NATIONAL PERINATAL
EPIDEMIOLOGY CENTRE

Perinatal Mortality National Clinical Audit in Ireland

Annual Report 2020

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Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

BBA – Born Before Arrival

BMI – Body Mass Index

CCU – Critical Care Unit

CMACE – Centre for Maternal and Child Enquiries

CS – Caesarean Section

FGR – Fetal Growth Restriction

GROW – Gestation-Related Optimal Weight

HDU – High Dependency Unit

HPO – Healthcare-Pricing Office

HSE – Health Service Executive

ICU – Intensive Care Unit

ICSI – Intracytoplasmic Sperm Injection

IOG – Institute of Obstetricians and Gynaecologists

IUGR – Intra-Uterine Growth Restriction

IUI – Intrauterine Insemination

MCA – Major Congenital Anomaly

MBRRACE UK – Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK

NWIHP – National Women and Infants Health Programme

NOCA – National Office of Clinical Audit

NPEC – National Perinatal Epidemiology Centre

PMR – Perinatal Mortality Rate

PMNCA – Perinatal Mortality National Clinical Audit

RR – Rate Ratio

SGA – Small for Gestational Age

TGCS – Robson Ten Group Classification System

TOP – Termination of Pregnancy

TOW – Term Optimal Weight

TTTS – Twin to Twin Transfusion Syndrome

Foreword

Welcome to the 2020 Annual Perinatal Mortality Report from the National Perinatal Epidemiology Centre (NPEC). This is the ninth report of the national clinical audit on perinatal mortality using the NPEC data collection tool and classification system.

The NPEC appreciates the provision of data to the audit in the first place; even more so that this was achieved despite the increased workload and uncertainty that arose with the COVID-19 Pandemic starting in March 2020. In addition to the data, we also greatly value the feedback and discussion with the units; it all goes to enhance the system learning and understand how this data can be used to assess/improve the care we all provide. I sincerely thank all my colleagues in the maternity services in Ireland who continue to engage with the NPEC and produce knowledge of which we are all proud.

The NPEC actively encourages the use of data in the units through individual hospital reports and the use of the national data set. This report also shows the maternity service commitment to transparency with the identification of individual units in the report.

It is disappointing to see that the Perinatal mortality rate has remained static for a few years (2018-2019) and has shown a slight increase in 2020.

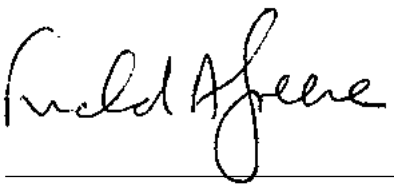
While the NWIHP working with the maternity services are progressing a number of the recommendations from previous NPEC reports; a coordinated approach including other agencies such as the Institute of Obstetrics and Gynaecology and the Healthy Ireland Programme (Department of Health and Well Being in the HSE); would allow a care bundle approach towards initiating further improvement - this has worked in other countries; an example is provided in the report (page 12). Implementation of the recommendations in this report and perhaps packaging them with those such as CTG interpretation/risk assessment, as recommended in the Therapeutic Hypothermia Report 2019,[1] would assist the maternity services in Ireland to achieve further reduction in the perinatal mortality and morbidity rates.

Inevitably we can enhance the knowledge we have by integrating knowledge from beyond our own system, learning from other health colleagues who investigate the death of babies in their care. International comparison of these outcomes can enhance our learning. This comparison is difficult when we are not comparing like with like, where definitions differ. In this report we again raise the need for a discussion about the case definitions we use in the Republic of Ireland.

As we read through the findings in this audit report, there are clearly areas that warrant research across the spectrum of pregnancy-related health; there is increasing evidence that more research is needed to improve outcomes for women and babies. In this report we call on Research funding Organisations and Health Service Funders to invest in and encourage research around the impact, experience and awareness of perinatal morbidity and perinatal death and the development and implementation of prevention systems – i.e. reduction of perinatal loss related to fetal growth problems.

The NPEC continues to collaborate with the NWIHP and acknowledges the key relationship between the two organisations. We are also grateful to our colleagues in the National Office of Clinical Audit (NOCA) to whose standards our audits are aligned and who provide us with constructive feedback and support.

Lastly, I would like to thank the staff in the NPEC for their ongoing dedication to the mission of the Centre and their adoption of virtual approaches during the Pandemic to continue to achieve our audit reports. Thanks to our Perinatal Mortality National Clinical Audit Governance Committee (PMNCAGC) for their guidance and intellectual input; around this audit. Working with all the stakeholders involved, the NPEC continues its mission to improve the care of mothers and babies in Ireland, as evidenced by the production of this report.



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[1]Neonatal Therapeutic Hypothermia in Ireland, Annual Report 2019. Cork. Available at: www.ucc.ie/en/media/research/nationalperinatalepidemiologycentre/Published2019AnnualReportv1.pdf

Acknowledgements

It is with sincere thanks and appreciation that the NPEC would like to acknowledge the many healthcare professionals who contribute to the NPEC audit on perinatal mortality. In particular, we would like to thank the unit co-ordinators (see Appendix A) who continue to co-ordinate the collection of perinatal mortality data at unit level. This report would not have been possible without their dedicated support and co-operation. Collation of audit data at unit level was particularly challenging during the Pandemic 2020/21 and the added problems following the HSE Cyber-attack (May 2021) and subsequent impact on IT systems. The on-going support of unit co-ordinators in collating data is highly commendable, particularly as many do so without protected time for clinical audit.

The NPEC would like to acknowledge members of the NPEC Perinatal Mortality National Clinical Audit Governance Committee (PMNCAGC), listed in Appendix B, for their guidance in the continual optimisation of the NPEC national clinical audit of perinatal mortality. We would also like to extend thanks to the NPEC Governance Committee, who represent a diverse range of key stakeholders from maternity centres and universities throughout the country, for their support and guidance as the Centre continues to grow and evolve (Appendix C).

We are grateful for the support of the National Office of Clinical Audit (NOCA), whose endorsement of this report is included in Appendix D.

The NPEC would also like to acknowledge the National Perinatal Reporting System (NPRS) for their continued collaboration in consolidating national data on perinatal deaths thus ensuring that both agencies represent the most accurate and complete record of Irish perinatal mortality data annually as recommended by the Chief Medical Officer.

As with our previous annual reports, expert commentary was invited on a specific topic of perinatal care and services in Ireland. I would like to thank Dr Sarah Petch, SpR on the Higher Specialty Training Scheme in Obstetrics & Gynaecology, and Professor Fionnuala McAuliffe, Consultant Obstetrician at the National Maternity Hospital and Head of Women's and Children's Health at UCD Perinatal Research Centre, for their invited commentary on "The role of maternal health and maternal obesity in perinatal mortality".

Introduction

This Perinatal Mortality National Clinical Audit (PMNCA) Report provides information on perinatal deaths arising from births occurring in the Republic of Ireland (ROI) for the reporting year 2020.

Since 2009, the NPEC, in collaboration with the multidisciplinary Perinatal Mortality National Clinical Audit Governance Committee (see Appendix B), has conducted a national clinical audit of Perinatal Mortality annually. The fundamental aim of this clinical audit is to provide a national review of perinatal deaths, to identify quality improvement initiatives and make recommendations for the improvement of care for mother and babies in Ireland. It is acknowledged that ongoing monitoring of quality and safety data is essential to continually drive improvements in the maternity services. The information provided in this report contributes to a body of evidence that will guide future clinical practice; the counselling of bereaved parents, public health interventions, and inform policy makers within the health services.

A significant recent development is the endorsement of this clinical audit by the National Clinical Effectiveness Committee (NCEC). The NPEC Perinatal Mortality National Clinical Audit (PMNCA) is the second audit to be quality assured by the NCEC and becomes No. 2 in the NCEC suite of National Clinical Audits. The NCEC endorsement mandates that the appropriate services engage with the NPEC National Clinical Audit of Perinatal Mortality, thereby superseding all other national clinical audits on the topic.[2]

This PMNCA 2020 report is divided into seven sections (Figure I) with additional information provided in the Appendices.

Section 1 contains the main findings including:

- National and international comparison of Perinatal Mortality Rates (PMR) and the impact of in-utero transfer on individual unit's PMR.
- Distribution of Perinatal Deaths by the Robson Ten Group Classification System.
- Maternal and infant characteristics impacting on adverse perinatal outcomes.
- Management of delivery in women experiencing perinatal loss.
- Infant characteristics impacting on adverse perinatal outcomes.
- Perinatal mortality following termination of pregnancy.
- Investigations to determine the cause of perinatal death.

Section 2 contains the invited expert commentary:

- The role of maternal health and maternal obesity in perinatal mortality.

Sections 3, 4, 5 and 6 provide findings specific to (respectively):

- Stillbirths.
- Early neonatal deaths.
- Perinatal deaths associated with intrapartum events.
- Late neonatal deaths.

Section 7 presents data on early neonatal deaths with a birthweight <500g and a gestational age at delivery of <24 weeks.

- These deaths are not included in the PMR.

Fgure I: Outline of the PMNCA Report Sections

[2]The report from the NCEC was published by Minister Donnelly on April 25th, 2022, and is available at: www.gov.ie/en/publication/032fa-national-clinical-effectiveness-committee-national-clinical-audit-perinatal-mortality

Executive Summary

This is the ninth report of the national clinical audit on Perinatal Mortality in Ireland, using the NPEC data collection tool and classification system on cause of death. All 19 Irish maternity units reported anonymised data on 357 deaths arising from 57,114 births occurring in 2020, of at least 500g birthweight or at least 24 weeks gestation.

Stillbirths and early neonatal deaths accounted for 240 (67.2%) and 117 (32.8%) of the 357 deaths, respectively. There were a further 35 late neonatal deaths. The Perinatal Mortality Rate was 6.25 deaths per 1,000 births; corrected for Major Congenital Anomaly (MCA), the rate was 3.68 per 1,000 births; the stillbirth rate was 4.20 per 1,000 births; the early neonatal death rate was 2.06 per 1,000 live births.

The level of variation in the rate of PMR between maternity units was higher in 2020 compared to 2019. However, when adjusted for MCA and in-utero transfers, no maternity unit was considered an outlier as defined by NOCA. There is evidence of an increase in perinatal mortality (rate ratio, RR=1.18, 95%CI=1.01-1.37, p-value=0.032). Decreasing rates of perinatal mortality were observed in Ireland in the decade prior to 2012, the PMR levelled off thereafter, however is increasing again since 2018. While reductions in perinatal mortality rates are not easy to achieve, other countries have made significant reductions in PMR, particularly with stillbirth rates in recent years.

Among mothers experiencing perinatal death, the proportion of women attending their first antenatal visit at 20 weeks gestation or later was 7.2%. This was slightly higher compared to 5.5% in 2019.

The care of pregnant mothers was transferred in utero to another maternity unit in 10.4% of the perinatal deaths, most commonly to a tertiary referral maternity unit.

The rate of autopsy uptake following perinatal death in 2020 (52.3%) is higher than rates reported in previous years with the exception of one year (54.4% in 2017). Similar to previous years, a post-mortem examination was performed more often in stillbirths (59.2%) than in neonatal deaths (37.7%). In the vast majority of perinatal deaths that did not receive an autopsy, an autopsy was offered and presumably declined by parents (82.2%).

There continues to be a high rate of placental histology examinations performed following perinatal death (98.3 % in stillbirths and in 96.1% of early neonatal deaths).

Similar to 2018 and 2019, Major Congenital Anomaly (MCA) was the most common cause of death in stillbirths in 2020 (32.9%) followed by specific placental conditions (30.4%). The cause of death was unexplained in eleven percent of stillbirths (10.8%). In sixty percent of these unexplained cases, it was reported that the maternity unit was pending post-mortem results (most commonly coronial autopsy reports).

MCA was the primary cause death in over half of the early neonatal deaths in 2020 (58.1%). Respiratory disorder was the second most common cause of death, accounting for more than one in five (21.4%) early neonatal deaths, most commonly associated with severe pulmonary immaturity. Major congenital anomaly was also the most common cause of late neonatal deaths.

Low birthweight continues to be associated with perinatal deaths, particularly with stillbirths. Over one third (34.7%) of all stillbirths were classified as severely small for gestational age (<3rd customised birthweight centile).The level of antenatal diagnosis of fetal growth restriction in severely small for gestational age remains low (25.3%).

An association between maternal age and perinatal mortality was identified. Compared to mothers aged between 30-34 years, women aged greater than 40 years had a 1.8 fold increased rate of perinatal mortality (p value=0.002) in 2020.

An association between increased BMI and perinatal mortality was again identified in 2020. Obese women had more than twice the risk of perinatal mortality compared to women who gave birth during 2020 with a healthy BMI (p value <0.001).

While the numbers involved were small, ethnic minorities were over-represented in the mothers who experienced perinatal deaths.

In 2020, the perinatal mortality rate for babies in multiple pregnancies was 2.35 times higher than for singleton babies.

While on-going clinical audit is essential to identify key factors influencing adverse perinatal outcomes, the opportunity to learn from the tragic event of a perinatal death would be greatly enhanced by the establishment of a confidential review into defined cohorts of perinatal deaths.

Key findings in 2020

Perinatal Mortality Rate (PMR)

- The PMR was 6.25 per 1,000 births in 2020.
- Corrected for Major Congenital Anomaly (MCA), the PMR was 3.68 per 1,000 births in 2020.
- There is evidence of an increase in perinatal mortality (rate ratio, RR=1.18, 95%CI=1.01-1.37, p-value=0.032) in 2020. Decreasing rates of perinatal mortality were observed in Ireland in the decade prior to 2012, the PMR levelled off thereafter, however is increasing again since 2018.
- Variation in the rate of PMR was identified between maternity units. However, when adjusted for MCA and in-utero transfers, no maternity unit was considered an outlier as defined by NOCA.

Stillbirths: Accounted for 67.2% of perinatal deaths in 2020.

- Similar to recent years, MCA was the most common cause of death in 2020 followed by specific placental conditions.

Early neonatal deaths: Accounted for 32.8 % in 2020.

- MCA was the most common cause of neonatal death followed by severe pulmonary immaturity.

Late Neonatal deaths: There were 35 late neonatal deaths in 2020.

- MCA was the most common cause of late neonatal death.

Low birth weight centiles: As in previous reports, low birthweight centiles was associated with perinatal deaths in 2020, particularly stillbirths.

Multiple Births: An increased risk of perinatal mortality with multiple births compared to single pregnancy was again identified in 2020. Perinatal death from multiple births accounted for 8.1% of all perinatal deaths.

