmortem (PM) examinations of late fetal deaths, stillbirths and neonatal deaths by hospital: 2012

NHS Board/Hospital of death	LFD		SB		NND		All events	
	No.	% PM	No.	% PM	No.	% PM	No.	% PM
Scotland	**164**	**46.3**	**274**	**57.7**	**148**	**34.5**	**586**	**48.6**
Ayrshire & Arran								
Crosshouse Hospital	10	20.0	21	57.1	10	40.0	41	43.9
Other[1]	-	-	1	0.0	-	-	1	0.0
Borders								
Borders General Hospital	-	-	5	80.0	2	100.0	7	85.7
Dumfries & Galloway								
Cresswell Maternity Hospital	1	100.0	4	50.0	2	100.0	7	71.4
Fife								
Victoria Hospital	10	80.0	20	45.0	20	35.0	50	48.0
Forth Valley								
Forth Valley Royal Hospital	13	46.2	11	72.7	3	66.7	27	59.3
Grampian								
Aberdeen Maternity Hospital	16	50.0	30	73.3	10	20.0	56	57.1
Dr. Gray's Hospital	2	100.0	2	100.0	1	-	5	80.0
Other[1]	2	-	1	100.0	2	50	5	40.0
Greater Glasgow & Clyde								
Glasgow Royal Maternity Hospital	1	100.0	26	73.1	14	7.1	41	51.2
Southern General Hospital	8	37.5	28	28.6	15	40.0	51	33.3
RHSC, Glasgow	-	-	-	-	10	50.0	10	50.0
Paisley Maternity Hospital	17	35.3	19	57.9	1	100.0	37	48.6
Other[1]	1	100.0	2	50.0	-	-	3	66.6
Highland								
Raigmore Hospital	10	50.0	15	73.3	3	-	28	57.1
Other[1]	-	-	1	0.0	1	100.0	2	50.0
Lanarkshire								
Wishaw General Hospital	19	42.1	20	50.0	11	18.2	50	40.0
Other[1]	-	-	2	50.0	1	0.0	3	33.3
Lothian								
RHSC, Edinburgh	-	-	-	-	2	-	2	-
St. John's at Howden, Livingston	10	40.0	14	42.9	1	-	25	40.0
New Royal Infirmary of Edinburgh	25	64.0	36	69.4	22	59.1	83	65.1
Other[1]	1	0.0	1	100.0	-	-	2	50.0
Tayside								
Ninewells Hospital	18	27.8	15	33.3	17	11.8	50	24.0
Islands	-	-	-	-	-	-	-	-

1 Includes births at home.
Source: Survey.

Table A9a Singleton live births, stillbirths and neonatal deaths by birthweight: 2012[p]

Birthweight (g)	Live births		NRS Live births	Stillbirths			NND		
	No.	%	No.	No.	%	95% CI	No.	%	95% CI
Total	**55157**	**100.0**	**56288**	**255**	**100.0**		**119**	**100.0**	
<1500	408	0.7	416	107	42.0	34.4,50.7	70	58.8	45.9,74.3
1500-2499	2348	4.3	2396	63	24.7	19.0,31.6	17	14.3	8.3,22.9
2500-3499	26509	48.1	27053	50	19.6	14.5,25.9	21	17.6	10.9,27.0
3500-4499	24620	44.6	25125	31	12.2	8.3,17.3	8	6.7	2.9,13.3
4500+	1241	2.2	1266	4	1.6	0.4,4.1	2	1.7	0.2,6.2
Not known	31	0.1	32	-	-	-	1	0.8	0.0,4.8

p Provisional SMR02.
Source: SMR02, NRS and Survey.

Table A9b Singleton live births, stillbirths and neonatal deaths by gestation: 2012[p]

Gestation (weeks)	Live births		NRS Live births	Stillbirths			NND		
	No.	%	No.	No.	%	95% CI	No.	%	95% CI
Total	**55157**	**100.0**	**56288**	**255**	**100.0**		**119**	**100.0**	
<24	29	0.1	30	-	-	-	30	25.2	17.0,36.0
24-27	106	0.2	108	58	22.7	17.3,29.4	24	20.2	12.9,30.1
28-31	350	0.6	357	42	16.5	11.9,22.3	19	16.0	9.6,25.0
32-36	2646	4.8	2700	68	26.7	20.7,33.8	15	12.6	7.0,20.8
37+	51974	94.2	53040	87	34.1	27.3,42.1	31	26.1	17.7,37.0
Not known	52	0.1	53	-	-	-		-	-

p Provisional SMR02.
Source: SMR02, NRS and Survey.

Table A10a Normally-formed birthweight specific singleton stillbirth mortality rates[1]: 2007 - 2012

Birthweight (g)	2007	2008	2009	2010	2011	2012[p]
Total	**5.3**	**4.6**	**4.4**	**4.2**	**4.3**	**4.0**
Under 1500	203.7	166.5	186.4	182.1	179.6	179.2
1500-2499	25.3	21.6	20.3	19.0	22.6	22.1
2500-3499	3.1	3.1	2.6	2.3	1.9	1.8
3500-4499	0.9	1.0	1.2	1.1	1.5	1.2
4500+	1.8	0.8	1.5	2.4	1.5	3.2

1 Rate per 1000 total births (excl. stillbirths and neonatal deaths with lethal malformations).
p Provisional SMR02.
Source: SMR02, NRS and Survey.

Table A10b Normally-formed gestation specific singleton stillbirth mortality rates[1]: 2007 - 2012

Gestation (weeks)	2007	2008	2009	2010	2011	2012[p]
Total	**5.3**	**4.6**	**4.4**	**4.2**	**4.3**	**4.0**
<24	-	-	-	-	-	-
24-27	370.2	239.6	312.1	286.9	345.5	309.0
28-31	117.3	101.9	91.9	105.0	78.1	85.0
32-36	25.8	21.2	20.9	17.6	19.5	22.5
37+	2.0	2.1	1.8	1.7	1.8	1.6

1 Rate per 1000 total births (excl. stillbirths and neonatal deaths with lethal malformations).
p Provisional SMR02.
Source: SMR02, NRS and Survey.

Table A11a Normally-formed birthweight specific singleton neonatal mortality rates[1]: 2007 - 2012

Birthweight (g)	2007	2008	2009	2010	2011	2012[p]
Total	**2.1**	**1.7**	**1.6**	**1.6**	**1.7**	**1.5**
Under 1500	175.1	109.0	113.5	134.5	130.2	145.5
1500-2499	4.2	2.9	2.5	2.1	4.3	2.9
2500-3499	0.7	0.9	0.6	0.5	0.6	0.5
3500-4499	0.3	0.2	0.6	0.4	0.3	0.2
4500+	-	1.5	-	0.8	0.8	0.8

1 Rate per 1000 live births (excl. neonatal deaths with lethal malformations).
p Provisional SMR02.
Source: SMR02, NRS and Survey.

Table A11b Normally-formed gestation specific singleton neonatal mortality rates[1]: 2007 - 2012

Gestation (weeks)	2007	2008	2009	2010	2011	2012[p]
Total	**2.1**	**1.7**	**1.6**	**1.6**	**1.7**	**1.5**
<24	*	*	*	*	*	*
24-27	263.2	162.8	205.6	251.3	260.8	207.2
28-31	57.4	18.2	25.4	36.6	35.1	45.2
32-36	2.4	3.3	2.1	1.1	4.5	1.5
37+	0.5	0.6	0.6	0.4	0.4	0.4

1 Rate per 1000 live births (excluding neonatal deaths with lethal malformations).
* Rates not calculated as SMR2 data is incomplete.
p Provisional SMR02.
Source: SMR02, NRS and Survey.

Table A12 Stillbirths and neonatal deaths by gestation for twins: 2012

Gestation (weeks)	Both twins died				Twin 1 died				Twin 2 died				Total
	SB		NND		SB		NND		SB		NND		
Total	**4**		**16**		**8**		**10**		**7**		**3**		**48**
Under 20													**0**
20-23			4	(1)									**4**
24-27			6		1		3				1		**11**
28-36	4	(1)	6	(4)	4	(1)	6	(3)	6		2	(2)	**28**
37-41					3	(1)	1	(1)	1	(1)			**5**
Not Known													**0**

Includes 15 deaths from congenital anomaly (shown in brackets).
Other Twins:
2 sets where one twin was a late fetal death.
7 sets where both twins were late fetal deaths.
3 sets where one twin died in the postnatal period.
Triplets and Quadruplets:
Eight sets of triplets were registered in 2012.
Source: Survey.

Table A13 Proportion of normally-formed singleton infants who are small for gestational age (SGA) by death classification: 2012

Obstetric Classification	Antepartum stillbirth			Intrapartum stillbirth & neonatal death		
	Total	SGA	%	Total	SGA	%
Total	**210**	**36**	**17.1**	**100**	**6**	**6.0**
Antepartum or intrapartum haemorrhage	35	6	17.1	18	-	0.0
Associated obstetric factors	1	-	0.0	10	-	0.0
Hypertensive disorders of pregnancy	5	-	0.0	2	1	50.0
Infection	13	1	7.7	46	1	2.2
Intrauterine growth restriction	1	1	100.0	1	1	100.0
Maternal disorder	12	2	16.7	-	-	-
Mechanical	8	-	0.0	2	-	0.0
No antecedent or associated obstetric factors	29	1	3.4	6	-	0.0
Specific fetal conditions	6	-	0.0	2	-	0.0
Specific placental conditions	97	23	23.7	6	3	50.0
Unable to classify	3	2	66.7	7	-	0.0

Source: Survey.