Autopsy Rates: The rate of autopsy uptake continues to be higher in stillbirths compared to neonatal deaths.

Maternal factors: Maternal age (greater than 40 years) and high BMI were associated with a higher risk of perinatal mortality in 2020.

Recommendations

Recommendations from previous reports being progressed by relevant stakeholders in the maternity services.

- The Hospital Groups should examine the allocation of funding for the perinatal pathology service to ensure that a structured approach is taken to recruit staff in a timely manner. This has now been progressed by the NWIHP with a number of perinatal pathology posts being filled and funding is being sought to complete the plan for a networked perinatal pathology service.

- Further engagement with the Coroner Society of Ireland to explore the timeliness of autopsy reports provided to maternity units is warranted. This has now been progressed via the Department of Health. In October 2021, a Submission document to the Department of Health regarding the Coroner's (Amendment) Act 2019 was made on behalf of the NPEC, NWIHP, NOCA and the PMNCAGC.

Based on the findings of this and previous reports, the NPEC Perinatal Mortality National Clinical Audit Governance Committee makes the following recommendations:

- Robust clinical audit of perinatal outcomes in all maternity units in Ireland is vital for quality patient care. Funding should be provided to ensure protected time for clinical audit and implementation of its findings.
  - There are multiple demands for data in the maternity services and indeed some duplication; there needs to be a review of the data requirements and a streamlining in keeping with good data governance and indeed the HIQA data quality framework.[3]

- The establishment of a confidential review for stillbirth and neonatal deaths should be considered in order to enhance the learning to assist better care.

  This could take the format of a standardized review of specific cohorts, such as:

  - unexpected intrapartum related deaths
  - multiple pregnancies
  - term stillbirths and neonatal deaths (in normally formed babies)

These cohorts could be reviewed on a rolling basis. Owner; the National Women and Infants Health Programme (NWIHP) and the Institute of Obstetrics and Gynaecology (IOG).

- Standardised approach to improved antenatal detection of fetal growth restriction (FGR) with timely delivery is a potential preventative strategy to reduce perinatal mortality.[4]
  - One option, used previously in other centres, is the generation of customized birth weight centile charts for every woman during pregnancy and concomitantly, staff are trained in risk assessment, plotting of symphysial fundal height (SFH) with appropriate pathways to scan weight estimates; identifying fetuses at risk through Intrauterine growth Restriction and management to reduce stillbirths in Ireland.[5]

    Based on feedback to the NPEC, other methodologies could be considered.

A multidisciplinary working group should be developed to address a national standardised approach to the detection of FGR. A national approach should also evaluate the use of a standard growth curve and management options across all Irish maternity units. Owner; the NWIHP and the IOG.

- Consideration should be given to the establishment of a national working group to include Obstetricians, Neonatologists, Midwives and Allied Health Professionals whose remit is to look at the problem of preterm birth (PTB) in Ireland at a national level and how it is best addressed. Owner; the NWIHP.

[3] Health Information and Quality Authority. (HIQA) Guidance on a data quality framework for health and social care. Health Information and Quality.2018. Available from: www.hiqa.ie/sites/default/files/2018-10/Guidance-for-a-data-quality-framework.pdf

[4] Clinical Practice Guideline No 29 (2014). Fetal Growth Restriction Guideline - Recognition, Diagnosis and Management: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive

[5] www.perinatal.org.uk/

- All health care professionals (obstetricians, GPs and midwives) should see every interaction with a woman as an opportunity to address weight, nutrition and lifestyle to optimize her health. This also supports the HSE Programme 'Making Every Contact Count' (MECC).[6] Owner; All Healthcare staff.

- Defining and auditing perinatal loss.

  (a) To allow for international comparison of stillbirths, a move towards collecting data on fetal deaths >22 weeks and <24 weeks should be considered in the audit of perinatal mortality in Ireland.[7]

  (b) A national working group should be convened to review the definition of perinatal mortality in the Republic of Ireland (ROI). This working group should include the NWIHP, NPEC, the General Registers Office (GRO), the Institute of Obstetrics and Gynaecology, the National Clinical Programme for Paediatrics and Neonatology and the Department of Health. Owner; the NPEC.

Example of a care bundle for the Irish context might include:

- Public health programmes which focuses on
  - reducing smoking in pregnancy.
  - weight management to lower BMI and prepare women for a healthier entry to pregnancy.
  - raising awareness of stillbirth and reduced fetal movements.
- Healthcare staff education on modifiable health risk factors for perinatal mortality and using the MECC programme.
- Develop a care pathway including staff education around risk assessment and surveillance for fetal growth restriction using a standard national approach.
- Effective fetal monitoring during labour with potential cross over effects for a reduction in Neonatal Brain injury and intrapartum related death.
- Integrate best practice research for a reduction of preterm labour.
- Develop a standard approach to assessment of all Perinatal Deaths including/consulting with parents for reviews of their care. The learning points from these reviews should be communicated to all staff.[1,2]
- Establish a Confidential Review for stillbirth and neonatal deaths, which should be considered in order to enhance the lessons which may improve care.[1,2]

[1] Neonatal Therapeutic Hypothermia in Ireland, Annual Report 2019. Cork. Available at link **HERE**

[2] Health Service Executive. On the Implementation of the National Standards for bereavement care following pregnancy loss and perinatal death, 2021. Available at link **HERE**

Later in the report, the NPEC advocates the introduction and use of a '*Care Bundle*' approach in an attempt to lower perinatal mortality as has been achieved in other countries (see page24).

Implications for research identified in the findings of this report.

As we read through the findings in this audit report, there is clearly areas that warrant research across the spectrum of pregnancy-related health; there is increasing evidence that more research is needed to improve outcomes for women and babies.

Research Organisations and Health Service Funders should invest in and encourage research team collaboration to undertake multi-disciplinary research on the impact, experience and awareness of perinatal morbidity and perinatal death, including the role of bereavement care and pre-conception health awareness. From this audit examples for research include:

- the implementation of prevention systems – i.e. reduction of perinatal loss related to fetal growth problems.
- the exploration of new methodologies that address supporting facilitators and reducing barriers around risk reduction/positive self-care behaviours e.g. substance misuse, weight management, care attendance including social inclusion, etc.; covering the pre-conception and pregnancy periods.[8]
- Further research exploring factors impacting on autopsy rates, particularly in the case of neonatal deaths.

[6] www.hse.ie/eng/about/who/healthwellbeing/making-every-contact-count/

[7] Kelly K et al. A review of stillbirth definitions: A rationale for change. European Journal of Obstetrics & Gynaecology and Reproductive Health. 256 (2021) 235-245

[8] Facilitators and barriers to substance-free pregnancies in high-income countries: A meta-synthesis of qualitative research. Tamara Escañuela Sáncheza, Karen Matvienko-Sikarc, Laura Linehan, Keelin O'Donoghue, Molly Byrned and Sarah Meaney. Women and Birth 2022; 35 (2); e99-110

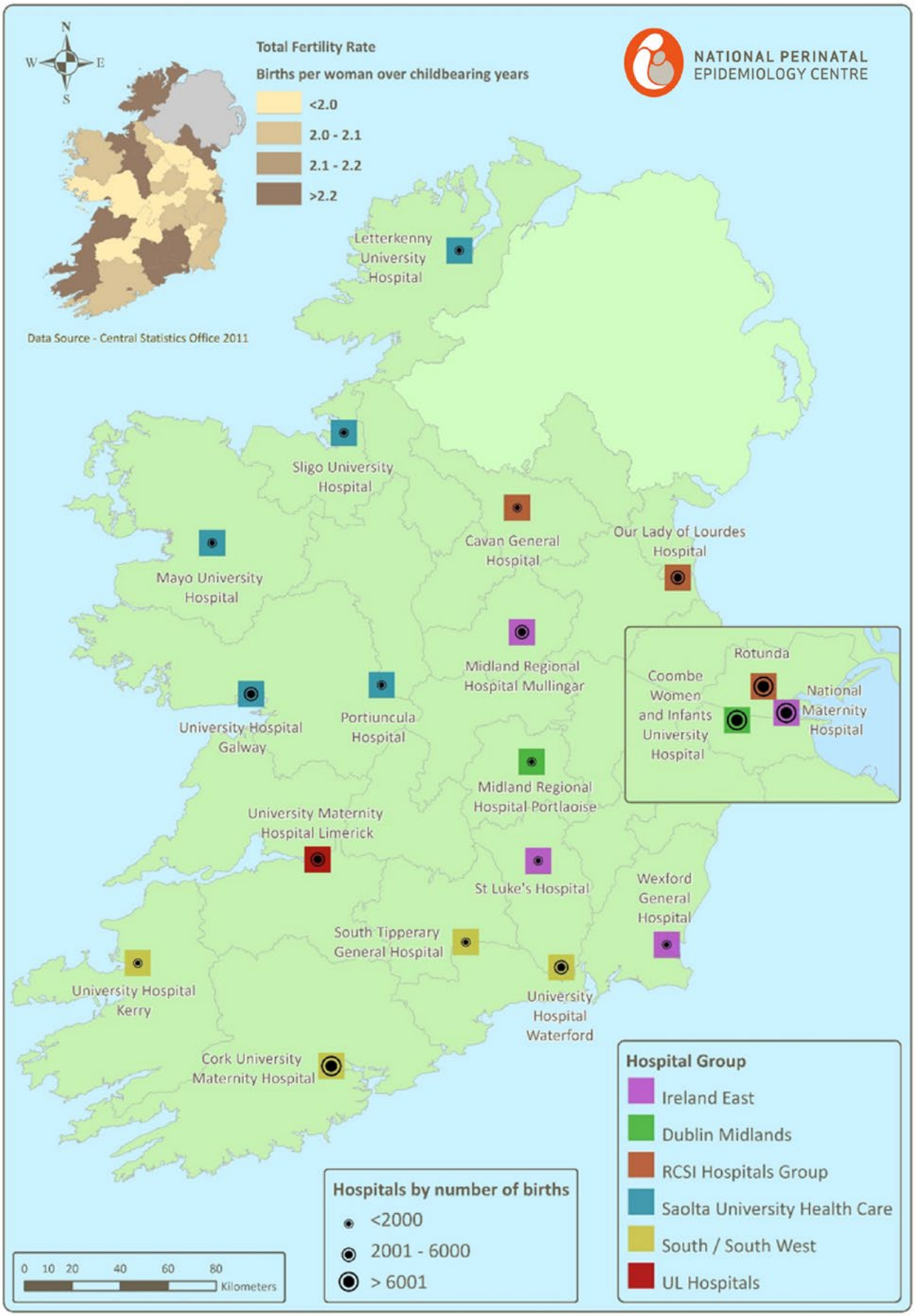


Figure II: Map of maternity units and hospital groups in the Republic of Ireland

Methods

Data collection and management

In 2020, there were 19 maternity units in Ireland. Within each maternity, unit coordinators with the responsibility of submitting perinatal mortality data to the NPEC have been identified. Pseudonymised data on perinatal deaths from births that occurred between January 1 and December 31 2020 were submitted to the NPEC by all 19 units using a standardised notification dataset either electronically, via the secure online NPEC database, or alternatively by paper format (see Appendix E). The notification dataset is completed using data on fetal and maternal characteristics recorded in the clinical records. Implemented nationally in 2011, the NPEC notification dataset was based on the validated Centre for Maternal and Child Enquiries (CMACE) Perinatal Death Notification Form[9] and has been endorsed by the Clinical Advisory Group at the Institute of Obstetrics and Gynaecology, the Faculty of Paediatrics and the HSE National Obstetric Programme Working Group.

Figure III illustrates the NPEC data collection and management processes. There has been a steady improvement in the overall quality of data reported by all maternity units since the implementation of the NPEC perinatal mortality notification dataset in 2011. To ensure completeness and accuracy of information, all data is validated directly with the respective maternity units. The NPEC also undertakes extensive reconciliation of its annual perinatal mortality dataset with that of the National Perinatal Reporting System (NPRS). This consolidation with the NPRS is in response to recommendations by the Chief Medical Officer[10] and ensures that both agencies datasets represent the most accurate record of perinatal mortality annually.

As previously acknowledged, this report comes from the efforts of many people and among the most important are the coordinators at the maternity hospitals. At unit level, there is an enormous amount of work done by these individuals, some working alone, some with colleagues. When we get data in the NPEC, we often must verify facts about the cases and follow up about outstanding reports, etc. We are aware that many coordinators

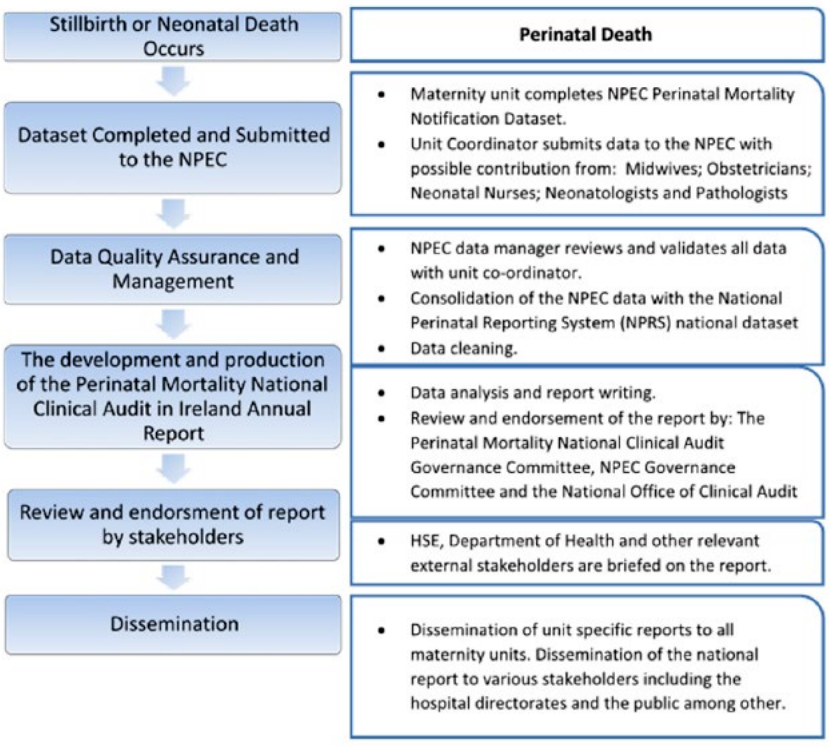


Figure III: NPEC data collection and management processes

[9] Centre for Maternal and Child Enquiries (CMACE) (2010) Perinatal Mortality 2008: United Kingdom. London: CMACE

[10] Holohan, T. (2014) HSE Midland Regional Hospital, Portlaoise Perinatal Deaths (2006-date). Dublin: Department of Health. Available at: www.lenus.ie/hse/bitstream/10147/313524/1/portlaoiseperinataldeaths.pdf

are doing this work in their own time and often after hours. Audit is a very important component of health services, it is our way of checking what we are doing, can we improve, where is there variance. It is an area that is recognized as being very important in all strategic documents, but it is rarely supported in specified resources. There are multiple demands for data in the maternity services and indeed some duplication; there needs to be a review of the data requirements and a streamlining in keeping with good data governance and indeed the HIQA data quality framework.[11] It is difficult to fund resources for audit when the frontline is under pressure for resources, however its value is not less important, and it needs support. As in previous reports we again make a recommendation in this area.

- **Recommendation:** Robust clinical audit of perinatal outcomes in all maternity units in Ireland is vital for quality patient care. Funding should be provided to ensure protected time for clinical audit and implementation of its findings.

The 2020 birth cohort

This report describes the perinatal deaths that occurred among infants born from 1 January to 31 December 2020. Thus, neonatal deaths in January 2020 of infants born in December 2019 are not included while neonatal deaths in January 2021 of infants born in December 2020 are included. The NPEC have been reporting on the perinatal mortality for a birth cohort since the 2015 perinatal mortality report. This method of reporting perinatal mortality for a birth cohort allows more accurate estimates of mortality rates to be produced as appropriate denominators are available. The MBRRACE-UK Perinatal Mortality Surveillance Reports are also based on perinatal mortality for a birth cohort.[12] The NPEC Perinatal Mortality Reports for the years 2011-2014 were based on deaths in a calendar year. Therefore, in this 2020 report, 2011-2014 figures have been revised to adjust for this.

Rate calculations

To assess perinatal mortality, overall and unit-specific perinatal mortality rates (PMRs) per 1,000 births and corresponding 95% confidence intervals were derived. For incidence rates, 95% confidence intervals were calculated using exact Poisson confidence limits unless stated otherwise. Stillbirth, neonatal and corrected PMRs, which exclude deaths associated with or due to a major congenital anomaly, were also calculated. Total births was the denominator used for all the PMRs, except for early neonatal deaths which use total live births (i.e., total births minus stillbirths). Denominator data were provided directly by the Irish Healthcare Pricing Office[13] and the Hospital Inpatient Enquiry (HIPE). Denominator data by body mass index was obtained from seven maternity units.

Perinatal deaths are included in a maternity unit's rate if the baby was delivered in the maternity unit or if the unit was the intended place of delivery, but the baby was born before arrival. In the event of a neonatal death, the perinatal death is assigned to the maternity unit where the baby was delivered regardless of where the baby died (includes post-natal transfers to tertiary maternity units/paediatric centres).

Rate ratios

Further analysis was conducted to assess variation in incidence rates between years, maternal age groups, body mass index categories and nulliparous and multiparous women. This analysis in-

[11] Health Information and Quality Authority.(HIQA) Guidance on a data quality framework for health and social care. Health Information and Quality.2018. Available from: www.hiqa.ie/sites/default/files/2018-10/Guidance-for-a-data-quality-framework.pdf

[12] Draper ES, Gallimore ID, Kurinczuk JJ, Smith PW, Boby T, Smith LK, Manktelow BN, on behalf of the MBRRACE-UK Collaboration. MBRRACE-UK Perinatal Mortality Surveillance Report, UK Perinatal Deaths for Births from January to December 2019. Leicester: The Infant Mortality and Morbidity Studies, Department of Health Sciences, University of Leicester. 2021.

[13] Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press]

volved using Poisson regression which calculates a rate ratio (for example, the rate in one year divided by the rate in the previous year). Rate ratios have the advantage of being easy to interpret. They are interpreted against the rate to which they are being compared (the reference group/reference rate). A rate ratio is greater than one if a rate is greater than the rate to which it is being compared. For example, a rate ratio of 1.25 indicates the rate being examined is 25% higher than (or 1.25 times) the rate to which it is being compared. Conversely, a rate ratio will be less than one if a rate is less than the rate to which it is being compared. For example, a rate ratio of 0.80 indicates that the rate being examined is equivalent to 80% of the rate to which it is being compared, i.e. it is 20% lower. The Poisson regression analysis provides a 95% confidence interval for the rate ratio and the associated p-value, both of which indicate whether the rate difference is in line with what might be expected due to chance. A rate difference is considered to be beyond what might be expected by chance, i.e. statistically significant, if the 95% confidence interval for the rate ratio does not include the value one. This is equivalent to the p-value derived from the analysis being less than 0.05. If the p-value is less than 0.001 then the rate difference may be considered highly statistically significant.

Funnel plots

Variations in PMRs between maternity units could potentially be due to random chance or reflect differences in baseline characteristics of the childbearing population. For this reason, funnel plots were used to assess performance outcomes for individual units in comparison to the overall average. In brief, the plot is a scatter diagram of individual maternity unit mortality rates against the number of births within that unit. The national rate is indicated by the solid straight line. The 95% confidence interval is indicated by the curved dashed line. The dashed lines represent the limits within which 95% of units are expected to lie (i.e. within two exact binomial standard errors). The 99.8% confidence interval for the national rate is plotted using solid lines. These solid lines represent the limits within which 99.8% of units are expected to lie (i.e. within three exact binomial standard errors).

The width of the confidence interval is adjusted to allow for meaningful comparison between unit-specific rates and the national rate. The confidence interval is wider for smaller units reflecting the lack of precision in rates calculated based on small numbers. The confidence interval narrows for larger maternity units, giving the diagram a

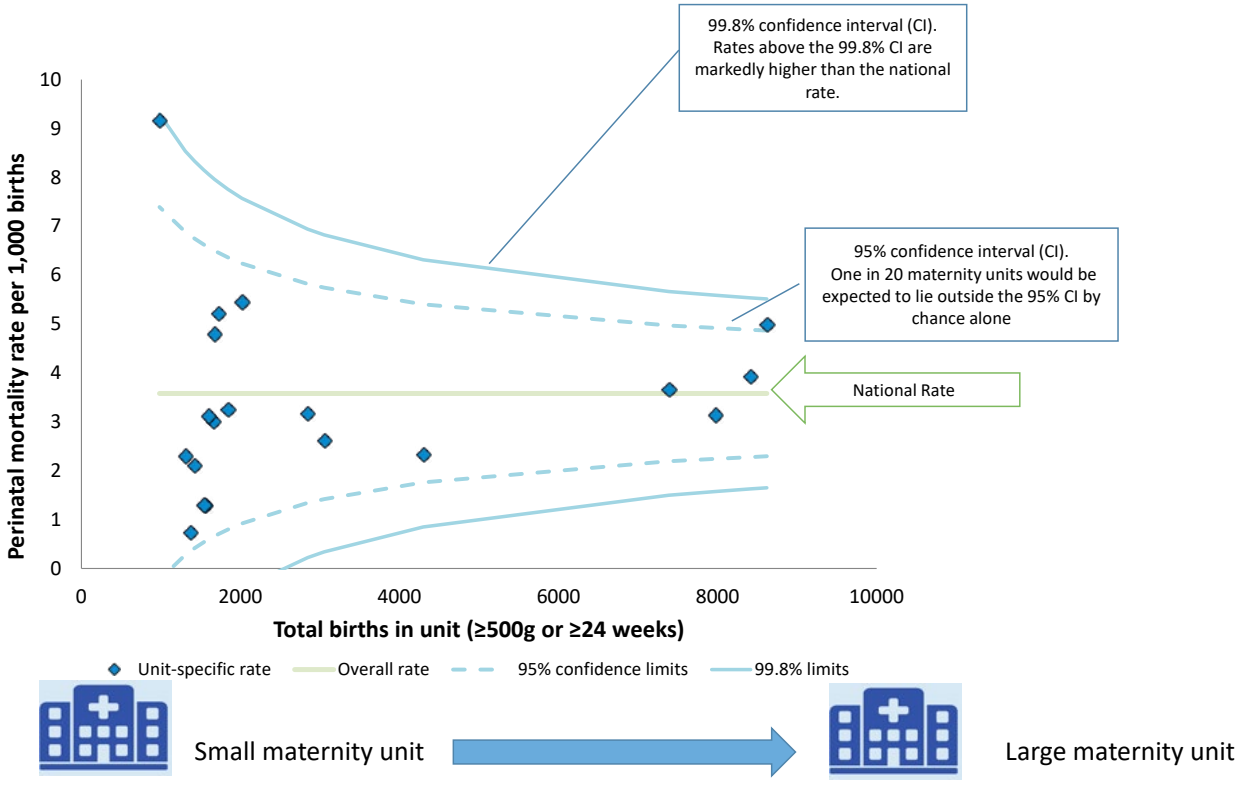


Figure IV: Diagram outlining the interpretation of a Funnel Plot

'funnel' shape. Maternity unit rates outside the 95% and 99.8% confidence interval are statistically significantly different from the national rate. In general, one in 20 units would be expected to lie outside the 95% confidence limits by chance alone whereas an observation outside the 99.8% confidence limits is especially rare, i.e. there is a 0.2% chance of this happening (Figure IV).

Birthweight centile

As with previous reports, we have produced charts to highlight the issue of failure of fetal growth in utero in relation to the stillbirths and early neonatal deaths that occurred in Ireland in 2020. To do so, we used the Gestation Related Optimal Weight (GROW) software[14] and coefficients derived from the multiple regression analysis of data on 11,072 births in six maternity units in Dublin, Galway, Limerick and Belfast in 2008-2009.[15]

The regression analysis determined the Term (i.e. 40 weeks) Optimal Weight (TOW) in Ireland to be 3,490.7g. The normal range (i.e. the range from the 10th centile weight to the 90th centile weight) around the TOW was then calculated and the recommended proportionality growth function was applied to the TOW, the 10th centile term weight and the 90th centile term weight in order to determine the optimal weight and normal range at all gestations (21-44 weeks for the stillbirths and early neonatal deaths in Ireland in 2020). These steps are described in detail in the GROW documentation.

Customised birthweight centiles were also derived using the GROW software. There was missing data for maternal height (n=28, 7.8%) and weight (n=26, 7.3%). For these cases, we used the median height and weight of the mothers with complete data. The GROW software also provides estimated customised birthweight centiles in cases with missing data. Ultimately, customised birthweight centiles were calculated for 355 of the 357 perinatal deaths in 2020.

Classification of abnormal placental histology

Abnormal placental findings have been classified and presented under the following broad categories: maternal vascular malperfusion, fetal vascular malperfusion, cord pathology, cord pathology with distal disease, delayed villous maturation defect, chorioamnionitis, villitis and 'other placental condition' (Appendix F). This is in keeping with recommendations in a publication from an international consensus meeting of pathology, often referred to as the 'Amsterdam convention'.[16] It is envisaged that this will optimise classification of placental conditions causing or contributing to perinatal loss.

Classification of death

The NPEC data collection form requests contributors to identify maternal, fetal and neonatal conditions, using specific categories, which caused or were associated with the death. Unit contributors are also requested to assign the principal cause of death with reference to the post mortem and placental pathology if performed. Guidance and definitions for completing specific categories are described in Appendix G. Briefly described; categories include both pathophysiological entities and clinical conditions present at time of death including congenital fetal anomaly, placental pathology and Intra-Uterine Growth Restriction (IUGR). Classification of stillbirths were made using the NPEC maternal and fetal classification system. In the case of neonatal deaths, the NPEC neonatal classification system was used to attribute the main neonatal cause of death and the NPEC maternal and fetal classification system was used to identify the underlying obstetric condition/sentinel event associated with the death.

[14] Gardosi J, Francis A. Customised Weight Centile Calculator. GROW version 8.0.6.1(IE), 2021 Gestation Network, www.gestation.net

[15] Unterscheider J, Geary MP, Daly S, McAuliffe FM, Kennelly MM, Dornan J, Morrison JJ, Burke G, Francis A, Gardosi J, Malone FD. The customized fetal growth potential: a standard for Ireland. Eur J Obstet Gynecol Reprod Biol 2013; 166(1):14-7

[16] Khong TY, Mooney EE et al (2016). Sampling and definition of placental lesions. Arch Pathol Lab Med 2016 Jul;140 (7):698-713

Robson Ten Group Classification System

For the first time in 2020, all 19 units that participated in the perinatal mortality audit also provided data on all deliveries classified according to the Ten Group Classification System (Appendix H). For the reporting years 2018 and 2019, 16 and 17 of the 19 Irish maternity units respectively collated data on all births using the TGCS. This facilitated perinatal deaths corrected for congenital anomalies to be classified according to the Ten Groups at national level.

Definitions and terminology

While individual units define perinatal cases similarly, there is some variation. To allow for comparison across all units the NPEC used the following definitions for the current report:

Stillbirth: The NPEC seeks to apply a definition of stillbirth in accordance with the Irish Stillbirths Registration Act, which specifies stillbirth as a child born weighing 500 grammes or more or having a gestational age of 24 weeks or more who shows no sign of life.[17] In previous reports, we considered delivery ≥24 gestational weeks to be coterminous with having a gestational age of 24 weeks or more. However, cases of fetus papyraceous, where one of the twin fetuses died early in development, were not included as stillbirths. From 2016, cases of intrauterine death diagnosed before 24 gestational weeks with a birthweight <500g are not considered to have reached a gestational age of 24 weeks or more and thus are not included as stillbirths in this audit.

Early neonatal death: Death of a live born baby occurring within 7 completed days of birth.

Late neonatal death: Death of a live born baby occurring after the 7th day and within 28 completed days of birth.

Live birth: Live birth refers to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life - e.g. beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles - whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born.[18]

Total births: For the purpose of calculating perinatal mortality rates, the denominator used was the number of births (live birth and stillbirths) from 24 weeks gestation or birthweight >500g.

Stillbirth rate: Number of stillbirths per 1,000 births (live births and stillbirths from 24 weeks gestation or weighing >500g). The reporting guideline used by the Irish Healthcare Pricing Office perinatal statistics report on stillbirths uses the criterion of birthweight >500g.[19] For consistency, we also report the stillbirth rate using the criterion of birthweight >500g.

Neonatal death rate: Number of early neonatal deaths per 1,000 live births (from 24 weeks gestation or weighing >500g). The Irish Healthcare Pricing Office perinatal statistics report on early neonatal deaths with a birthweight >500g. For consistency, we also report the early neonatal death rate using the criterion of birthweight >500g.