Table A14 Main obstetric factors by gender causing death in singleton stillbirths and neonatal deaths: 2012

Obstetric classification	Stillbirths [1]		Neonatal deaths [2]	
	Males	Females	Males	Females
Total	125	130	68	51
Antepartum or intrapartum haemorrhage	21	19	11	2
Associated obstetric factors	-	2	4	5
Hypertensive disorders of pregnancy	3	2	1	1
Infection	5	12	22	20
Intrauterine growth restriction	1	1	1	-
Major congenital anomaly	16	12	18	14
Maternal disorder	7	5	-	-
Mechanical	4	4	2	-
No antecedent or associated obstetric factors	13	16	3	3
Specific fetal conditions	3	3	-	2
Specific placental conditions	50	52	2	1
Unable to classify	2	2	4	3
	Rates			
Total	**4.3**	**4.7**	**2.4**	**1.9**
Antepartum or intrapartum haemorrhage	0.7	0.7	0.4	0.1
Associated obstetric factors	-	0.1	0.1	0.2
Hypertensive disorders of pregnancy	0.1	0.1	0.0	0.0
Infection	0.2	0.4	0.8	0.7
Intrauterine growth restriction	0.0	0.0	0.0	-
Major congenital anomaly	0.6	0.4	0.6	0.5
Maternal disorder	0.2	0.2	-	-
Mechanical	0.1	0.1	0.1	-
No antecedent or associated obstetric factors	0.4	0.6	0.1	0.1
Specific fetal conditions	0.1	0.1	-	0.1
Specific placental conditions	1.7	1.9	0.1	0.0
Unable to classify	0.1	0.1	0.1	0.1

1 Rate per 1000 singleton total births.
2 Rate per 1000 singleton live births.
Source: Survey.

Table A15 Singleton late fetal deaths, therapeutic and spontaneous; by obstetric classification, comparison with stillbirths: 2012

	Late Fetal Deaths				Stillbirth	
	Therapeutic		Spontaneous			
Obstetric Cause	No.	%	No.	%	No.	%
Total[1]	**60**	**100.0**	**83**	**100.0**	**255**	**100.0**
Major congenital anomaly	49	81.7	12	14.5	28	11.0
Hypertensive disorders of pregnancy	*	*	-	-	5	2.0
Antepartum or intrapartum haemorrhage	-	-	18	21.7	40	15.7
Infection	7	11.7	31	37.3	17	6.7
Intrauterine growth restriction	-	-	-	-	2	0.8
Maternal disorder	-	-	*	*	12	4.7
Mechanical	-	-	*	*	8	3.1
Associated obstetric factors	*	*	*	*	2	0.8
Specific fetal conditions	-	-	-	-	6	2.4
Specific placental conditions	*	*	6	7.2	102	40.0
No antecedent or associated obstetric factors	*	*	11	13.3	29	11.4
Unable to classify	-	-	-	-	4	1.6

1 Termination of pregnancy was not recorded for 2 singleton LFDs and have been excluded from this table.
* Indicates values that have been suppressed due to potential risk of disclosure.
Source: Survey and SMR02.

Table A16 Multiple late fetal deaths, therapeutic and spontaneous, by obstetric classification, comparison with stillbirths: 2012

	Late Fetal Deaths				Stillbirth	
	Therapeutic		Spontaneous			
Obstetric cause	No.	%	No.	%	No.	%
Total	**6**	**100.0**	**13**	**100.0**	**19**	**100.0**
Major congenital anomaly	*	*	-	-	4	21.1
Hypertensive disorders of pregnancy	-	-	-	-	-	-
Antepartum or intrapartum haemorrhage	-	-	*	*	-	-
Infection	-	-	5	38.5	-	-
Intrauterine growth restriction	-	-	-	-	1	5.3
Maternal disorder	-	-	-	-	1	5.3
Mechanical	*	*	-	-	1	5.3
Associated obstetric factors	-	-	-	-	-	-
Specific fetal conditions	-	-	*	*	6	31.6
Specific placental conditions	-	-	-	-	2	10.5
No antecedent or associated obstetric factors	-	-	*	*	4	21.1
Unable to classify	-	-	-	-	-	-

* Indicates values that have been suppressed due to potential risk of disclosure.
Source: Survey and SMR02.

Table A17 Late fetal deaths notified to the survey by birthweight and gestational age: 2012

Gestational age (weeks)	All weights	Birthweight (g)											
		<200	200-	300-	400-	500-	600-	700-	800-	900-	1000-	1100+	NK
Total[1]	**163**	**17**	**16**	**36**	**27**	**14**	**8**	**1**	**1**	**1**	**1**	**-**	**41**
<20	-	-	-	-	-	-	-	-	-	-	-	-	-
20	57	9	8	15	1	1	-	-	1	-	-	-	22
21	45	7	2	15	9	2	1	-	-	-	-	-	9
22	40	-	3	6	15	5	3	1	-	1	-	-	6
23	21	1	3	-	2	6	4	-	-	-	1	-	4
Not known	-	-	-	-	-	-	-	-	-	-	-	-	-

1 One LFD missing from total - recorded with a gestational age of 39 weeks.
Source: Survey.

Table A18 Cause of post-neonatal deaths by age at death: 2012

Cause of death	Age at death (months)				Total	
	1-2	3-5	6-8	9-11	No.	%
Total	**39**	**16**	**5**	**9**	**69**	-
Percent	**56.5**	**23.2**	**7.2**	**13.0**	-	**100.0**
Extreme immaturity (<24 wks)	1	-	-	-	1	1.4
Gastro-intestinal disease	2	-	-	-	2	2.9
Infection	2	2	2	1	7	10.1
Injury/trauma (inc. iatrogenic trauma)	-	-	-	1	1	1.4
Major congenital anomaly	13	7	1	4	25	36.2
Neurological disorder	2	-	-	-	2	2.9
Other specific causes	1	2	-	2	5	7.2
Respiratory disorders	4	-	-	-	4	5.8
Sudden unexpected death	13	3	2	1	19	27.5
Unable to classify due to lack of information	1	2	-	-	3	4.3

Source: Survey.

Table A19 Post-neonatal mortality rates[1] by cause of death: 2012

Main cause of death	Total	Rate
Extreme immaturity (<24 wks)	1	0.02
Gastro-intestinal disease	2	0.03
Infection	7	0.12
Injury/trauma (inc. iatrogenic trauma)	1	0.02
Major congenital anomaly	25	0.43
Neurological disorder	2	0.03
Other specific causes	5	0.09
Respiratory disorders	4	0.07
Sudden unexpected death	19	0.33
Unable to classify due to lack of information	3	0.05

1 Rate per 1000 live births.
Source: Survey.

Table A20 Post-neonatal deaths by cause of death and place of death: 2012

Main cause of death	Neonatal unit	Other Hospital [1]	Home	Hospice	Missing	Total
Total	**17**	**21**	**23**	**1**	**7**	**69**
Extreme immaturity (<24 wks)	1	0	0	0	0	1
Gastro-intestinal disease	2	0	0	0	0	2
Infection	2	0	5	0	0	7
Injury/trauma (inc. iatrogenic trauma)	0	0	1	0	0	1
Major congenital anomaly	5	12	5	1	2	25
Neurological disorder	2	0	0	0	0	2
Other specific causes	1	1	1	0	2	5
Respiratory disorders	4	0	0	0	0	4
Sudden unexpected death	0	8	11	0	0	19
Unable to classify due to lack of information	0	0	0	0	3	3

1 Includes A&E, Paediatric Intensive Care Units and Childrens Wards.
Source: Survey.

Table A21 Post-neonatal deaths by postmortem and cause of death: 2012

Main cause of death	Yes	No	No postmortem	Total
Total	**37**	**7**	**25**	**69**
Extreme immaturity (<24 wks)	-	-	1	1
Gastro-intestinal disease	1	-	1	2
Infection	7	-	-	7
Injury/trauma (inc. iatrogenic trauma)	1	-	-	1
Major congenital anomaly	6	3	16	25
Neurological disorder	-	-	2	2
Other specific causes	2	1	2	5
Respiratory disorders	1	-	3	4
Sudden unexpected death	19	-	-	19
Unable to classify due to lack of information	-	3	-	3

Source: Survey.

Table A22 Singleton births in Scotland detected[1] with congenital anomalies[a] at birth or during infancy[2]; numbers by anomaly and year: 2007 - 2011

Congenital anomaly	2007[r]	2008[r]	2009[r]	2010[r]	2011
Neural Tube Defects	36	35	30	31	26
Anencephalus	2	5	4	4	1
Spina bifida +/- hydrocephalus	31	24	24	22	21
Encephalocoele	3	6	2	5	4
Hydrocephalus[3]	17	19	18	21	16
Anomalies of the heart & circulatory system[4]	521	520	566	553	612
Heart	316	289	344	317	367
Circulatory System	242	250	250	272	325
Cleft Palate	61	76	62	73	57
Cleft lip +/- cleft palate	49	63	46	37	46
Trisomy 13	5	3	1	2	1
Trisomy 18	10	14	10	14	7
Down's Syndrome	70	61	76	53	61

a See codes used for definition of congenital anomalies.
1 Anomalies have been located from the diagnostic summaries contained within the linked source data comprising profiles of neonatal and inpatient hospital discharge records, stillbirth notifications, Scottish birth record and death registrations.
2 All Infants followed up from birth for period of one year to allow detection of anomalies from hospital inpatient records or NRS death registrations.
3 Hydrocephalus is not included in the Neural Tube Defects total.
4 Infants may be diagnosed with both heart and circulatory anomalies but are only counted once Anomalies of heart and circulatory system.
r Revised.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).

SPIMMR Congenital Anomaly	ICD-9 Codes	ICD-10 Codes
Neural Tube Defects	740, 741, 742.0	Q00, Q01, Q05, Q07.0
Anencephalus	740	Q00
Spina bifida +/- Hydrocephalus	741	Q05,Q07.0
Encephalocele	742.0	Q01
Hydrocephalus	742.3	Q03
Anomalies of the heart and circulatory system	745-747,425.3; 394-411*; 414-417*; 424.0-425.2*; 425.4-426.9*	Q20-Q28, I42.4
Heart	745-746	Q20-Q24
Circulatory system	747	Q25-Q28
Cleft Palate	749.0	Q35
Cleft lip +/- Cleft palate	749.1-749.2	Q36-Q37
Trisomy 13	758.1	Q91.4- Q91.7
Trisomy 18	758.2	Q91.0-Q91.3
Down's Syndrome	758.0	Q90

* These codes are taken to be congenital anomalies if used on death certificates.