Overall perinatal mortality rate (PMR): Number of stillbirths and early neonatal deaths per 1,000 births (live births and stillbirths from 24 weeks gestation or weighing >500g). Again for consistency with the Irish Healthcare Pricing Office reporting of perinatal statistics, we also report the neonatal death rate using the criterion of birthweight >500g. Late neonatal deaths are not included in the PMR.

Corrected PMR: Perinatal mortality rate excluding perinatal deaths associated with or due to a major congenital anomaly.

Booking: Some data sought by the NPEC Perinatal Death Notification Form relate to the time of booking. Booking in this regard relates to the mother's first antenatal visit at the maternity unit.

[17] Stillbirth Registration Act, 1994. Available at: www.irishstatutebook.ie/eli/1994/act/1/enacted/en/print

[18] World Health Organisation. Available at: www.who.int/healthinfo/statistics/indmaternalmortality/en/

[19] Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press]

In utero transfer: From January 2016, the NPEC Perinatal Death Notification Form contains a specific question on whether the obstetric care of the mother was transferred to another maternity unit with the fetus in utero. The identity of the transferring unit and gestational age at time of in-utero transfer are also captured.

Parity: The number of completed pregnancies, whether live birth or stillbirth, of at least 24 weeks gestation or with a birthweight ≥500g. We refer to parity prior to the pregnancy that resulted in a perinatal loss in 2020.

Gravida: The number of times the mother has been pregnant, irrespective of duration. We refer to gravida prior to the pregnancy that resulted in a perinatal loss in 2020.

Termination of pregnancy (TOP): Following the Repeal of the Eighth amendment and the subsequent Health (Regulation of Termination of Pregnancy) Act 2018; termination of pregnancy became legal in the Republic of Ireland (ROI) in January 2019.

The NPEC Perinatal Death Notification Form contains a specific question on whether the perinatal loss occurred following Termination of Pregnancy (TOP). TOP refers to all cases where the pregnancy is medically ended, with the expected outcome of fetal or early neonatal death, in either of the following events: when there is a risk to the life, or of serious harm to the health, of the pregnant woman and for a condition likely to lead to death of foetus either before or within 28 days of birth. Since January 2019, limited data on perinatal deaths, as defined in this audit, following TOP are detailed in the NPEC Perinatal Mortality Audit Reports.

Data Quality Statement

In the National Perinatal Epidemiology Centre the maintenance of data at high quality standards is a priority. The purpose of this data quality statement is to support the interpretation and quality of the information contained in this report.

This quality statement, presented in Appendix I, has been developed in line with the Health Information and Quality Authority (HIQA) guidance on data quality framework for health and social care.[20] The statement describes the quality of the data according to five data quality dimensions as defined by HIQA:

1. Relevance
2. Accuracy and reliability
3. Timeliness and punctuality
4. Coherence and comparability
5. Accessibility and clarity

The Perinatal Mortality National Clinical Audit adheres to following national and international legislation and standards:

- The European Union General Data
- Protection Regulation 2016
- The Data Protection Act 1988 and the
- Data Protection (Amendment) Act 2003
- Data Protection Act 2018 (Section 36(2)) (Health Research) Regulations 2018
- Information Management Standards for National Health and Social Care Data (2017)
- National Office of Clinical Audit Standards for National Clinical Audit
- National Standards for Safer Better Healthcare (2012)
- FAIR (Findable, Accessible, Interoperable, and Re-usable) Data Principles

[20] Health Information and Quality Authority. Guidance on a data quality framework for health and social care 2018. : HIQA; 2018 [cited 2019]. Available from: www.hiqa.ie/sites/default/files/2018-10/Guidance-for-a-data-quality-framework.pdf

1. Main findings

Perinatal mortality rate

This section of the report provides details of the perinatal mortality rate (PMR), maternal and infant characteristics and autopsy uptake. In line with previous reports, the findings provided in this section relate to stillbirths and early neonatal deaths only. Separate sections are then provided for stillbirths, early neonatal deaths and late neonatal deaths describing clinical management and the main cause of death based on the NPEC Classification System.

In 2020, the 19 Irish maternity units reported 57,114 births with a birthweight >500g or gestational age of ≥ 24 weeks. Of these 57,114 births, 357 met the criteria and were classified as perinatal deaths. Stillbirths and early neonatal deaths accounted for 240 (67.2%) and 117 (32.8%) of the 357 deaths, respectively. There were a further 35 late neonatal deaths in 2020.

The reporting guideline used by the Irish Healthcare Pricing Office (HPO) in their publication of national perinatal statistics, uses the criterion of birthweight >500g. In 2020, there were 57,064 babies born weighing >500g. Of these 57,064 babies, 330 met the criteria and were classified as perinatal deaths. Stillbirths and early neonatal deaths accounted for 219 (66.4%) and 111 (33.6%) of the 330 deaths, respectively. A further 35 babies met the criteria and were classified as late neonatal deaths in 2020.

As detailed in Table 1.1, the stillbirth rate associated with the criteria of birthweight >500g or gestational age >24 weeks was 4.20 per 1,000 births and the early neonatal death rate using the same criteria was 2.06 per 1,000 live births compared respectively to 3.84 and 1.95 per 1,000 births based on birthweight >500g. The overall PMR was 6.25 deaths per 1,000 births and when corrected for congenital anomaly was reduced to 3.68 whereas the respective rates based on birthweight >500g were 5.78 and 3.40 per 1,000 births.

Table 1.1: Frequency and rate of perinatal mortality outcomes, 2020

	BWT ≥500g or gestational age ≥24 weeks		BWT ≥500g	
	Number	Rate (95% CI)	Number	Rate (95% CI)
Total births	57,114		57,064	
Stillbirths	240	4.20 (3.69-4.77)	219	3.84 (3.35-4.38)
Early neonatal deaths	117	2.06 (1.70-2.47)	111	1.95 (1.61-2.35)
Perinatal deaths	357	6.25 (5.62-6.93)	330	5.78 (5.18-6.44)
Corrected perinatal deaths	210	3.68 (3.2-4.21)	194	3.40 (2.94-3.91)

Note: BWT=Birthweight; Rate per 1,000 births; 95% CI=95% Poisson confidence interval;
Corrected perinatal deaths exclude deaths due to a congenital anomaly.

European comparison of the rate of stillbirth

In 2022, a published article entitled, the *Clarity and consistency in stillbirth reporting in Europe: why is it so hard to get this right?*[21] compared routine stillbirth statistics in Europe reported by Eurostat with data from the Euro-Peristat research network for stillbirths ≥500 grammes (g) and ≥1000g. Based on the former criteria, Figure 1.1 illustrates the 2020 Irish total stillbirth rate and the corrected Irish stillbirth rate, which excludes cases due to a major congenital anomaly in comparison to the reported stillbirth rate for the other countries in Europe.

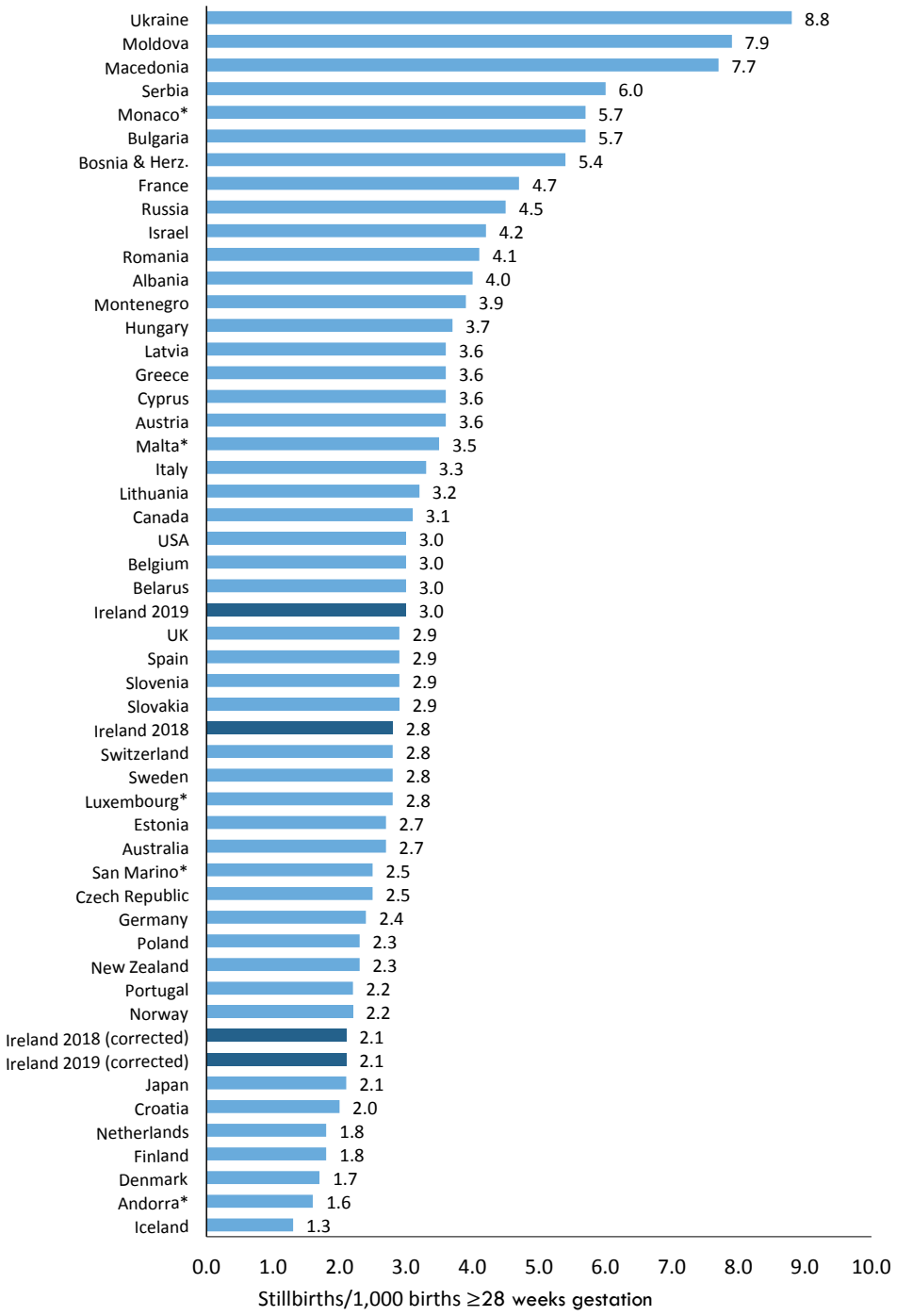


Figure 1.1: Irish stillbirth rate in 2020 compared to the stillbirth rate in other countries in Europe in 2015

Note: Rates based on stillbirths among births with ≥500 grammes. The Irish stillbirth rate, when corrected by excluding cases due to a major congenital anomaly, is adjusted to 2.61 per 1,000 births in 2020.

[21] Gissler M, Durox M, Smith L, Blondel B, Broeders L, Hindori-Mohangoo A, Kearns K, Kolarova R, Loghi M, Rodin U, Szamotulska K. Clarity and consistency in stillbirth reporting in Europe: why is it so hard to get this right?. European journal of public health. 2022 Apr;32(2):200-6. June 2022. Available: https://academic.oup.com/eurpub/article/32/2/200/6528409?login=true

Comparison of perinatal mortality, 2015-2020

Table 1.2 compares the perinatal mortality outcomes for 2020, based on the criteria of birthweight ≥500g or gestational age ≥24 weeks at delivery, with those of the previous five years. There was no change in rates of perinatal mortality compared to 2019.

Table 1.2: Comparison of perinatal statistics, 2012-2020

	Total births	Stillbirths		Early neonatal deaths		Perinatal deaths		Corrected perinatal deaths	
	N	n	rate	n	rate	n	rate	n	rate
2012	71,755	299	4.17	141	1.97	440	6.13	292	4.07
2013	69,146	294	4.25	162	2.34	456	6.59	296	4.28
2014	67,663	324	4.79	142	2.10	466	6.89	315	4.66
2015	65,904	287	4.35	166	2.50	453	6.87	279	4.23
2016	64,133	250	3.90	124	1.90	374	5.83	228	3.56
2017	62,076	235	3.79	111	1.80	346	5.57	220	3.54
2018	61,298	217	3.54	108	1.77	325	5.30	196	3.20
2019	59,574	242	4.06	118	1.99	360	6.04	222	3.73
2020	57,114	240	4.20	117	2.06	357	6.25	210	3.68
Rate Ratio compared to 2019 (95% CI)		1.03 (0.87-1.24)		1.03 (0.80-1.34)		1.03 (0.89-1.20)		0.99 (0.82-1.19)	
Rate Ratio compared to 2018 (95% CI)		1.19 (0.99-1.43)		1.16 (0.90-1.51)		1.18 (1.01-1.37)		1.15 (0.95-1.40)	

Note: Rates are per 1,000 births; RR=Rate ratio comparing rate in 2020 versus rate in 2018 and 2019; 95% CI=Exact Poisson 95% confidence intervals; Corrected perinatal deaths exclude deaths due to a major congenital anomaly.

Decreasing rates of perinatal mortality were observed in the decade prior to 2012.[22] Then the rates levelled off, as illustrated in Figure 1.2, and since 2018, there is an increase in perinatal mortality in Ireland (rate ratio, RR=1.18, 95%CI=1.01-1.37, p-value=0.032).