Table A23a Singleton births in Scotland detected[1] with congenital anomalies[a] at birth or during infancy[2]; rates per 1000 births by anomaly and year: 2007 - 2011

Congenital anomaly	2007[r]	2008[r]	2009[r]	2010[r]	2011
Neural Tube Defects	0.65	0.61	0.53	0.55	0.47
Anencephalus	0.04	0.09	0.07	0.07	0.02
Spina bifida +/- hydrocephalus	0.56	0.42	0.43	0.39	0.38
Encephalocoele	0.05	0.11	0.04	0.09	0.07
Hydrocephalus[3]	0.31	0.33	0.32	0.37	0.29
Anomalies of the heart & circulatory system[4]	9.46	9.11	10.07	9.87	10.97
Heart	5.74	5.06	6.12	5.66	6.58
Circulatory System	4.39	4.38	4.45	4.86	5.83
Cleft Palate	1.11	1.33	1.10	1.30	1.02
Cleft lip +/- cleft palate	0.89	1.10	0.82	0.66	0.82
Trisomy 13	0.09	0.05	0.02	0.04	0.02
Trisomy 18	0.18	0.25	0.18	0.25	0.13
Down's Syndrome	1.27	1.07	1.35	0.95	1.09

See footnotes at Table A22.

Table A23b Singleton births in Scotland detected[1] with congenital anomalies[a] at birth, during infancy[2]; or aborted[3] because of pre-natal diagnosis; rates per 1,000 births by anomaly and year: 2007- 2011

Congenital anomaly	2007[r]	2008[r]	2009[r]	2010[r]	2011
Neural Tube Defects	1.18	1.03	1.05	1.04	0.88
Anencephalus	0.31	0.33	0.36	0.39	0.18
Spina bifida +/- hydrocephalus	0.76	0.54	0.53	0.54	0.56
Encephalocoele	0.11	0.16	0.16	0.11	0.14
Hydrocephalus[4]	0.36	0.42	0.48	0.50	0.32
Anomalies of the heart & circulatory system[5]	9.55	9.19	10.18	10.00	11.14
Heart	5.83	5.15	6.23	5.78	6.74
Circulatory System	4.39	4.38	4.45	4.86	5.83
Cleft Palate	1.13	1.33	1.10	1.30	1.02
Cleft lip +/- cleft palate	0.89	1.10	0.82	0.66	0.82
Trisomy 13	0.18	0.16	0.05	0.04	0.04
Trisomy 18	0.36	0.44	0.41	0.39	0.27
Down's Syndrome	1.94	1.58	1.83	1.36	1.69

a See codes used for definition of congenital anomalies in Table A22.
1 Anomalies have been located from the diagnostic summaries contained within the linked source data comprising profiles of neonatal and inpatient hospital discharge records, stillbirth notifications, Scottish birth record and death registrations.
2 All Infants followed up from birth for period of one year to allow detection of anomalies from hospital inpatient records or NRS death registrations.
3 Refers to the therapeutic abortions notified in accordance with the Abortion Act 1967.
4 Hydrocephalus is not included in the Neural Tube Defects total.
5 Infants may be diagnosed with both heart and circulatory anomalies but are only counted once Anomalies of heart and circulatory system.
r Revised.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).

Table A24 Stillbirth mortality by NHS board of residence; numbers and rates[1]: 2007 - 2012

NHS board	2007		2008		2009		2010		2011		2012	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Scotland[2]	**327**	**5.6**	**325**	**5.4**	**317**	**5.3**	**291**	**4.9**	**299**	**5.1**	**274**	**4.7**
Ayrshire & Arran	27	6.9	17	4.3	18	4.6	20	5.2	17	4.4	22	5.9
Borders	2	1.7	8	7.0	9	7.7	7	6.0	6	5.4	6	5.2
Dumfries & Galloway	6	4.0	7	4.9	8	5.3	8	5.5	1	0.7	5	3.6
Fife	23	5.6	30	6.9	23	5.5	35	8.3	24	5.6	24	5.9
Forth Valley	16	4.7	18	5.2	11	3.3	16	4.8	16	5.0	13	4.0
Grampian	32	5.2	31	4.9	29	4.5	25	4.0	26	4.1	33	5.1
Greater Glasgow & Clyde	94	6.8	80	5.6	76	5.4	71	5.0	94	6.6	64	4.5
Highland	17	5.5	14	4.2	23	7.2	12	3.7	15	4.8	20	6.3
Lanarkshire	32	4.9	36	5.2	44	6.6	36	5.6	29	4.4	24	3.9
Lothian	51	5.4	48	4.8	47	4.8	48	4.9	45	4.6	50	5.1
Orkney	-	-	3	13.8	2	10.0	-	-	-	-	2	9.9
Shetland	1	4.1	-	-	4	14.4	-	-	3	12.2	-	-
Tayside	25	5.9	33	7.4	23	5.2	13	3.0	23	5.2	11	2.6
Western Isles	1	3.8	-	-	-	-	-	-	-	-	-	-

1 Rate per 1000 total births.
2 Records that could not be aligned to an NHS board via their postcode have been assigned to the board of the hospital of occurrence.
Source: Survey and NRS.

Table A25 Neonatal mortality by NHS board of residence; numbers and rates[1]: 2007 - 2012

	2007		2008		2009		2010		2011		2012	
NHS board	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**	**No.**	**Rate**
Scotland[2]	**188**	**3.3**	**168**	**2.8**	**165**	**2.8**	**150**	**2.6**	**159**	**2.7**	**148**	**2.6**
Ayrshire & Arran	21	5.4	15	3.8	12	3.1	7	1.8	14	3.6	12	3.2
Borders	2	1.7	2	1.8	3	2.6	5	4.5	1	0.9	4	3.5
Dumfries & Galloway	6	4.0	5	3.5	3	2.0	5	3.6	3	2.1	4	2.9
Fife	20	4.9	20	4.6	19	4.6	16	3.7	13	3.0	25	6.2
Forth Valley	7	2.1	12	3.5	10	3.0	5	1.6	6	1.9	10	3.1
Grampian	13	2.1	11	1.7	17	2.6	13	2.1	11	1.7	12	1.9
Greater Glasgow & Clyde	47	3.4	51	3.6	37	2.6	40	2.8	41	2.9	24	1.7
Highland	6	2.0	3	0.9	9	2.8	9	2.9	13	4.2	8	2.5
Lanarkshire	17	2.6	11	1.6	11	1.7	18	2.8	19	2.9	11	1.8
Lothian	30	3.2	26	2.6	27	2.8	17	1.7	25	2.5	26	2.6
Orkney	1	5.3	-	-	-	-	2	9.8	-	-	1	5.0
Shetland	2	8.2	4	14.4	-	-	-	-	-	-	-	-
Tayside	15	3.6	8	1.8	17	3.9	13	3.0	10	2.3	8	1.9
Western Isles	1	3.8	-	-	-	-	-	-	3	12.8	3	12.7

1 Rate per 1000 live births.
2 Records that could not be aligned to an NHS board via their postcode have been assigned to the board of the hospital of occurrence.
Source: Survey and NRS.

Table A26 FIGO Classification stillbirth and neonatal death by NHS board of residence[1]: 2012

NHS board of residence	Stillbirths		Neonatal deaths	
	Weighing 500g +	Weighing 1000g + and normally formed	Weighing 500g +	Weighing 1000g + and normally formed
Scotland	**258**	**176**	**127**	**45**
Ayrshire & Arran	21	16	10	3
Borders	6	4	4	1
Dumfries & Galloway	4	2	4	3
Fife	22	14	18	6
Forth Valley	13	9	10	5
Grampian	30	19	10	4
Greater Glasgow & Clyde	60	39	22	3
Highland	20	13	7	6
Lanarkshire	23	17	10	3
Lothian	47	34	25	8
Orkney	2	2	1	-
Shetland	-	-	-	-
Tayside	10	7	3	2
Western Isles	-	-	3	1
Outwith Scotland	-	-	-	-
	Rates[2]			
Scotland	**4.4**	**3.0**	**2.2**	**0.8**
Ayrshire & Arran	5.6	4.3	2.7	0.8
Borders	5.2	3.5	3.5	0.9
Dumfries & Galloway	2.9	1.4	2.9	2.2
Fife	5.4	3.5	4.5	1.5
Forth Valley	4.0	2.8	3.1	1.5
Grampian	4.6	2.9	1.5	0.6
Greater Glasgow & Clyde	4.2	2.8	1.6	0.2
Highland	6.3	4.1	2.2	1.9
Lanarkshire	3.7	2.8	1.6	0.5
Lothian	4.8	3.4	2.5	0.8
Orkney	9.9	9.9	5.0	-
Shetland	-	-	-	-
Tayside	2.4	1.7	0.7	0.5
Western Isles	-	-	12.7	4.2

1 Records that could not be aligned to an NHS board via their postcode have been assigned to the board of the hospital of occurrence.
2 Stillbirths per 1000 total births, neonatal deaths per 1000 live births.
3 Unknown birthweights are excluded.
Source: Survey and NRS.