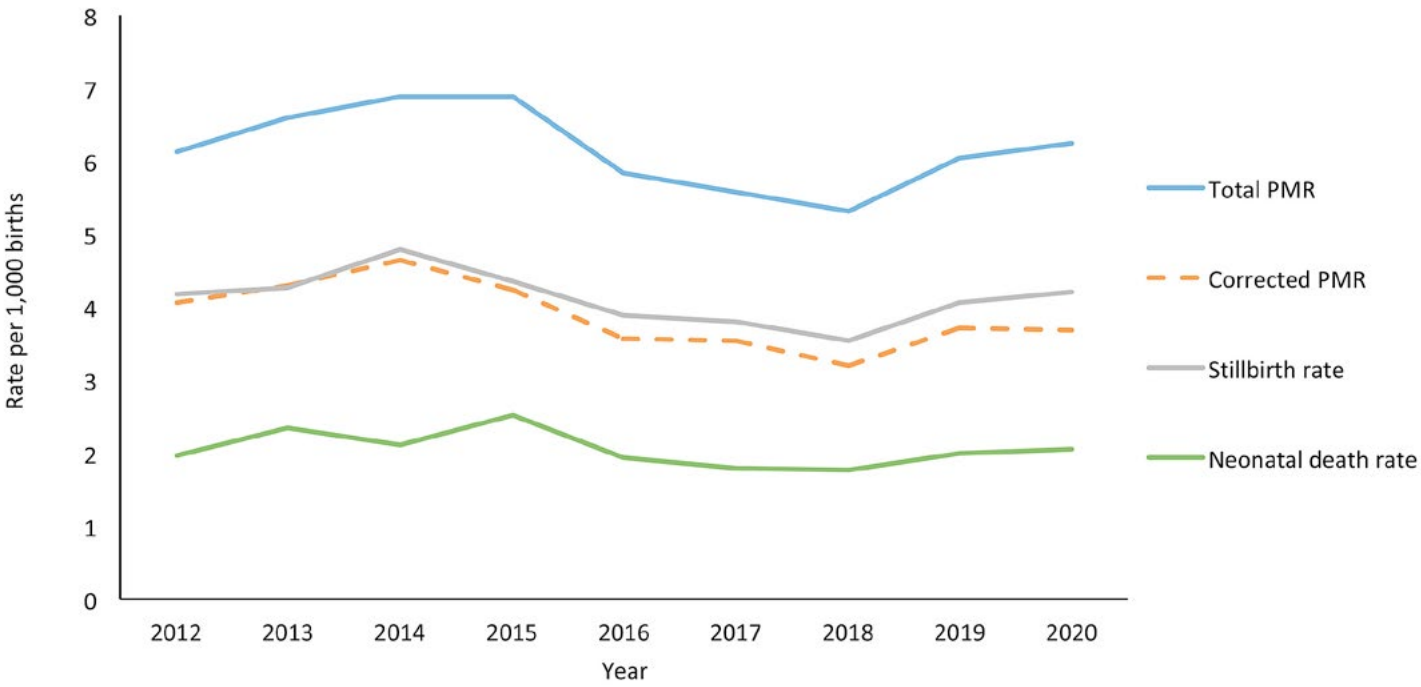


Figure 1.2: Trend in perinatal mortality rates in Ireland, 2012-2020

Note: Rates per 1,000 births; PMR = perinatal mortality rate; Corrected PMR excludes deaths due to a Major Congenital Anomaly.

While reductions in perinatal mortality are not easy to achieve, other countries have made significant reductions in recent years. In the UK, a 20% reduction in stillbirths and a 5.1% reduction in neonatal deaths was achieved.[23] A similar approach in New Zealand has led to an 11% reduction in stillbirths.[24] The Netherlands have shown the highest rate of decrease in stillbirths of 48 countries, at 6.2% per year from 2000 to 2015, while Ireland had a reduction of 3.5% per year.[25] The reductions in the different countries have been achieved through the use of various care bundles, with the greatest reductions been found in stillbirths. NHS England has the 'Saving Babies Lives Care Bundle' which focuses on reducing smoking in pregnancy, risk assessment and surveillance for fetal growth restriction, raising awareness of reduced fetal movement, effective fetal monitoring during labour and the reduction of preterm birth.[26] Similar approaches are undertaken in New Zealand, for example, the National Maternity Monitoring Group (NMMG) was established in 2012 as part of the Maternity Programme to oversee and review national maternity standards and highlight areas in need of improvement. The Netherlands have prioritised the implementation of learning points from audits, and a programme has been developed to help local teams with the implementation process.[27]

[22] Healthcare Pricing Office. (2016) Perinatal Statistics Report 2014. Dublin:

[23] NHS England. Better Births Four Years On: A Review of Progress.; 2020 https://www.england.nhs.uk/wp content/uploads/2020/03/better-births-four-years-on-progress-report.pdf.

[24] PMMRC. Twelfth Annual Report of the Perinatal and Maternal Mortality Review Committee Reporting Mortality 2016.; 2018

[25] Flenady V, Wojcieszek AM, Middleton P, et al. Stillbirths: Recall to action in high-income countries. Lancet. 2016;387(10019):691-702.

[26] Saving-Babies-Lives-Care-Bundle-Version-Two-Updated-Final-Version.pdf (england.nhs.uk).

[27] www.actiontoolkit.nl.

In the Irish context, the introduction of a care bundle approach by the relevant agencies (the NWIHP, the IOG and the Department of Health and Well Being in the HSE), may assist the maternity services in Ireland to achieve a reduction in the perinatal mortality and morbidity rates. An example of a care bundle for the Irish context might include:

- Public health programmes which focuses on
  - reducing smoking in pregnancy,
  - weight management to lower BMI and prepare women for a healthier entry to pregnancy
  - raising awareness of stillbirth and reduced fetal movements.
- Healthcare staff education on modifiable health risk factors and using the MECC programme.
- Develop a care pathway including staff education around risk assessment and surveillance for fetal growth restriction using a standard national approach
- Effective fetal monitoring during labour with potential cross over effects for a reduction in Neonatal Brain injury and intrapartum related death.[28]
- Integrate best practice research for a reduction of preterm labour
- Develop a standard approach to assessment of all Perinatal Deaths including/consulting with parents for reviews of their care. The learning points from these reviews should be communicated to all staff.[29]
- Establish a Confidential Review for stillbirth and neonatal deaths, which should be considered in order to enhance the lessons which may improve care.

The value of a care bundle would be a service wide approach to more effective care using the learning from this audit, international success and research and learning around the topic of Perinatal Mortality and potential cross over effects to reduce neonatal morbidity.

[28] Neonatal Therapeutic Hypothermia in Ireland, Annual Report 2019. Cork. Available at: www.ucc.ie/en/media/research/nationalperinatalepidemiologycentre/Published2019AnnualReportv1.pdf

[29] Health Service Executive. On the Implementation of the National Standards for bereavement care following pregnancy loss and perinatal death, 2021. Available at: www.hse.ie/eng/about/who/acute-hospitals-division/woman-infants/bereavement-care/hse-national-standards-for-bereavement-care.pdf

Variation by maternity unit

Based on the criteria of a birthweight ≥500g and/or a gestational age of ≥ 24 weeks at delivery, in 2020, the uncorrected PMR across the Irish maternity units ranged from 1.46 to 10.70 per 1,000 births and the corrected PMR ranged from 0.87 to 6.50 per 1,000 births (Table 1.3). This level of variation across units is higher in 2020 compared to 2019. There was weak correlation between the unit specific corrected PMR in 2019 and 2020. It must be noted that year-to-year changes at the level of individual units are volatile due to the smaller numbers involved. Moreover, the profile of mothers delivered may differ across Irish maternity units and this may explain variation in perinatal mortality rates. However, to establish this requires more detailed information on all mothers delivered at Irish maternity units than is currently available.

Table 1.3: Perinatal mortality rates across Irish maternity units in 2019 and 2020

Unit	Uncorrected PMR (95% CI)		Corrected PMR (95% CI)	
	2019	2020	2019	2020
Cavan (CGH)	5.08 (2.51-11.42)	1.46 (0.18-5.25)	3.63 (1.18-8.45)	1.46 (0.18-5.25)
Coombe (CWIUH)	5.92 (4.46-8.01)	5.68 (4.11-7.64)	4.16 (2.55-5.39)	3.17 (2.03-4.71)
Cork (CUMH)	8.32 (4.44-8.19)	6.67 (4.91-8.86)	4.72 (2.47-5.44)	3.41 (2.18-5.07)
Drogheda (OLOL)	4.06 (3.62-9.61)	7.04 (4.31-10.86)	2.71 (1.86-6.65)	5.99 (3.49-9.57)
Galway (UHG)	3.87 (3.49-9.57)	10.7 (7.12-15.43)	1.06 (1.94-6.92)	6.50 (3.79-10.38)
Kerry (UHK)	1.68 (2.36-12.05)	1.73 (0.21-6.24)	0.84 (0.91-8.56)	0.87 (0.02-4.81)
Kilkenny (SLHK)	1.37 (2.83-11.71)	5.56 (2.4-10.92)	1.37 (1.12-8.00)	2.78 (0.76-7.1)
Letterkenny (LUH)	3.04 (2.92-11.16)	3.87 (1.42-8.41)	2.43 (1.34-7.93)	1.94 (0.4-5.65)
Limerick (UMHL)	4.09 (3.9-8.87)	4.88 (2.23-9.24)	2.65 (2.02-5.95)	2.66 (1.33-4.75)
Mayo (MUH)	5.84 (2.67-11.06)	2.83 (0.77-7.23)	1.95 (1.43-8.46)	1.41 (0.17-5.1)
Mullingar (RHM)	6.54 (3.12-10.52)	4.88 (2.23-9.24)	4.02 (1.42-7.24)	4.88 (2.23-9.24)
National Maternity (NMH)	9.12 (4.42-7.94)	8.24 (6.31-10.58)	5.00 (2.53-5.34)	5.41 (3.86-7.35)
Portiuncula (PUH)	5.23 (2.7-11.14)	6.43 (2.94-12.17)	3.27 (1.44-8.52)	3.57 (1.16-8.31)
Portlaoise (MRHP)	4.03 (2.77-11.44)	5.67 (2.45-11.15)	4.03 (1.48-8.74)	4.96 (2-10.2)
Rotunda (RH)	8.07 (4.51-7.95)	6.60 (4.98-8.59)	5.34 (2.5-5.22)	3.00 (1.94-4.43)
Sligo (SUH)	2.93 (2.53-11.5)	6.02 (2.6-11.84)	2.19 (1.19-8.51)	3.77 (1.22-8.76)
Tipperary University Hospital (TippUH)	5.65 (1.84-13.13)	5.12 (1.4-13.04)	4.52 (0.7-9.87)	2.56 (0.31-9.21)
Waterford (UHW)	4.63 (2.78-10.61)	5.51 (2.52-10.43)	2.89 (1.27-7.54)	4.28 (1.72-8.81)
Wexford (WGH)	1.81 (2.90-11.06)	5.03 (2.17-9.89)	1.21 (1.33-7.86)	2.52 (0.69-6.43)
National*	6.04 (5.44-6.7)	6.25 (5.62-6.93)	3.73 (3.25-4.25)	3.68 (3.2-4.21)

Note: Rates per 1,000 births based on birthweights ≥500g or gestational age ≥24 weeks; PMR=perinatal mortality rate; 95% CI= 95% Poisson confidence interval; Corrected PMR excludes deaths due to a congenital anomaly; *Includes one baby not cared for or included in any of the 19 maternity units.

In utero transfer

In Ireland, women with high-risk pregnancies may be transferred to the care of tertiary maternity units with facilities for specialist fetal medicine and high-level neonatal intensive care. Of the 357 perinatal deaths in 2020, there were 37 cases (10.4%) where the care of the pregnant woman was transferred in utero. These 37 in utero transfers resulted in 15 stillbirths (40.5%) and 22 early neonatal deaths (59.5%). All but six of the 37 in utero transfer cases in 2020 were transferred to one of the country's four large maternity hospitals (i.e., the National Maternity Hospital, the Rotunda Hospital, The Coombe Women & Infants University Hospital, and the Cork University Maternity Hospital).

The solid horizontal line in Figure 1.3 represents the national PMR in 2020 (6.25 deaths per 1,000 births) and the lettered square markers represent each unit's PMR. The dashed curves represent the 95% confidence limits around the national rate and the full curves represent the 99.8% confidence limits. For maternity units with a PMR equivalent to the national rate, there is a 5% chance that a unit's observed PMR will be outside the 95% confidence limits and a one-in-500 or 0.2% chance that a unit's observed PMR will be outside the 99.8% confidence limits.

In Figure 1.3, the red square markers represent each unit's PMR in 2020 if the 37 in utero transfers had not happened, i.e., if all mothers who experienced perinatal loss after their care was transferred in utero had instead experienced perinatal loss in the care of the maternity unit where she intended to deliver at the time of her first antenatal visit. As previously mentioned, in Ireland, women with high-risk pregnancies may be transferred to the care of tertiary maternity units with facilities for specialist fetal medicine and high-level neonatal intensive care. These transfers are undertaken in the best interest of the mother and her baby/babies to allow appropriate care for preterm deliveries, complex congenital fetal anomalies and maternal complications.

As we can see in Figure 1.3, without these in utero transfer cases, almost all of the country's small maternity units would have had a higher PMR while the PMR for the four large maternity hospitals, considered together, would have been 14.6% lower. This impact varied across the four large maternity hospitals, as illustrated in Figure 1.3. Without these in utero transfers, the PMR in 2020 would have been 6.4% lower for one hospital, 9.1% lower for another hospital, 14.0% lower for the third hospital and 26.2% lower for the fourth hospital. This fourth hospital had an uncorrected PMR above the national rate and between the upper 95% confidence limit and the upper 99.8% confidence limit. However, the rate for this unit was almost identical for the national rate after adjusting for in utero transfers.

Among the smaller units, one maternity unit had an uncorrected PMR above the national rate and between the upper 95% confidence limit and the upper 99.8% confidence limit. Another unit had an uncorrected PMR below the national rate and between the lower 95% confidence limit and the lower 99.8% confidence limit. Neither of the PMRs of these units were influenced by in utero transfers.

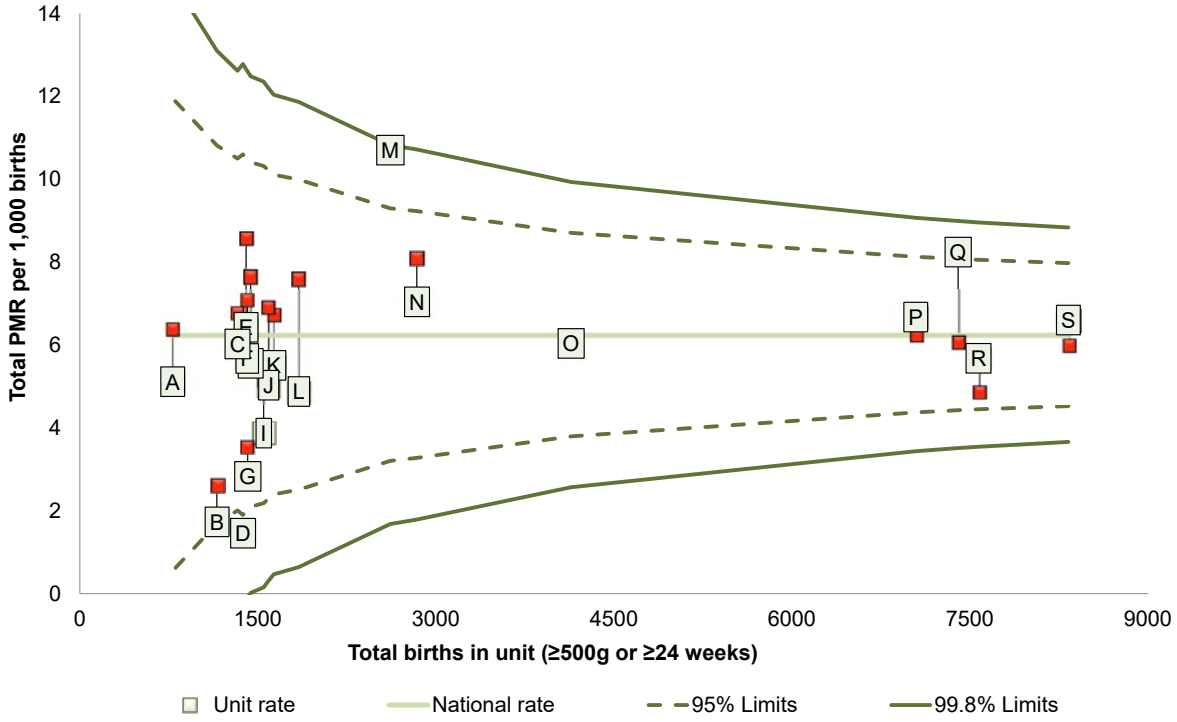


Figure 1.3: Funnel plot of the perinatal mortality rate (PMR) for Irish maternity units, 2020

Note: Two units (H & F) have similar unit rates, represented by the overlapping lettered square markers.

A – Tipperary (TippUH);
B – Kerry (UHK);
C – Sligo (SUH);
D – Cavan (CGH);
E – Portiuncula (PUH);
F – Portlaoise (MRHP);
G – Mayo (MUH);
H – Kilkenny (SLHK);
I – Letterkenny (LUH);
J – Wexford (WGH);
K – Waterford (UHW);
L – Mullingar (RHM);
M – Galway (UHG);
N – Drogheda (OLOL);
O – Limerick (UMHL);
P – Cork (CUMH);
Q – National Maternity (NMH);
R – Coombe (CWIUH);
S – Rotunda (RH).

Corrected perinatal mortality rate

The solid horizontal line in Figure 1.4 represents the national corrected PMR in 2020 (3.68 deaths per 1,000 births) based on the 210 perinatal deaths not due to congenital anomaly.

Fifteen (7.1%) of the 210 perinatal deaths were associated with cases where the care of the pregnant woman was transferred in utero. As indicated by the red markers in Figure 1.4, the corrected PMR of most small maternity units would have been higher if these in utero transfers did not occur and the corrected PMR of three of the four large maternity hospitals would have been lower.

Two small maternity hospitals had corrected PMRs (6.50 and 5.99 per 1,000 births for M and N, respectively) that were higher than the national rate and just above the upper 95% confidence limit. One of the units had one in utero transfer to another maternity hospital. The corrected PMR would have been slightly higher (6.88 per 1,000 births) and above the 95% confidence limits if in utero transfer cases had stayed in the care of the hospital. There were no in utero transfers associated with the second small maternity hospital (N) that might have influenced its corrected PMR. Neither of these units were above the 95% confidence limit in 2019, and as such they do not meet the criteria for the National Office of Clinical Audit (NOCA) escalation process which defines a statistical outlier as results that fall "two standard deviations on or above the expected value across two consecutive reporting periods or above three standard deviations on or above the expected value in one or more reporting period".[30]

One large maternity hospital had a corrected PMR (5.41 per 1,000 births) higher than the national rate and above the upper 95% confidence limit. There were seven perinatal deaths after in utero transfer to this maternity hospital. Without these cases, the corrected PMR would have been 4.46 per 1,000 births and thus under the upper 95% confidence limit.

[30] National Office of Clinical Audit (NOCA) Monitoring and escalation policy 2017. Available at: Available at: http://s3-eu-west-1.amazonaws.com/noca-uploads/general/NOCA-GEN-POL014_-_NOCA_-_Monitoring_Escalation_Policy_v2.1.pdf

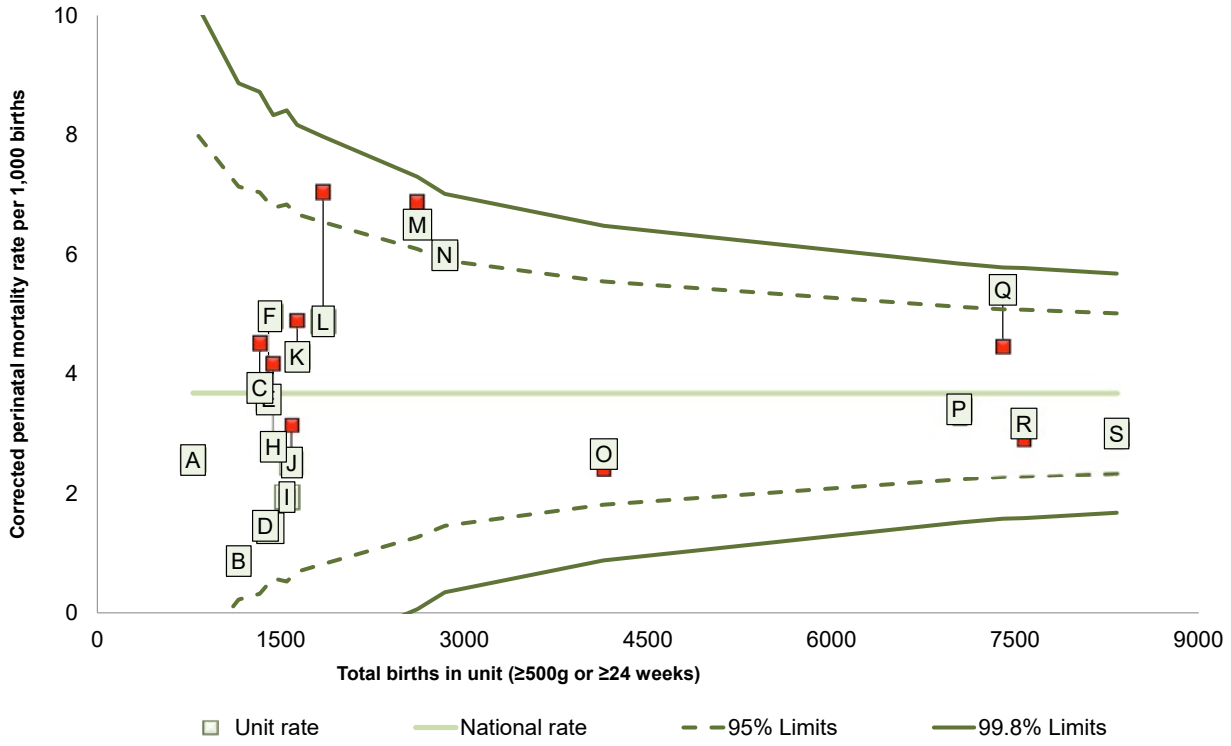


Figure 1.4: Funnel plot of the corrected perinatal mortality rate for Irish maternity units, 2020.

Note: Two units (D & G) have similar unit rates, represented by the overlapping lettered square markers.

A – Tipperary (TippUH);
B – Kerry (UHK);
C – Sligo (SUH);
D – Cavan (CGH);
E – Portiuncula (PUH);
F – Portlaoise (MRHP);
G – Mayo (MUH);
H – Kilkenny (SLHK);
I – Letterkenny (LUH);
J – Wexford (WGH);
K – Waterford (UHW);
L – Mullingar (RHM);
M – Galway (UHG);
N – Drogheda (OLOL);
O – Limerick (UMHL);
P – Cork (CUMH);
Q – National Maternity (NMH);
R – Coombe (CWIUH);
S – Rotunda (RH).

Stillbirth and early neonatal death rate

In Figure 1.5, the solid horizontal line represents the annual national stillbirth rate of 4.2 per 1,000 births based on cases reported for 2020. All the units were within 95% confidence limit.

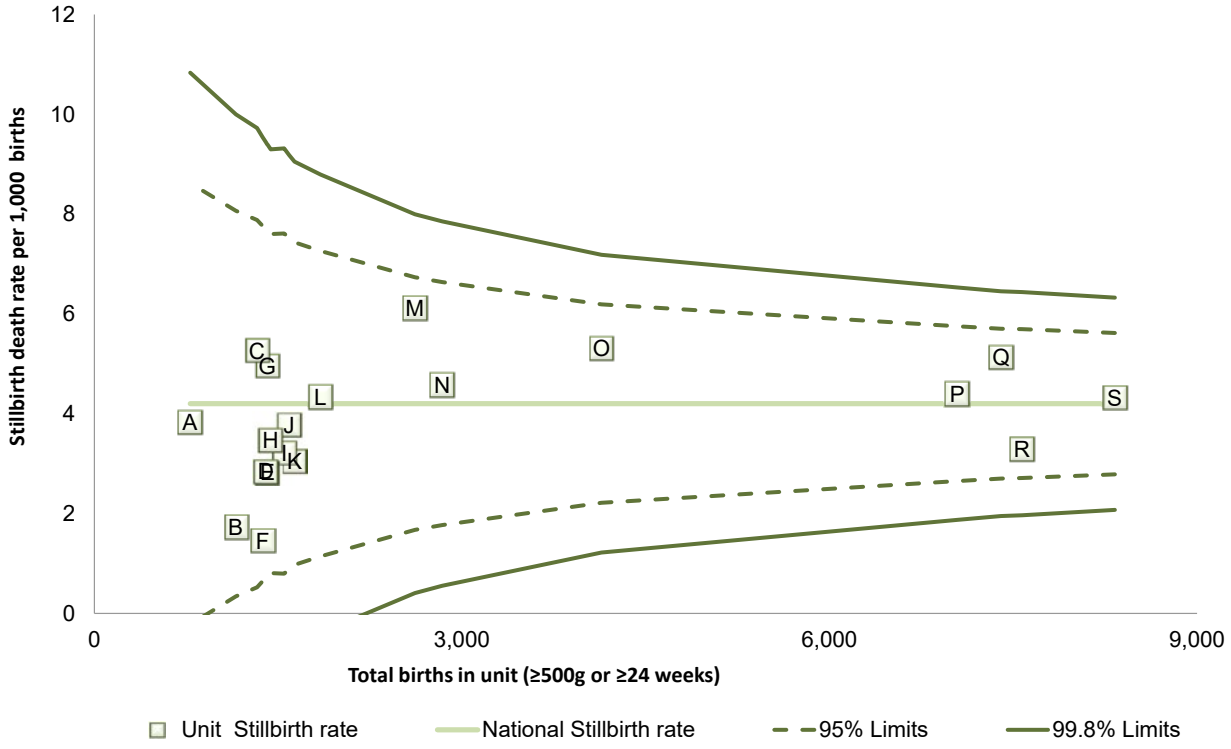


Figure 1.5: Funnel plot of the stillbirth rate for Irish maternity units, 2020

Note: Two units (D & E) have similar unit rates, represented by the overlapping lettered square markers.

A – Tipperary (TippUH);
B – Kerry (UHK);
C – Sligo (SUH);
D – Portiuncula (PUH);
E – Mayo (MUH);
F – Cavan (CGH);
G – Portlaoise (MRHP);
H – Kilkenny (SLHK);
I – Letterkenny (LUH);
J – Wexford (WGH);
K – Waterford (UHW);
L – Mullingar (RHM);
M – Galway (UHG);
N – Drogheda (OLOL);
O – Limerick (UMHL);
P – Cork (CUMH);
Q – National Maternity (NMH);
R – Coombe (CWIUH);
S – Rotunda (RH).

The solid horizontal line in Figure 1.6 represents the annual national early neonatal death rate of 2.06 per 1,000 live births based on cases reported for 2020. One of the four large maternity hospitals had a rate higher than the national rate just above the upper 95% confidence limit. As shown in earlier funnel plots, deaths due to congenital anomaly or following in utero transfer were associated with elevating the rate of perinatal deaths in the large tertiary maternity hospitals. A small unit had a rate higher than the national rate and above the upper 95% confident limit, as discussed earlier with respect to the perinatal mortality funnel plots.

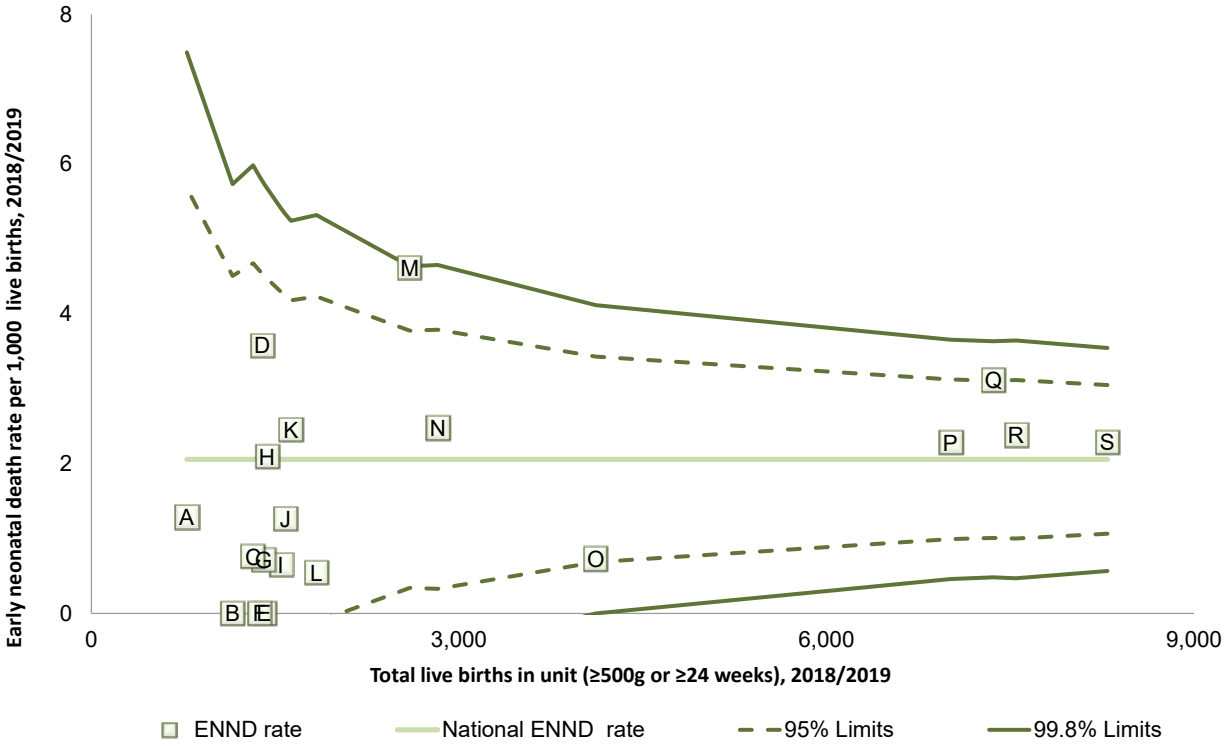


Figure 1.6: Funnel plot of the early neonatal death rate for Irish maternity units, 2020

Note: Two units (C & G) have similar unit rates as do two other units (E & F), represented by the overlapping lettered square markers.