Table A27a Pregnancy losses from 20 weeks gestation to end of first year[1]: 2012

NHS board of residence[2]	Fetal deaths	Live births	Stillbirths	Early neonatal deaths	Late neonatal deaths	Neonatal deaths	Post-neonatal deaths	Infant deaths
Scotland	**164**	**58027**	**274**	**106**	**42**	**148**	**69**	**217**
Ayrshire & Arran	10	3701	22	9	3	12	3	15
Borders	1	1139	6	3	1	4	3	7
Dumfries & Galloway	1	1390	5	2	2	4	1	5
Fife	11	4019	24	21	4	25	7	32
Forth Valley	13	3255	13	7	3	10	5	15
Grampian	17	6470	33	10	2	12	12	24
Greater Glasgow & Clyde	25	14072	64	14	10	24	13	37
Highland	11	3145	20	6	2	8	2	10
Lanarkshire	20	6145	24	9	2	11	7	18
Lothian	35	9827	50	16	10	26	11	37
Orkney	1	201	2	1	-	1	-	1
Shetland	2	276	-	-	-	-	-	-
Tayside	17	4150	11	6	2	8	4	12
Western Isles	-	237	-	2	1	3	-	3
Outwith Scotland	-	-	-	-	-	-	1	1

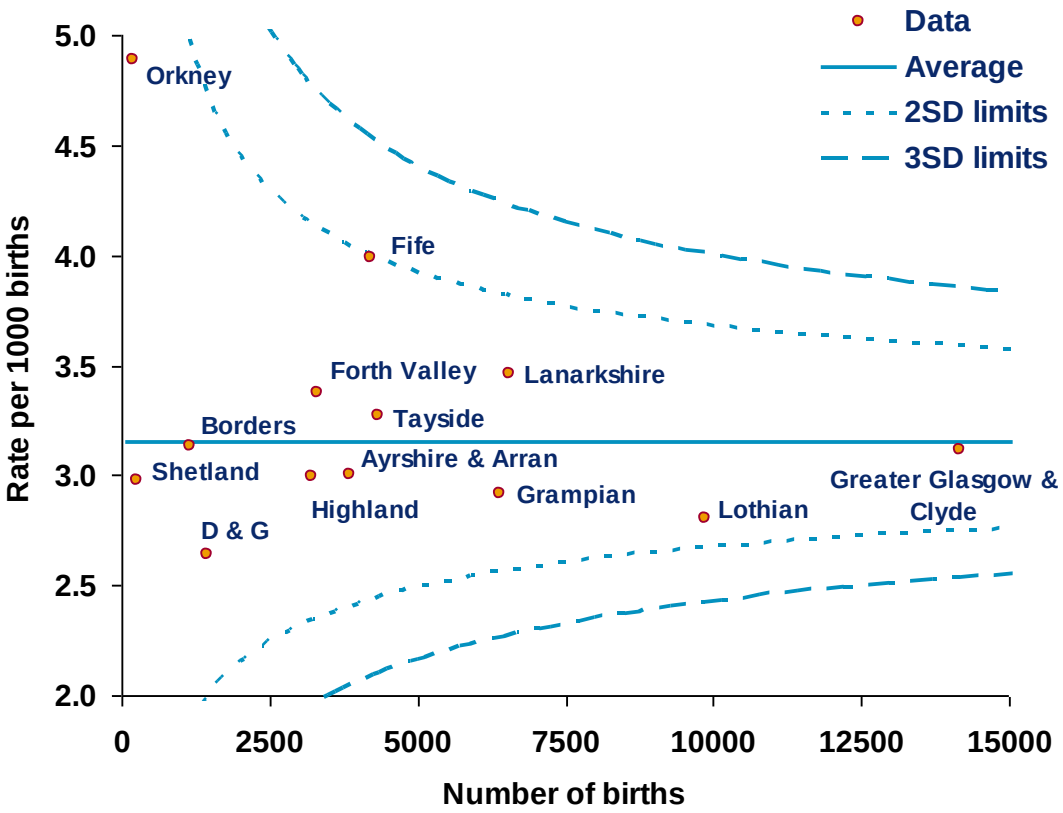
1 Live birth data are taken from NRS and all other numbers are from the survey.
2 Records that could not be aligned to an NHS board via their postcode have been assigned to the board of the hospital of occurrence.
Source: NRS and Survey.

Table A27b Pregnancy loss rates from 20 weeks gestation to end of first year[1]: 2012

NHS board of residence[2]	Late fetal deaths[3]	Stillbirths[4]	Perinatal[4]	Neonatal[5,6]	Post-neonatal[5]	Infant[5]	Extended[3] (20 wks - 1yr) ('total loss')
Scotland	**2.8**	**4.7**	**6.5**	**2.6**	**1.2**	**3.7**	**11.2**
Ayrshire & Arran	2.7	5.9	8.3	3.2	0.8	4.1	12.6
Borders	0.9	5.2	7.9	3.5	2.6	6.1	12.2
Dumfries & Galloway	0.7	3.6	5.0	2.9	0.7	3.6	7.9
Fife	2.7	5.9	11.1	6.2	1.7	8.0	16.5
Forth Valley	4.0	4.0	6.1	3.1	1.5	4.6	12.5
Grampian	2.6	5.1	6.6	1.9	1.9	3.7	11.3
Greater Glasgow & Clyde	1.8	4.5	5.5	1.7	0.9	2.6	8.9
Highland	3.5	6.3	8.2	2.5	0.6	3.2	12.9
Lanarkshire	3.2	3.9	5.3	1.8	1.1	2.9	10.0
Lothian	3.5	5.1	6.7	2.6	1.1	3.8	12.3
Orkney	4.9	9.9	14.8	5.0	-	5.0	19.6
Shetland	7.2	-	-	-	-	-	-
Tayside	4.1	2.6	4.1	1.9	1.0	2.9	9.6
Western Isles	-	-	-	12.7	-	12.7	-

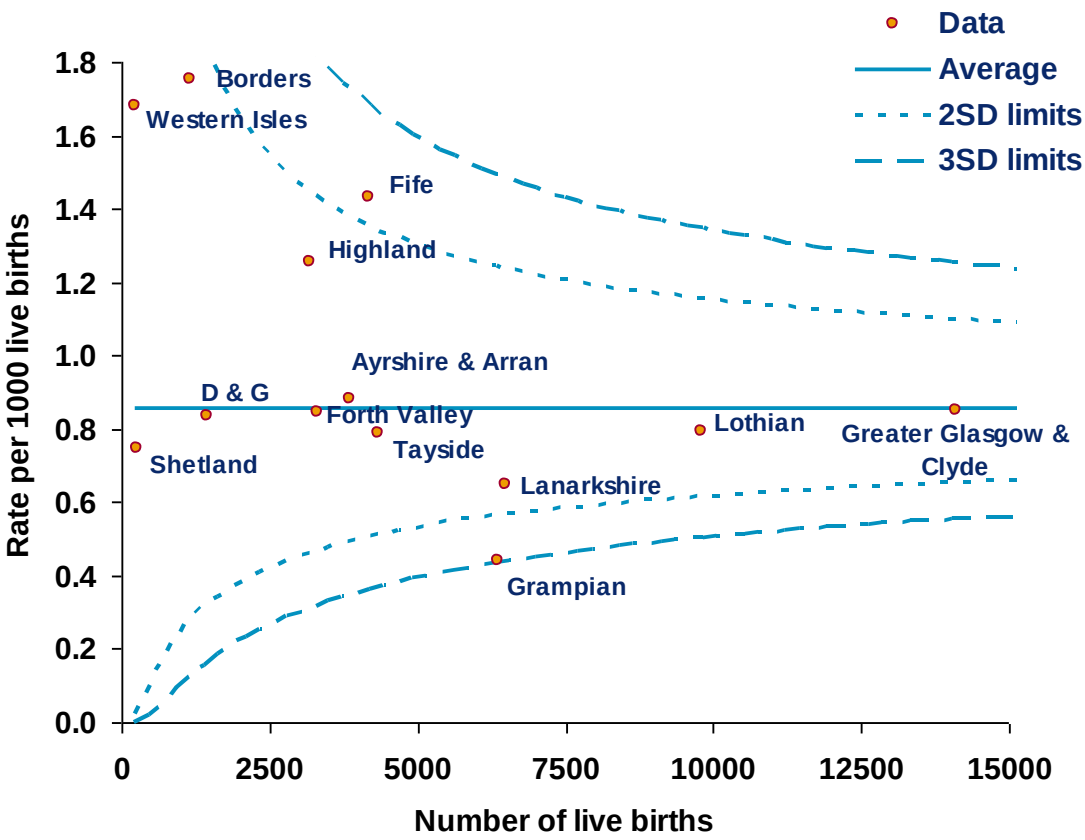
1 Live birth data are taken from NRS and all other numbers are from the survey.
2 Records that could not be aligned to an NHS board via their postcode have been assigned to the board of the hospital of occurrence.
3 Rate per 1000 total births + late fetal deaths.
4 Rate per 1000 total births.
5 Rate per 1000 live births.
6 Includes three registered neonatal deaths born at <20 weeks gestation.
Source: NRS, SMR02 and Survey.

Figure A28a FIGO classification stillbirth rates[1] (normally formed >= 1000g); by NHS board of residence[2]: 2008 - 2012



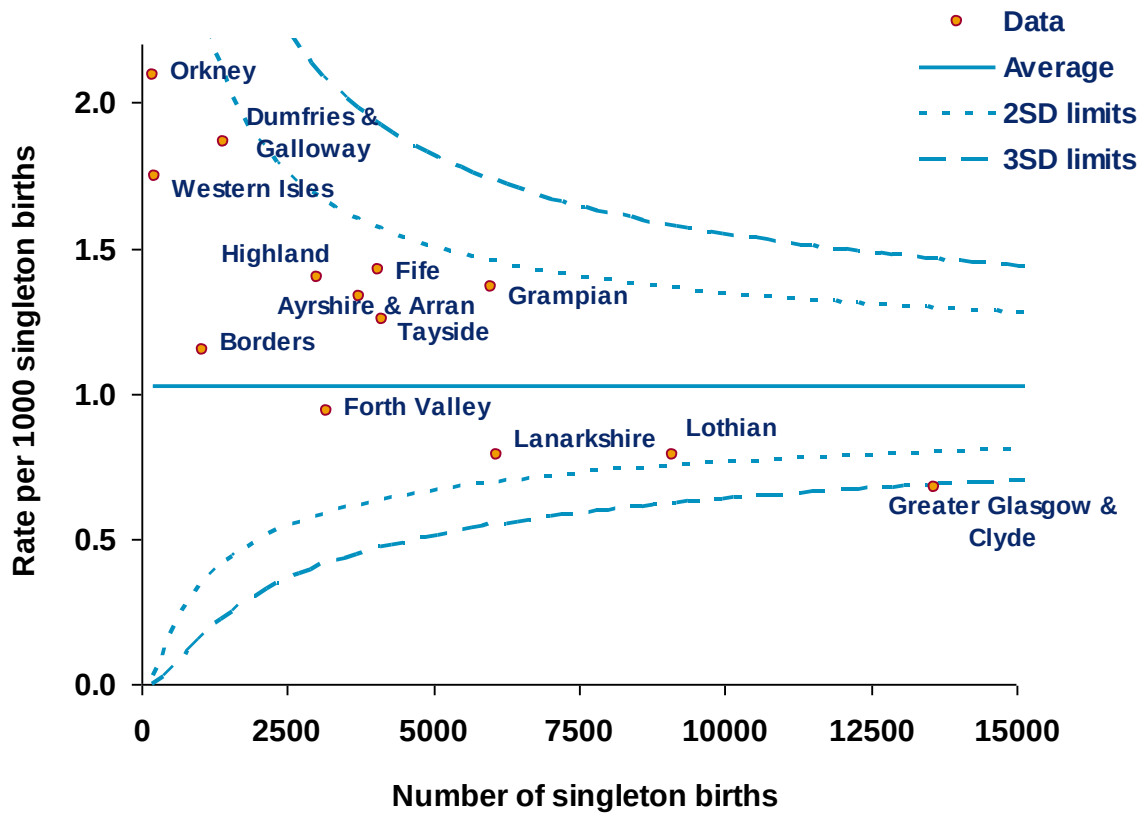
1 Rate per 1000 total births.
2 Four stillbirth records could not be matched to an NHS board.
Source: Survey.
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

Figure A28b FIGO classification neonatal death rates[1] (normally formed >= 1000g); by NHS board of residence[2]: 2008 - 2012



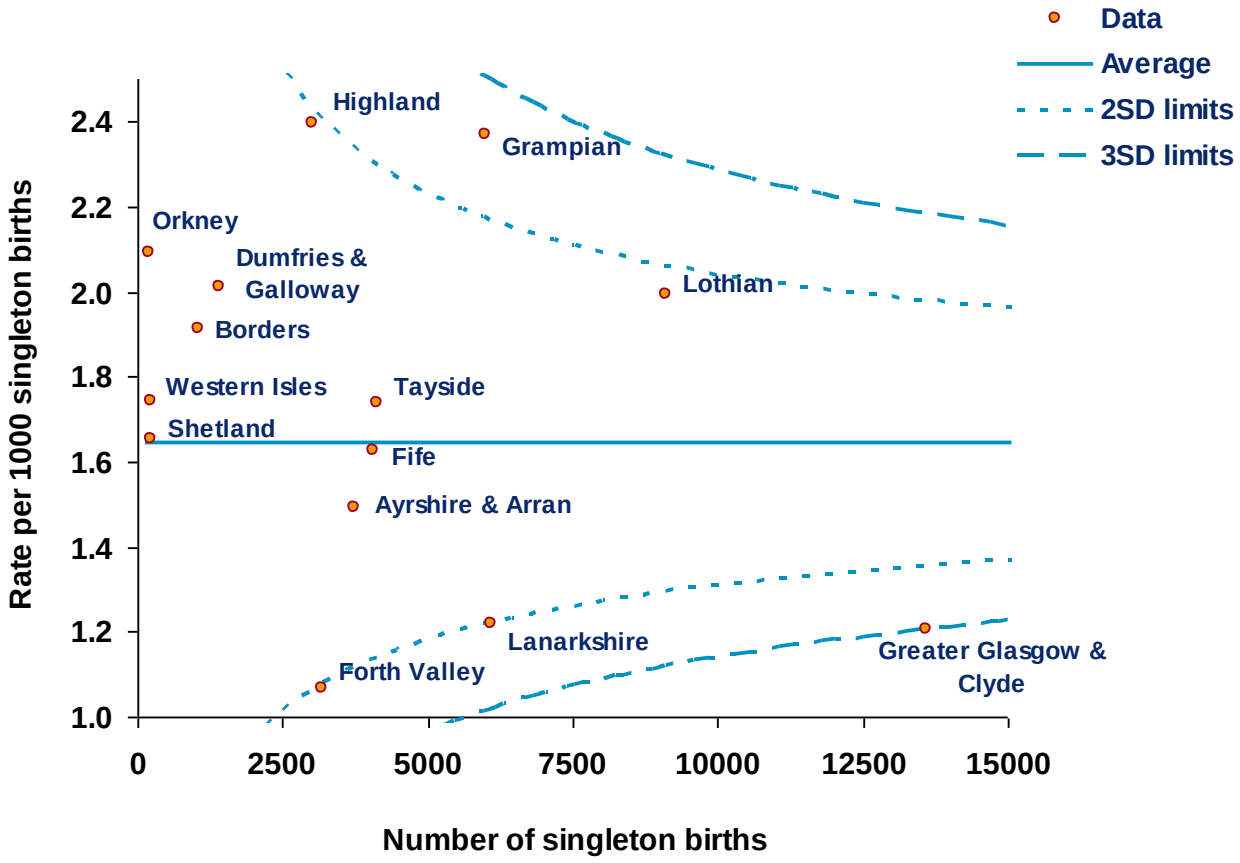
1 Rate per 1000 live births.
Source: Survey.
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

Figure A29a Neural Tube Defects[1] rates[2] by NHS board of residence: 2007 - 2011



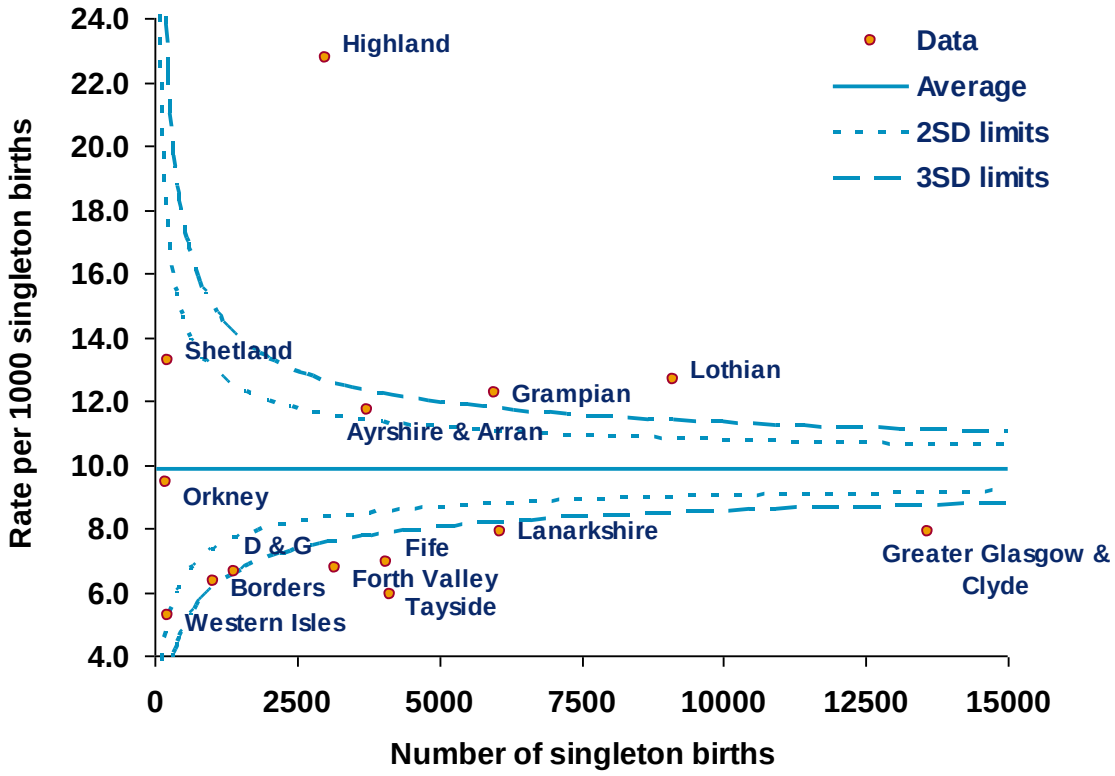
1 Singletons detected with NTD at birth, during infancy or aborted.
2 Rate per 1000 singleton total births.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

Figure A29b Down's Syndrome[1] rates[2] by NHS board of residence: 2007 - 2011



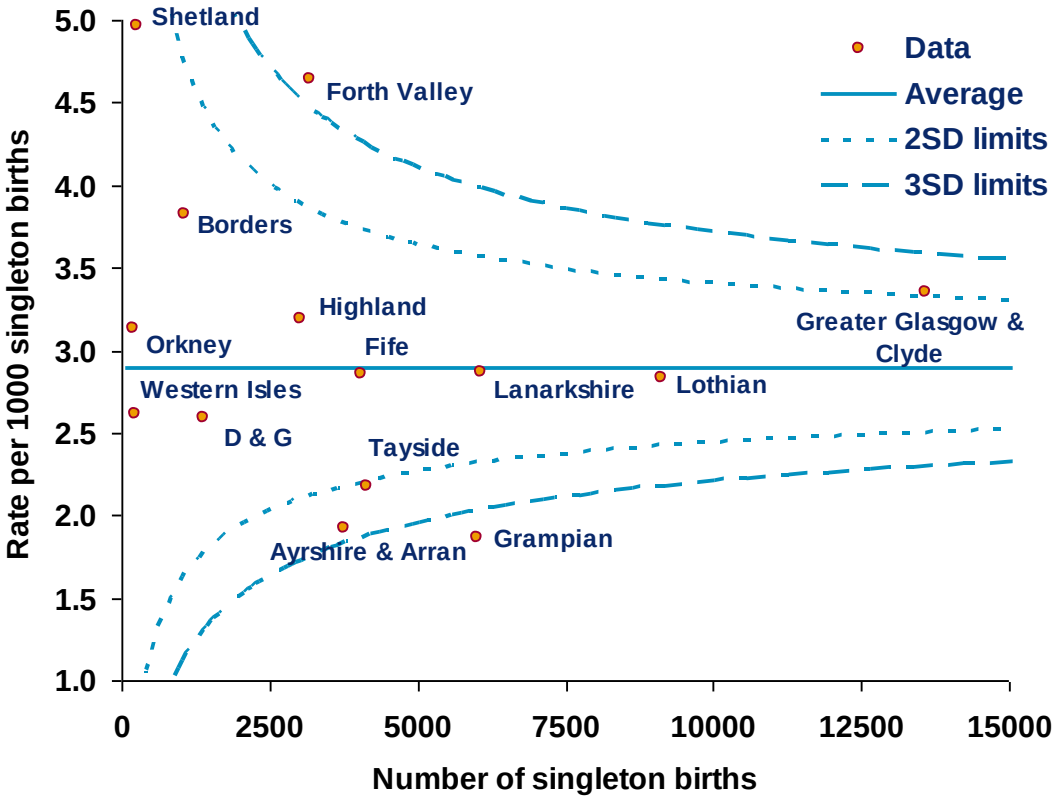
1 Singletons detected with Down's Syndrome at birth, during infancy or aborted.
2 Rate per 1000 singleton total births.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

Figure A29c Heart and circulatory system anomalies[1] rates[2] by NHS board of residence: 2007 - 2011



1 Singletons detected with heart and circulatory system anomalies at birth, during infancy or aborted.
2 Rate per 1000 singleton total births.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

Figure A29d Heart and circulatory system anomalies[1] rates by NHS board of residence; acute admissions only[2]: 2007 - 2011



1 Singletons detected with heart and circulatory system anomalies at birth, during infancy or aborted.
2 An SMR01 is generated for patients receiving care as an inpatient or daycase in the General/ Acute specialties.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).
NB Funnel plots in the 2010 and 2011 reports are erroneous. Amended charts are available to view in the revised versions of both SPIMMR 2010 and SPIMMR 2011.