A - Tipperary (TippUH);
B – Kerry (UHK);
C – Sligo (SUH);
D – Portiuncula (PUH);
E – Mayo (MUH);
F – Cavan (CGH);
G – Portlaoise (MRHP);
H – Kilkenny (SLHK);
I – Letterkenny (LUH);
J – Wexford (WGH);
K – Waterford (UHW);
L – Mullingar (RHM);
M – Galway (UHG);
N – Drogheda (OLOL);
O – Limerick (UMHL);
P – Cork (CUMH);
Q – National Maternity (NMH);
R - Coombe (CWIUH);
S – Rotunda (RH).

Distribution of Perinatal Deaths by Robson Ten Group Classification System

The Robson Classification, also referred to as the Ten Group Classification System (TGCS), is a classification system providing a common starting point for further detailed analysis within which all perinatal outcomes can be measured and compared.[31] The system classifies all pregnant women into one of 10 categories that are mutually exclusive and, as a set, totally comprehensive.[32]

The categories are based on five basic obstetric characteristics that are routinely collected for all maternities: parity, gestational age, onset of labour, fetal presentation, and number of fetuses.

In cases of antepartum stillbirth, the baby is usually delivered following induction of labour or by pre-labour caesarean section. This places most women who experience antepartum stillbirth into Group 2 or Group 4, depending on parity. It thereby causes these groups to have relatively high perinatal mortality rates compared to groups 1 and 3, which is a consequence of care after the perinatal loss event rather than reflecting valid differences in risk. To address this issue, we report perinatal mortality data for Groups 1 and 2 combined and Group 3 and 4 combined. The TGCS allows for further investigation of Perinatal Mortality by group. Treating Groups 1 & 2 and Groups 3 & 4 as single cohorts allows focus on the principal groups of nulliparous and multiparous women, irrespective of mode of delivery.[33]

[31] Robson MS (2001). Classification of caesarean sections. Fetal and Maternal Medicine Review, 12, pp 23-39 doi:10.1017/S0965539501000122

[32] Robson M et al. The 10-Group Classification System (Robson classification), induction of labor, and cesarean delivery. International Journal of Gynecology and Obstetrics 131 (2015) S23–S27

[33] O'Farrell IB, Manning E, P Corcoran, Greene RA, on behalf of the Perinatal Mortality Group. Perinatal Mortality in Ireland Annual Report 2017. Cork: National Perinatal Epidemiology Centre, 2019.

For the first time in 2020, all 19 units that participated in the perinatal mortality audit also provided data on all deliveries classified according to the TGCS. For the reporting years 2018 and 2019, 16 and 17 of the 19 Irish maternity units respectively collated data on all births using the TGCS. This facilitated the perinatal deaths corrected for congenital anomalies to be classified according to the Ten Groups at national level. The table below outlines the number of deliveries reported to the NPEC for the TGCS for the years 2018, 2019, 2020 (n=163,066). Groups One through Five accounted for 87.7% of the deliveries (n= 143,046) but represented 26.6% of the perinatal deaths (n= 166).

Higher perinatal mortality rates are expected in groups 8 and group 10 considering the range of complications associated with both multiple pregnancy and prematurity. Prematurity is strongly associated with perinatal mortality. This is made especially clear by the TGCS. Group Ten contains all single cephalic pregnancies delivered preterm. This group contained 4% of the deliveries, it had the highest PMR and contributed 1.6 per 1,000 babies delivered to the overall PMR of 3.8 per 1,000 babies delivered.

The incidence of perinatal mortality varies across the groups. The Robson TGCS highlights the groups and reasons that contribute to the overall PMR and allows more focussed interventions to improve clinical care. The TGCS reinforces the need for close monitoring of multiple pregnancy and other pregnancies at risk of premature birth.

Table 1.4: Incidence of corrected perinatal deaths for major congenital anomaly by Robson TGCS in Irish maternity units 2018, 2019, 2020

Group	Group description	Group size			
		Number of babies delivered	Perinatal deaths (n)	Rate per 1,000	Group contribution to rate
All*		163066	622	3.8	–
1	Nulliparous, singleton, cephalic, ≥37 spontaneous labour	55536	74	1.33	0.5
2	Nulliparous, singleton, cephalic, ≥37 induced or elective CS				
3	Multiparous (excluding previous CS), singleton, cephalic, ≥37 spontaneous labour	62370	77	1.23	0.5
4	Multiparous (excluding previous CS), singleton, cephalic, ≥37 induced or elective CS				
5	Previous CS, singleton, cephalic, ≥37 induced or elective CS	25140	15	0.6	0.1
6**	All nulliparous women with a single breech pregnancy	7282	106	14.56	0.7
7**	All multiparous breech (including previous CS)				
9**	All women with a single pregnancy with a transverse or oblique lie, including women with previous uterine scars				
8	All multiple pregnancies (including previous CS)	5838	95	16.27	0.6
10	All singleton, cephalic, <37 (including previous CS)	6900	255	36.96	1.6

*Note: Rate is per 1,000 babies delivered 95% **Groups 6,7 and 9 are combined into one group.

Maternal characteristics

The findings presented below relate to characteristics of mothers of stillbirths and early neonatal deaths born with a birthweight ≥500g or having achieved a gestational age ≥24 weeks.

Age

The age of mothers experiencing perinatal loss was known for 356 of the 357 perinatal deaths in 2020 (99.7%) (Table 1.5). The mothers who experienced perinatal loss in 2020 ranged in age from teenage years (the youngest 17 years of age) through to mid-forties (46 years of age). Their age distribution broadly reflected that of the population of mothers who gave birth in Ireland in 2020 (Table 1.5). Over half of the population (51.1%) who gave birth in 2020 were aged 25-34 years, whereas a slightly lower proportion of mothers who experienced perinatal loss were in this age group (47.9%). The age profile of mothers who experienced a stillbirth was similar to that of mothers who experienced early neonatal death, with a higher proportion of women who experienced stillbirth in 2020 aged 25-29 years compared to women who experienced early neonatal death (20% versus 12%, respectively).

Table 1.5: Age distribution of mothers experiencing perinatal loss, 2020

Age group	All births[34] 2020 N(%)	Perinatal deaths (N=357) N(%)	Stillbirths (N=240) N(%)	Early Neonatal deaths (N=117) N(%)
<25yrs	5218(9.1)	34(9.5)	23(9.6)	11(9.4)
25-29yrs	9595(16.8)	62(17.4)	48(20.0)	14(12.0)
30-34yrs	19613(34.3)	109(30.5)	75(31.3)	34(29.1)
35-39yrs	17948(31.4)	105(29.4)	68(28.3)	37(31.6)
>40yrs	4739(8.3)	46(12.9)	26(10.8)	20(17.1)
Not stated	1(0)	1(0.3)	0(0)	1(0.9)

Note: Values are shown as n (%) unless otherwise stated. Maternal age unknown for one ENND.

An association between maternal age and perinatal mortality was found. Compared to mothers aged between 30-34 years, women aged greater than 40 years had at 1.8 times the rate of perinatal mortality (p=0.002) in 2020 (Table 1.6).

Table 1.6: Comparing the rate ratio of perinatal mortality by age group among mothers, 2020

Age group	Rate per 1,000 births (95% CI)	Rate Ratio 95% CI	P-Value
<25yrs	6.52(4.52-9.09)	1.17(0.8-1.72)	0.418
25-29yrs	6.46(4.96-8.28)	1.16(0.85-1.59)	0.343
30-34yrs	5.56(4.57-6.7)	1.00 (reference)	-
35-39yrs	5.85(4.79-7.08)	1.05(0.81-1.38)	0.707
>40yrs	9.71(7.12-12.93)	1.75(1.24-2.47)	0.002

Note: Maternal age unknown for one ENND. 95% CI=Exact Poisson 95% confidence intervals.

[34]Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press].

Ethnicity

Assessment of risk of perinatal loss associated with ethnic group is impeded by the absence of national data on ethnicity for the pregnant population in Ireland. In 2020, the majority of mothers who experienced perinatal loss were of white Irish ethnicity (n=246 of 356, 69.1%, data missing for one case) (Table 1.7). This is close to the proportion of white Irish women in the female population aged 15-49 years enumerated by the National Census 2016. While the numbers involved were small, Irish Traveller, Asian and Black ethnicities were overrepresented in the mothers who experienced perinatal deaths in 2020 (12.4%) compared to 5% of the female 15-49-year-old population.

Table 1.7: Ethnicity of mothers experiencing perinatal loss, 2020

Ethnicity	Perinatal deaths N=356* N(%)	15-49 year-old female population, 2016[35] (%)
White Irish	246(69.1)	77.1
Irish Traveller	18(5.1)	0.7
Other white background	54(15.2)	13.3
Asian/Asian Irish	17(4.8)	1.6
Black/Black Irish	9(2.5)	2.7
Other/mixed	12(3.4)	1.8
Not recorded/Missing	1(0.3)	2.7

Note: Values are shown as n (%) unless otherwise stated. *Percentages are based on available data (n=356).

Employment Status

Lower socio-economic status has been shown to be associated with poor pregnancy outcomes.[36] In the NPEC national clinical audit, data on the mother's and father's employment status at booking was sought. Data was not recorded for 18 (5.3%) of the 357 women who experienced perinatal loss, this was slightly lower than the proportion of unrecorded employment status in 2019 (6.3%). Table 1.8 provides a high-level overview of the data that were provided on mother's occupation alongside data available for the most comparable occupation categories for mothers of all births in Ireland (from the Perinatal Statistics Report 2020),[37] and for the 15–44-year-old female population from the National Census 2016.[38]

Employment status was specified for 94.9% of the mothers for whom data were recorded (Table 1.8). It can be seen that unemployment status was recorded for 8.8% of the mothers experiencing perinatal loss compared to 4.8% of all births in 2020, and 8.2% of the female population aged 15-44 years in 2016. The proportion of mothers engaged in home duties who experienced perinatal loss (16.2%) was slightly higher than the percentage of all women engaged in home duties who gave birth (15.3%) in 2020.

Table 1.8: Employment Status at booking of mothers experiencing perinatal loss, 2020

Employment Status	Perinatal deaths N=339 N(%)	All births* N=53,181 (%)	15-44 year-old female population, 2016 (%)
Employed	250(73.7)	42472(79.9)	57.8
Unemployed	30(8.8)	2573(4.8)	8.2
Home duties	55(16.2)	8136(15.3)	10.4
Student	3(0.9)	n/a	21.1
Others not in labour force	1(0.3)	n/a	2.5

Note: Data not known on employment status for 18 perinatal deaths. *Employment status was not stated or not classifiable for 6.7% of all births in 2020.

[35] Population data from the National Census 2016.

[36] Centre for Maternal and Child Enquiries (CMACE) (2010) Perinatal Mortality 2008: United Kingdom. London: CMACE.

[37] Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press].

[38] Population data from the National Census 2016.

Gestation at booking

Gestation at the time of the mother's first antenatal visit to the maternity hospital was not recorded for 23 cases of perinatal death in 2020 (6.4%).

Of the 334 cases with data, twenty-three percent (23.1%) booked into hospital before 12 weeks gestation, almost sixty eight percent (67.7%) attended for antenatal care between 12- and 19-weeks' gestation (Table 1.9). In 2020, the median gestational age at booking was 13.43 weeks.

Table 1.9: Weeks gestation at date of first hospital booking, 2020

Gestation at booking	Stillbirths N=231 N(%)	Early Neonatal deaths N=103 N(%)	Perinatal deaths N=334 N(%)
Less than 12 Weeks	50(21.6)	27(26.2)	77(23.1)
12-19 Weeks	163(70.6)	63(61.2)	226(67.7)
20 Weeks or Later	14(6.1)	10(9.7)	24(7.2)
Not Booked	4(1.7)	3(2.9)	7(2.1)

Note: Gestation at booking unknown for 23 cases in 2020.

The proportion of women presenting for first antenatal visit at 20 weeks gestation or later was higher in 2020 (7.2%) compared to 2019 (5.5%) (Figure 1.7).

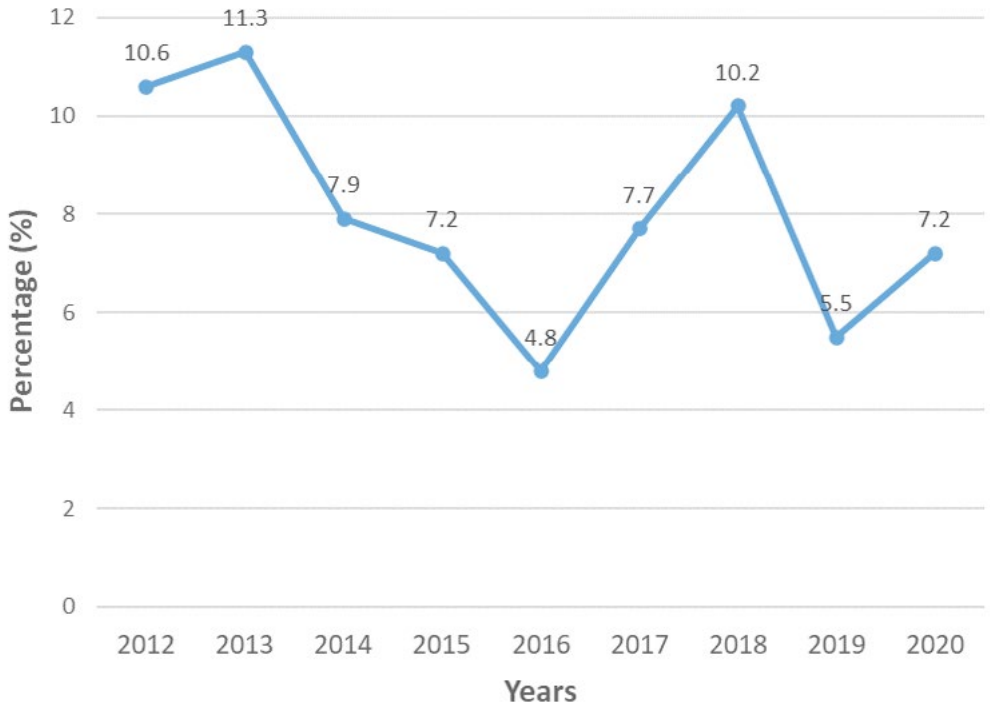


Figure 1.7: Proportion attending first booking appointment ≥20 weeks gestation among women who experienced perinatal loss in 2012-2020

Anatomy scan

Since 2017, the NPEC have collected data on whether a woman underwent an anatomy scan. As recommended by the National Maternity Strategy 2016-2026, access to fetal anomaly ultrasound scanning should be universally available to all pregnant women in Ireland.[39]

Data on whether a woman received an anatomy scan was recorded for 356 of 357 women who experienced perinatal loss in 2020. Of these 356 women, more than 90% of women (n=325, 91.3%) received an anomaly scan. Rates varied across the maternity units in 2020; however, all the units had rates higher than 84% compared to some units having rates of 40% and below in 2018-2019.