Table A30a Singleton births in Scotland & detected[1] with congenital anomalies[a] at birth or during infancy[2]; rates per 1000 births by health board of residence: 2007 - 2011

	Neural Tube Defects	Cleft Palate	Cleft Lip +/- Cleft Palate	Heart & Circulatory System	Patau syndrome (Trisomy 13)	Edwards syndrome (Trisomy 18)	Down's syndrome (Trisomy 21)
Scotland[3]	**0.55**	**1.16**	**0.84**	**9.75**	**0.04**	**0.19**	**1.11**
Ayrshire & Arran	0.80	0.85	0.96	11.58	0.11	0.21	1.33
Borders	0.38	1.15	1.15	6.12	0.00	0.00	1.34
Dumfries & Galloway	1.15	0.72	0.72	6.46	0.14	0.14	1.15
Fife	0.44	1.33	0.69	6.65	0.10	0.15	0.84
Forth Valley	0.75	0.88	1.63	6.72	0.06	0.38	1.07
Grampian	0.60	1.07	0.80	11.95	0.03	0.33	0.90
Greater Glasgow & Clyde	0.51	1.37	0.88	7.82	0.01	0.29	1.01
Highland	0.87	1.27	0.67	22.77	0.27	0.13	1.93
Lanarkshire	0.56	1.02	0.72	7.87	0.00	0.13	0.99
Lothian	0.35	1.21	0.64	12.59	0.00	0.02	1.36
Orkney	1.05	1.05	1.05	8.37	0.00	1.05	2.09
Shetland	0.00	0.83	1.65	13.23	0.00	0.83	0.00
Tayside	0.39	1.01	0.72	5.79	0.00	0.05	0.87
Western Isles	0.00	2.62	3.49	5.24	0.00	0.00	0.87

a See codes used for definition of congenital anomalies in Table A22.
1 Anomalies have been located from the diagnostic summaries contained within the linked source data comprising profiles of neonatal and inpatient hospital discharge records, stillbirth notifications, Scottish birth record and death registrations.
2 All Infants followed up from birth for period of one year to allow detection of anomalies from hospital inpatient records or NRS death registrations.
3 Exclude cases where health board of residence could not be assigned.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).

Table A30b Singleton births in Scotland & detected[1] with congenital anomalies[a] at birth, during infancy[2], or aborted[3] because of pre-natal diagnosis rates per 1000 births by health board of residence: 2007 - 2011

	Neural Tube Defects	Cleft Palate	Cleft Lip +/- Cleft Palate	Heart & Circulatory System	Patau syndrome (Trisomy 13)	Edwards syndrome (Trisomy 18)	Down's syndrome (Trisomy 21)
Scotland[4]	**1.02**	**1.16**	**0.84**	**9.86**	**0.09**	**0.37**	**1.65**
Ayrshire & Arran	1.33	0.85	0.96	11.68	0.16	0.37	1.49
Borders	1.15	1.15	1.15	6.31	0.00	0.00	1.91
Dumfries & Galloway	1.87	0.72	0.72	6.61	0.29	0.57	2.01
Fife	1.43	1.33	0.69	6.94	0.15	0.39	1.63
Forth Valley	0.94	0.88	1.63	6.72	0.06	0.38	1.07
Grampian	1.37	1.07	0.80	12.25	0.17	0.60	2.37
Greater Glasgow & Clyde	0.68	1.37	0.88	7.88	0.04	0.40	1.21
Highland	1.40	1.27	0.67	22.77	0.27	0.13	2.40
Lanarkshire	0.79	1.02	0.72	7.90	0.00	0.20	1.22
Lothian	0.79	1.23	0.64	12.67	0.11	0.44	2.00
Orkney	2.09	1.05	1.05	9.41	0.00	1.05	2.09
Shetland	0.00	0.83	1.65	13.23	0.00	1.65	1.65
Tayside	1.26	1.01	0.72	5.94	0.00	0.10	1.74
Western Isles	1.75	2.62	3.49	5.24	0.00	0.00	1.75

a See codes used for definition of congenital anomalies in Table A22.
1 Anomalies have been located from the diagnostic summaries contained within the linked source data comprising profiles of neonatal and inpatient hospital discharge records, stillbirth notifications, Scottish birth record and death registrations.
2 All Infants followed up from birth for period of one year to allow detection of anomalies from hospital inpatient records or NRS death registrations.
3 Refers to therapeutic abortions notified in accordance with the Abortion Act 1967.
4 Exclude cases where health board of residence could not be assigned.
Source: ISD Scottish Congenital Anomalies Register (linked SMR01, SMR02, SMR11, SBR and SSBID records).

12.3 Stillbirth and infant deaths by year of birth

SPIMMR has always reported on deaths in the year of registration for compatibility with NRS deaths. MBRRACE will, however, publish reports based on the year of death rather than of registration. In order to allow accurate comparison between MBRRACE reports in the future and recent SPIMMR data, Table 12.3.1 shows the numbers and rates of deaths based on the year of death from 2007 to 2012.

Table 12.3.1 Stillbirths and deaths in the first year of life (numbers and rates); by year of birth: 2007 - 2012

	2007	2008	2009	2010	2011	2012 [3]	
Live births	57901	59727	59207	58843	58625	58049	
Stillbirths	321	323	321	283	299	275	
Early NND	126	122	120	120	106	107	
Perinatal deaths	447	445	441	403	405	382	
Late NND	59	47	45	32	51	43	
NND	185	169	165	152	157	150	
PNND	77	87	65	69	77	66	
Infant deaths	262	256	230	221	234	216	
	Rates						**95% CI**
Stillbirth [1]	5.5	5.4	5.4	4.8	5.1	4.7	4.17,5.31
Early neonatal [2]	2.2	2.0	2.0	2.0	1.8	1.8	1.51,2.23
Perinatal [1]	7.7	7.4	7.4	6.8	6.9	6.5	5.91,7.24
Late neonatal [2]	1.0	0.8	0.8	0.5	0.9	0.7	0.54,1.00
Neonatal [2]	3.2	2.8	2.8	2.6	2.7	2.6	2.19,3.03
Post-neonatal [2]	1.3	1.5	1.1	1.2	1.3	1.1	0.88,1.45
Infant [2]	4.5	4.3	3.9	3.8	4.0	3.7	3.24,4.25

1 Rate per 1000 total births.
2 Rate per 1000 live births.
3 2012 may be missing records which have been registered in 2013.
Source: NRS (for live births and for calculating rates) and Survey (numbers of deaths).

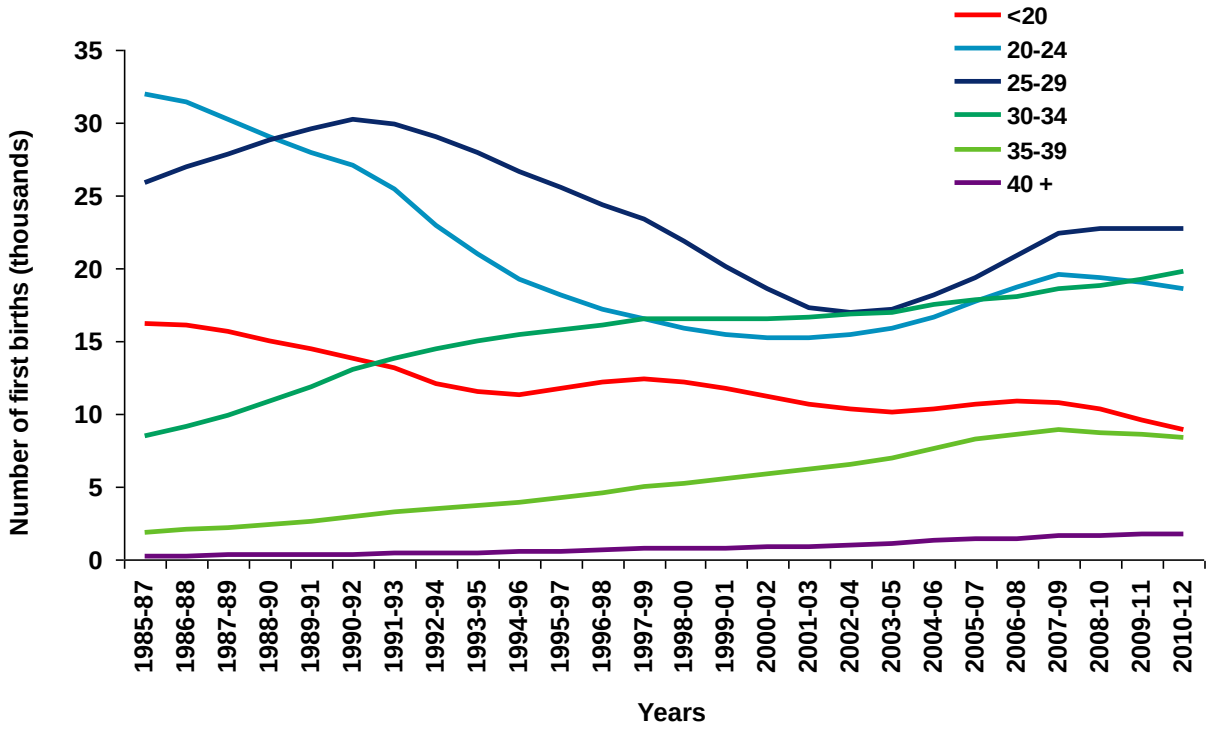
12.4 Other demographic data

Table 12.4.1 Stillbirth, neonatal death rates and post-neonatal death rates[1] by mothers' age[2]: 2008 - 2012 aggregated

Age group	Stillbirths	NND	PNND	Total births
<20	111	54	53	18477
20-24	297	150	64	53948
25-29	377	188	80	79891
30-34	369	207	79	81520
35-39	260	133	35	47250
40+	82	39	14	10747
Total	1496	771	325	291833
	Rates			
<20	6.0	2.9	2.9	
20-24	5.5	2.8	1.2	
25-29	4.7	2.4	1.0	
30-34	4.5	2.5	1.0	
35-39	5.5	2.8	0.7	
40+	7.6	3.6	1.3	

1 Rates per 1000 women who delivered 2008-2012 per age group.
2 Excludes records where age was unknown.
Source: Survey and NRS (Table 3.14: Live Births, Stillbirths and Maternities, 2008-2012).

Figure 12.4.2 Singleton total first births by maternal age group: 1985/87 - 2010/12



Source: SMR02.

12.5 Acknowledgements

Thanks are due to the clinical co-ordinators, midwifery, neonatal, pathology and secretarial staff who complete the SSBID Survey forms throughout Scotland. We also thank the staff of the National Records of Scotland who provide the basic data on births and deaths essential for the conduct of the Survey.

The full SPIMMR is available only as a web edition via a link on the Healthcare Improvement Scotland website (www.healthcareimprovementscotland.org) and within Scottish Health Statistics, the ISD website (www.isdscotland.org/Health-Topics/Maternity-and-Births/Stillbirth-and-Infant-Deaths)

The SPIMMR is overseen by the multidisciplinary Reproductive Health Advisory Group whose members are listed below and is written by Chris Lennox, Leslie Marr and Jim Chalmers who are ex officio members:

Name	Position	Representing
Sean Ainsworth	Consultant Neonatologist, NHS Fife	Scottish Neonatal Consultants Group
Audrey Brown	Consultant in Sexual and Reproductive Healthcare, NHS Greater Glasgow and Clyde	Sexual Health
Helen Bryers	Head of Midwifery, NHS Highland	Heads of Midwifery
Catherine Calderwood	Medical Adviser for Medical and Surgical Specialties, Maternity and Women's Health	Scottish Government (ex officio)
Jim Chalmers	Consultant in Public Health Medicine, Information Services Division	NHS National Services Scotland (ex officio)
Suzanne Clark	Public partner	
Hilary Critchley	Professor of Reproductive Medicine, University of Edinburgh **(Chair)**	
Margaret Evans	Paediatric Pathologist, NHS Lothian	Paediatric Pathologists
Ann Holmes	Chief Midwifery Advisor, Scottish Government	Consultant Midwives
Tracy Humphrey	Clinical Professor of Midwifery, NHS Grampian	Consultant Midwives
Harpreet Kohli	Director of Public Health, NHS Lanarkshire	Directors of Public Health
Chris Lennox	Clinical Advisor, Reproductive Health Programme	Healthcare Improvement Scotland (ex officio)
Hilary MacPherson	Consultant Obstetrician and Gynaecologist, NHS Forth Valley	
Leslie Marr	Manager, Reproductive Health Programme	Healthcare Improvement Scotland, (ex officio)
Morag Martindale	General Practitioner	Royal College of General Practitioners
Gillian Smith	Director, Royal College of Midwives	Royal College of Midwives
Ewen Walker	Consultant Obstetrician and Gynaecologist, NHS Ayrshire & Arran	Royal College of Obstetricians and Gynaecologists (Scotland) until April 2013

Healthcare Improvement Scotland Support Team

Naomi Fearns — Reproductive Health Programme Audit Coordinator
Kenny Gifford — Reproductive Health Programme Administrator

Information Services Division Support Team

Samantha Clarke — Senior Information Analyst
Celina Davis — Principal Analyst
Kirsten Monteath — Senior Information Analyst

12.6 Hospital co-ordinators 2012

NHS Board	Hospital	Co-ordinators
Ayrshire & Arran	Ayrshire Maternity Unit, Crosshouse Hospital	Gordon Dobbie
		Catherine Freckleton
		Janis Gladwinfield
Borders	Borders General Hospital	Clare Ketteridge
		Brian McGowan
Dumfries & Galloway	Cresswell Maternity Unit, Dumfries & Galloway Royal Infirmary	Heather Armstrong
		Anne Torrance
		Stephen Wisdom
Fife	Forth Park Hospital Victoria Hospital	Jeana Arnott
		Morag Telfer
		Graham Tydeman
Forth Valley	Stirling Royal Infirmary Forth Valley Royal Infirmary	Pamela Bean
		Hilary MacPherson
		Fiona Sinclair
Grampian	Aberdeen Maternity Hospital	Vivienne Anderson
		Peter Danielian
		Catherine Hauptfleisch
	Dr Gray's Hospital, Elgin	Neil Maclean
Greater Glasgow and Clyde	Princess Royal Maternity Hospital	Allan Jackson
		Jackie McGeoch
		Alan Mathers
		Dawn Kernaghan
		Lynn Wright
	Paisley Maternity Unit	Andrew Quinn
	Royal Hospital for Sick Children, Glasgow	Marianne Cloherty
		Jennifer Docherty
		Barbara Holland
		Beverly Montgomery
	Southern General Hospital	Sandra Bonner
		Alan Cameron
		Cheryl Gaughan
		Janice Gibson
Highland	Caithness General Hospital	Philip Boabang
	Raigmore Hospital	David Herd
		George Farmer
		Debbie Mackay
		Michelle Rodriguez
		Julie Smith
Lanarkshire	Wishaw General Hospital	Dina McLellan
		Ann Cunningham
Lothian	Royal Hospital for Sick Children, Edinburgh	Janet Burns
		Sheila Wurr
	Simpson Centre for Reproductive Health, Royal Infirmary, Edinburgh	Corrine Love
		Karen Edgar
	St John's Howden	Sarah Court
		Ann Reid
Tayside	Ninewells Hospital	Heather Clark
		Professor Gary Mires
		Britta Peters
		Rajesh Sharma
Western Isles	Western Isles Hospital	Catherine McDonald

12.7 Symbols and abbreviations

The following symbols and abbreviations have been used:

..	not available
-	nil
0.0	negligible
*	values that have been suppressed due to potential risk of disclosure
χ^2	shorthand for chi-squared, the name given to tests using chi-squared distribution

AP	Antepartum
APH	Antepartum haemorrhage
CMACE	Centre for Maternal and Child Enquiries
CNS	Central nervous system
CVS	Cardiovascular system
END	Early neonatal death
FIGO	International Federation of Gynaecology and Obstetrics
HMD	Hyaline membrane disease
HPD	Histological placental dysfunction
ICE	International Collaborative Effort
IP	Intrapartum
ISD	Information Services Division
IUD	Intrauterine death
IUGR	Intrauterine growth restriction
IVH	Intraventricular haemorrhage
LFD	Late fetal death
LND	Late neonatal death
MBRRACE -UK	Mothers and Babies Reducing Risk through Audit and Confidential Enquiries across the UK
MCQIC	Maternity and Children Quality Improvement Collaborative
NND	Neonatal death
NRS	National Records of Scotland
PM	Postmortem
PNND	Post-neonatal death
RHP	Reproductive Health Programme
SB	Stillbirth
SGA	Small for gestational age
SMR02	Scottish Morbidity Record (maternity dataset)
SPIMMR	Scottish Perinatal and Infant Mortality and Morbidity Report
SSBIDS	Scottish Stillbirth and Infant Death Survey
SUDI	Sudden Unexpected Death in Infancy

12.8 Definitions

Stillbirths Section 56(1) of the Registration of Births, Deaths and Marriages (Scotland) Act 1965 defined a stillbirth as a child which had issued forth from its mother after the 28th week of pregnancy and which did not breathe or show any other sign of life. The Still-Birth (Definition) Act 1992, which came into effect on 1 October 1992, amended Section 56(1) of the 1965 Act (and other relevant UK legislation), replacing the reference to the 28th week with a reference to the 24th week.

Perinatal deaths refer to stillbirths and deaths in the first week of life.

Neonatal deaths refer to deaths in the first four weeks of life.

> **Early neonatal deaths** refer to deaths in the first week of life.
> **Late neonatal deaths** refer to deaths in weeks two to four of life.

Post-neonatal deaths refer to deaths after the first four weeks but before the end of the first year.

Infant deaths refer to all deaths in the first year of life.

Late fetal deaths refer to infants born dead at 20-23^{+6} weeks of pregnancy or earlier in pregnancy if the birthweight is 500g or more.

Rates

Stillbirth and perinatal death rates are based on the total of live and stillbirths.
Neonatal, post-neonatal and infant death rates are based on live births only.
Late fetal death rates are based on the total of live and stillbirths and late fetal deaths.

12.9 Note on congenital anomalies and record linkage data

Much of the data relating to congenital anomalies are derived using record linkage techniques. These techniques link the data which relate to the same individual on different datasets. For example, to find out the number of babies born alive with spina bifida, the data on the Scottish Birth Record, which describes problems identified with the baby, is joined with data from hospital admissions in the first year of life. This linked file is then searched for individuals who have a record on either or both databases which suggests spina bifida. Such an approach is necessary because there are inevitably some babies where the relevant diagnosis has not been recorded properly on one or other of these two databases.

It is not straightforward to link individuals across different datasets and it can be particularly problematic with babies because they may not have a first name whilst in hospital and their surname may not be the same as the mother's surname, and it may change. ISD has been modifying the way that record linkage is performed and has recently implemented a technique which relies more heavily on the use of Community Health Index (CHI) numbers and less heavily on the previous approach of probability matching. Inevitably, this has changed the number of individuals identified with various conditions. The new approach has been used for all the congenital anomaly rates shown in the tables of this report. There has, therefore, been some revision of the numbers and rates reported for previous years.

12.10 Denominators

ISD figures

A3	**Singleton**		**Multiple**	
	Total Births	**Live births**	**Total Births**	**Live births**
	56541	56286	1760	1741

A10a, A11a	**Singleton**			
		denominator	**numerator**	**denominator**	**numerator**
		Total Births	**NF SB [1]**	**Live births**	**NF NND [2]**
	Total	**56485**	**227**	**56256**	**87**
	Under 1500	497	89	405	59
	1500-2499	2441	54	2386	7
	2500-3499	27093	49	27045	13
	3500-4499	25153	31	25123	6
	4500+	1269	4	1265	1
	nk	32	-	32	1

A10b, A11b	**Singleton**			
		denominator	**numerator**	**denominator**	**numerator**
		Total Births	**NF SB [1]**	**Live births**	**NF NND [2]**
	Total	**56485**	**227**	**56256**	**87**
	<24	25	-	25	25
	24-27	155	48	106	22
	28-31	388	33	354	16
	32-36	2752	62	2689	4
	37+	53111	84	53029	20
	nk	54	-	53	-

NRS figures

A14	**Singleton**			
	Male		**Female**	
	Total Births	Live births	Total Births	Live births
	29015	28891	27530	27397

A26, A27b	**NHS Board**	**Total Births**	**Live births**	**Total births & Late Fetal Deaths**
	Scotland	**58301**	**58027**	**58465**
	Ayrshire & Arran	3723	3701	3733
	Borders	1145	1139	1146
	Dumfries & Galloway	1395	1390	1396
	Fife	4043	4019	4054
	Forth Valley	3268	3255	3281
	Grampian	6503	6470	6520
	Greater Glasgow	14136	14072	14161
	Highland	3165	3145	3176
	Lanarkshire	6169	6145	6189
	Lothian	9877	9827	9912
	Orkney	203	201	204
	Shetland	276	276	278
	Tayside	4161	4150	4178
	Western Isles	237	237	237

1 Normally formed stillbirths.

2 Normally formed neonatal deaths.

12.11 National statistics

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and signifying compliance with the Code of Practice for Official Statistics.
Designation can be broadly interpreted to mean that the statistics:
• meet identified user needs;
• are well explained and readily accessible;
• are produced according to sound methods, and
• are managed impartially and objectively in the public interest.
Once statistics have been designated as National Statistics it is a statutory requirement that the Code of Practice shall continue to be observed.

Further details on National Statistics are contained at the National Statistics website (http://www.statistics.gov.uk).

Pre-release access

Under terms of the "Pre-Release Access to Official Statistics (Scotland) Order 2008", ISD are obliged to publish information on those receiving Pre-Release Access ("Pre-Release Access" refers to statistics in their final form prior to publication). The standard maximum Pre-Release Access is five working days. Shown below are details of those receiving standard Pre-Release Access and, separately, those receiving extended Pre-Release Access.

Standard pre-release access:

Scottish Government Health Department
NHS Board Chief Executives
NHS Board Communication leads
Members of the Reproductive Health Advisory Group

Extended pre-release access

Extended Pre-Release Access of 8 working days is given to a small number of named individuals in the Scottish Government Health Department (Analytical Services Division). This Pre-Release Access is for the sole purpose of enabling that department to gain an understanding of the statistics prior to briefing others in Scottish Government (during the period of standard Pre-Release Access).

Scottish Government Health Department (Analytical Services Division)

Early access for quality assurance

These statistics will also have been made available to those who needed access to help quality assure the publication:
Members of the Reproductive Health Advisory Group, Healthcare Improvement Scotland
Executive Team, Healthcare Improvement Scotland
NHS Fife

12.12 Classification

SECTION 10. ASSOCIATED FACTORS AND CAUSE OF DEATH

Please check ALL the maternal or fetal conditions that were present during the pregnancy or appeared to contribute to the death

Q10 (1) Major congenital anomaly and chromosomal defects: (please check all that apply)

☐ Central nervous system ☐ Gastro-intestinal system ☐ Chromosomal disorders
☐ Cardiovascular system ☐ Musculo-skeletal anomalies ☐ Metabolic diseases
☐ Respiratory system ☐ Multiple anomalies ☐ Urinary tract

Please specify diagnosis

Q10 (2) Hypertensive disorders of pregnancy: (please check all that apply)

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

Q10 (3) Antepartum or intrapartum haemorrhage: (please check all that apply)

☐ Placenta praevia ☐ Placental abruption ☐ Other

If other, please specify

Q10 (4) Mechanical: (please check all that apply)

Cord compression:
☐ Prolapse cord ☐ Cord around neck ☐ Other cord entanglement or knot

Uterine rupture:
☐ Before labour ☐ During labour

Shoulder dystocia:
☐

Mal-presentation:
☐ Breech ☐ Face ☐ Compound ☐ Transverse ☐ Other please specify

If other, please specify

Q10 (5) Maternal disorder: (please check all that apply)

☐ Pre-existing hypertensive disease ☐ Other endocrine conditions ☐ Drug misuse
☐ Pre-existing diabetes ☐ Thrombophilias ☐ Uterine anomalies
☐ Gestational diabetes ☐ Obstetric cholestasis

☐ Other please specify

Q10 (6) Infection: (please check all that apply)

Maternal infection: ☐ Bacterial ☐ Viral diseases ☐ Protozoal

☐ Other, specify

Ascending infection: ☐ Chorioamnionitis ☐ Other, please specify below

Q10 (7) Specific fetal conditions: (please check all that apply)

☐ Twin-twin transfusion ☐ Non immune hydrops ☐ Other

☐ Feto-maternal haemorrhage ☐ Iso-immunisation

If other, please specify

Q10 (8) Specific placental conditions: (please check all that apply)

☐ Placental infarction ☐ Chronic villitis

☐ Massive perivillous fibrin deposition ☐ Chronic intervillostitis

☐ Vasa praevia ☐ Fetal thrombotic vasculopathy

☐ Velamentous insertion ☐ Cord hypocoiling

☐ Deficient placental villus maturation ☐ Cord hypercoiling

Cord length ☐☐☐ cm

☐ Other, specify

Q10 (9) Intra-uterine growth restriction:

Was this diagnosis made? ☐ Yes ☐ No

What was this based on? (please check all that apply)

☐ Suspected antenatally ☐ Observed at delivery ☐ Observed at post mortem

What led you to your suspicion

Q10 (10) Associated obstetric factors: (please check all that apply)

Birth trauma: ☐ Intracranial haemorrhage ☐ Birth injury to scalp

☐ Fracture, specify

☐ Other, specify

Intrapartum anoxia *(evidence of significant hypoxia/anoxia during labour):* ☐

Other: ☐ Polyhydramnios ☐ Premature rupture of membranes
☐ Oligohydramnios ☐ Spontaneous premature delivery

☐ Other, specify

Q10 (11) No antecedent or associated obstetric factors:
☐

Q10 (12) Unable to classify because of lack of information:
☐

Q10 (13) Which condition, indicated in questions Q10 (1) to Q10 (12) as being present, was the MAIN condition causing or associated with the death (NB "non-MAIN" conditions are best described as the "Other clinically relevant maternal or fetal conditions/factors that were associated with but not necessarily causing the death". Please give the MAIN condition)

SECTION 11. CAUSE OF DEATH - NEONATES ONLY

Please check ALL the neonatal conditions that appeared to contribute to the death:

Q11 (1) Major congenital anomaly: (please check all that apply)

☐ Central nervous system ☐ Gastro-intestinal system ☐ Chromosomal disorders
☐ Cardiovascular system ☐ Musculo-skeletal anomalies ☐ Metabolic diseases
☐ Respiratory system ☐ Multiple anomalies ☐ Urinary tract

If other, please specify

Q11 (2) Immaturity:

☐ < 22 weeks gestation ☐ 22 to 24 weeks gestation

Q11 (3) Respiratory disorders: (please check all that apply)

- ☐ Severe pulmonary immaturity
- ☐ Surfactant deficiency lung disease
- ☐ Pulmonary hypoplasia
- ☐ Meconium aspiration syndrome
- ☐ Primary persistent pulmonary hypertension
- ☐ Chronic lung disease / Bronchopulmonary dysplasia (BPD)
- ☐ Other (for example, pulmonary haemorrhage, pneumonia, iatrogenic)

If other, please specify

Q11 (4) Gastro-intestinal disease:

- ☐ Necrotising enterocolitis (NEC)

If other, please specify

Q11 (5) Neurological disorder:

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

If other please specify

Q11 (6) Infection:

- ☐ Sepsis (generalised)
- ☐ Pneumonia
- ☐ Meningitis

Other, please specify

Please specify the organism (eg group B streptococcus)

Q11 (7) Injury / Trauma (including iatrogenic trauma) (post natal):

Was trauma a factor?

- ☐ Yes
- ☐ No

If yes, please specify

Q11 (8) Other specific causes:

- ☐ Malignancies / tumours*
- ☐ Specific conditions *

* please specify

Q11 (9) Sudden unexpected deaths:

☐ Sudden Unexpected Natural Death (includes SIDS)

☐ Neonatal death - cause unascertained

Q11 (10) Unable to classify because of lack of information:

☐

Q11 (11) Which condition, indicated in questions Q11 (1) to Q11 (10) as being present, was the MAIN condition causing or associated with the death (NB "non-MAIN" conditions are best described as the "Other clinically relevant maternal or fetal conditions/factors that were associated with but not necessarily causing the death". Please give the MAIN condition)