Fertility treatment

Currently in Ireland there is no national data on the number of births as a result of fertility treatment. The NPEC Notification Form contains a specific question on whether the pregnancy was the result of fertility treatment. In 2020, information was available for 325 of the 357 (91.0%) cases of perinatal death. In 20 of these 325 cases (6.1%) the pregnancy was reported to be the result of fertility treatment (n= 9 of 210 stillbirths, 4.3% and n=11 of 115 early neonatal deaths, 9.6%). A quarter (n=5, 25%) of these 20 pregnancies were associated with multiple births ending in perinatal loss of one or more infants.

The method of treatment was specified for all of the 20 pregnancies resulting from fertility treatment. In order of frequency, the methods were: in vitro fertilisation (including egg donation; n=17), fertility drug therapy (n=2) and intrauterine insemination (IUI; n=1).

Body mass index

Increased maternal Body mass index (BMI) has been associated with an increased risk of congenital anomaly and stillbirth.[40, 41] The recording of BMI in maternity records is a key recommendation of the Obesity and Pregnancy Clinical Practice Guideline.[42] While this may be common practice in maternity units, no national data on the BMI of the pregnant population are available. In this report, data on maternities by BMI were obtained for 35,122 women who gave birth or booked to give birth in one of the country's four large maternity hospitals in 2020, this data was then extrapolated to produce national estimates.

Body mass index (BMI) was available for 324 of the 357 (90.8%) of women who experienced perinatal loss in 2020 (Table 1.10). The BMI of 36.7% of these mothers was in the healthy range (18.5-24.9kg/m2), which is similar to the percentage of mothers in a healthy range in 2019. However, these percentages are slightly lower compared to the previous years, 2015-2018. Overall, women in the healthy BMI category (36.7%) were underrepresented among women who experience perinatal loss compared to the population of women who gave birth in 2020 (46.2%).

[39] Creating a better future together. National Maternity Strategy 2016-2026. Available at: https://www.gov.ie/en/publication/0ac5a8-national-maternity-strategy-creating-a-better-future-together-2016-2/

[40] Rasmussen SA, Chu SY, Kim SY, Schmid CH, Lau J. Maternal obesity and risk of neural tube defects: a metaanalysis. Am J Obstet Gynecol 2008;198:611-9

[41] Chu SY, Kim SY, Lau J, Schmid CH, Dietz PM, Callaghan WM, et al. Maternal obesity and risk of stillbirth: a metaanalysis. Am J Obstet Gynecol 2007;197:223-8.

[42] Clinical Practice Guideline No 2 (2011). Obesity and Pregnancy: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

Table 1.10: Body mass index of mothers who experienced perinatal loss in 2015-2020

BMI Category (kg/m²)	Perinatal deaths 2015 N(%)	Perinatal deaths 2016 N(%)	Perinatal deaths 2017 N(%)	Perinatal deaths 2018 N(%)	Perinatal deaths 2019 N(%)	Perinatal deaths 2020 N(%)	Maternities 2020 (%)*
Underweight (<18.5)	5(1.2)	6(1.8)	2(0.6)	1(0.4)	6(2.3)	2(0.6)	473(1.3)
Healthy (18.5-24.9)	179(43.8)	140(42)	135(43.3)	109(41.4)	95(37)	119(36.7)	16219(46.2)
Overweight (25.0-29.9)	128(31.3)	114(34.2)	103(33)	77(29.3)	72(28)	105(32.4)	11002(31.3)
Obese (≥ 30.0)	97(23.7)	73(21.9)	72(23.1)	76(28.9)	84(32.7)	98(30.2)	7428(21.1)

Note: Values are shown as n (%) unless otherwise stated; Percentage refers to the total 324 cases for which BMI was obtained in 2020. *Data on BMI were collated for 35,122 maternities in 2020 from seven maternity units. This is 63.5% of the 55,281 women who gave birth in hospital in 2020, according to HIPE data. We multiplied the BMI data on 35,122 women by 1.57 (i.e., 100%/63.5%) in order to estimate the national number of maternities by BMI category.

As shown in Table 1.11, women in the obese category who experienced perinatal loss in 2020 were over-represented relative to the population of women who gave birth in 2020. This was reflected in the perinatal mortality rate of 8.40 per 1,000 for obese women. Thus, obese women had almost twice the risk of perinatal mortality compared to women who gave birth in 2020 with a healthy BMI (p-value < 0.001).

Table 1.11: Perinatal mortality by body mass index (BMI) among mothers in 2020

BMI Category (kg/m²)	Rate per 1,000 (95% CI)	Rate Ratio (RR) 95% CI	P-Value
Underweight (<18.5)	2.69 (0.33-9.69)	0.58 (0.14-2.33)	0.439
Healthy (18.5-24.9)	4.67 (3.87-5.59)	1.00 (reference)	–
Overweight (25.0-29.9)	6.08 (4.97-7.35)	1.30 (1-1.69)	0.050
Obese (≥ 30.0)	8.40 (6.83-10.23)	1.80 (1.38-2.35)	<0.001

RR=Rate ratio, comparing the rate for women in each BMI category versus the rate for women in the healthy BMI category.

Smoking and substance misuse

Smoking status of the mothers at their time of booking was recorded for 344 (96.4%) of the 357 women. Of these, 47 (13.7%) were smokers at the time of booking. Twenty-one were smoking between one and nine cigarettes per day (n=21 of 40, 52.5%, missing information for 7 women), and nineteen were smoking at least up to 10 cigarettes per day (n=19 of 40, 47.5%).

Information on smoking in late pregnancy was available for 34 of the 47 smokers (72.3%) and only two (4.3%) stopped smoking during pregnancy. The prevalence of smoking during pregnancy or in the last trimester is not routinely known for all Irish pregnancies but rates of 12%, 15%, 16% and 19% have been reported for England, Northern Ireland, Wales and Scotland, respectively.[43]

Five women had a documented history of alcohol misuse prior to pregnancy and three women had a documented history of alcohol misuse during pregnancy. Six women had a documented history of drug misuse prior to pregnancy and four women had a documented history of drug misuse during pregnancy.

Previous pregnancy

Seventy percent of mothers who experienced perinatal loss in 2018 had at least one previous pregnancy (gravida > 0; 230 of 325, 70.8%). Table 1.12 specifies gravida/parity for the 357 women who experienced perinatal loss. Almost one third of women (n=105, 29.4%) had never been pregnant before (gravida = 0). Of the 252 women who had been pregnant (gravida > 0), over half (n=133, 52.8%) had pregnancies exceeding 24 weeks or 500g birthweight (gravida = parity, indicated by green shading). Over one third of these 252 mothers (n=91, 36.1%) experienced at least one pregnancy exceeding 24 weeks or 500g birthweight and at least one pregnancy less than 24 weeks gestation and under 500g birthweight (gravida > parity > 0, indicated by yellow shading). Additionally, for 11.1% (n=28) these women's previous pregnancies never exceeded 24 weeks gestation or 500g birthweight (gravida > parity = 0, indicated by orange shading).

Table 1.12: Gravida/parity of mothers prior to experiencing perinatal loss, 2020

GRAVIDA	PARITY								
	0	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**Total**
0	105	0	0	0	0	0	0	0	105
1	21	79	0	0	0	0	0	0	100
2	3	28	35	0	0	0	0	0	66
3	2	4	14	9	0	0	0	0	29
4	0	4	7	5	8	0	0	0	24
5	1	5	4	3	5	2	0	0	20
6	1	0	1	1	0	2	0	0	5
7	0	0	2	0	1	2	0	0	5
8	0	0	0	0	0	1	0	0	1
9	0	0	0	0	0	0	1	0	1
10	0	0	0	0	0	0	0	1	1
Total	133	120	63	18	14	7	1	1	357

Note: We refer to gravida and parity prior to the pregnancy ending in perinatal death in 2020. Green represents women with previous pregnancies that were all ≥24 weeks or ≥500g; yellow represents women who had experienced pregnancy ≥24 weeks or ≥500g and also pregnancy <24 weeks and <500g; and orange represents women whose previous pregnancies were always <24 weeks gestation and <500g birthweight.

[43] EURO-PERISTAT Project with SCPE and EUROCAT. European Perinatal Health Report. The health and care of pregnant women and babies in Europe in 2010. May 2013. Available: www.europeristat.com

Of the 252 women who had a previous pregnancy, 52.8% (n=113) were reported to have had a previous pregnancy-related problem (unknown for one woman). Caesarean section delivery was the most common previous pregnancy-related problem with over twenty percent of mothers (n=58 of 252, 23.0%) having a previous caesarean section delivery (Table 1.13). Experiencing three or more miscarriages was the second most common previous pregnancy problem (n=21, 8.3%) followed by Pre-term birth or mid-trimester loss (n=12, 4.8%).

Table 1.13: Previous pregnancy-related problems in mothers who experienced perinatal loss in 2015-2020

	2015 n(%)	2016 n(%)	2017 n(%)	2018 n(%)	2019 n(%)	2020 n(%)
Previous caesarean delivery	71(22.1)	69(26.1)	52(22.6)	41(16.8)	41(16.8)	58(23)
Pre-term birth or mid-trimester loss	24(7.5)	24(9.1)	13(5.7)	18(7.4)	18(7.4)	12(4.8)
Three or more miscarriages	24(7.5)	21(8)	7(3.0)	12(4.9)	12(4.9)	21(8.3)
Baby with congenital anomaly	10(3.1)	7(2.7)	7(3.0)	5(2.0)	5(2.0)	5(2)
Infant requiring intensive care	13(4)	11(4.2)	6(2.6)	8(3.3)	8(3.3)	7(2.8)
Stillbirth	12(3.7)	9(3.4)	5(2.2)	7(2.9)	7(2.9)	4(1.6)
Neonatal death	3(0.9)	5(1.9)	5(2.2)	3(1.2)	3(1.2)	6(2.4)
Pre-eclampsia	8(2.5)	11(4.2)	5(2.2)	9(3.7)	9(3.7)	8(3.2)
Placental abruption	4(1.2)	3(1.1)	2(0.9)	1(0.4)	0(0)	2(0.8)
Placenta praevia	1(0.3)	2(0.8)	1(0.4)	2(0.8)	2(0.8)	4(1.6)
Post-partum haemorrhage requiring transfusion	5(1.6)	5(1.9)	1(0.4)	5(2.0)	5(2)	4(1.6)
Other	35(10.9)	43(16.3)	26(11.3)	30(12.3)	30(12.3)	32(12.7)

Note: Percentage relates to the total number of mothers who had a previous pregnancy (n = 252); more than one previous pregnancy related problem may apply per woman.

In terms of parity, women who experienced perinatal loss in 2020 were broadly similar to the population of women who gave birth in 2020 although there was an overrepresentation of women with at least three previous deliveries among those who experienced perinatal loss (Table 1.14).

Table 1.14: Distribution of parity, 2015-2020

Parity	Perinatal deaths 2015 N(%)	Perinatal deaths 2016 N(%)	Perinatal deaths 2017 N(%)	Perinatal deaths 2018 N(%)	Perinatal deaths 2019 N(%)	Perinatal deaths 2020 N(%)	All births[44] 2020 (%)*
Nulliparous	172(38)	135(36.2)	147(42.5)	123(37.8)	156(43.5)	133(37.3)	22520(39.4)
Para 1	148(32.7)	128(34.3)	91(26.3)	88(27.1)	96(26.7)	120(33.6)	20010(35)
Para 2	84(18.5)	62(16.6)	69(19.9)	61(18.8)	69(19.2)	63(17.6)	9585(16.8)
Para 3+	49(10.8)	48(12.9)	39(11.3)	53(16.3)	38(10.6)	41(11.5)	4999(8.8)

While not statistically significant, the risk of perinatal death increased with increasing parity. For example, in 2020, women who had three or more previous deliveries had 39% of an increased risk of perinatal death compared to women who had no previous delivery. (Table 1.15).

[44]Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press].

Table 1.15: Comparing the rate ratio of perinatal mortality by parity among mothers, 2020

Parity	Rate per 1,000 95% CI	Rate Ratio 95% CI	P-Value
Nulliparous	5.91(4.95-7)	1.00 (reference)	-
Para 1	6(4.97-7.17)	1.02(0.79-1.3)	0.903
Para 2	6.57(5.05-8.4)	1.11(0.82-1.5)	0.484
Para 3+	8.2(5.89-11.11)	1.39(0.98-1.97)	0.066

Pre-existing medical problems

Information about pre-existing medical conditions was available for 356 of the 357 mothers who experienced perinatal loss in 2020 (99.7%) (Table 1.16). Over thirty percent of these 356 women had a pre-existing medical problem (n=121, 34.0%). This represents an increase compared to 2019 and 2018 (n=118, 32.8% and n=100, 30.8%).

The most common type of pre-existing medical problems were Psychiatric disorders with 8.4% of mothers (n=30 of 356 women) suffering from conditions of this type (Table 1.16). This was followed by Endocrine disorders which had second the highest percentage of occurrence (n= 17, 4.8%). Under the "Other" category a wide range of problems were captured, such as gynaecological issues, asthma, infection and musculoskeletal issues.

Table 1.16: Pre-existing medical problems in mothers who experienced perinatal loss in 2015-2020

	2015 n(%)	2016 n(%)	2017 n(%)	2018 n(%)	2019 n(%)	2020 n(%)
Psychiatric disorder	31(7.0)	40(11.5)	27(8.0)	17(5.2)	19(5.3)	30(8.4)
Endocrine disorder	24(5.4)	26(7.5)	22(6.5)	16(4.9)	23(6.4)	17(4.8)
Diabetes	16(3.6)	8(2.3)	7(2.1)	8(2.5)	13(3.6)	7(2)
Cardiac disease	6(1.4)	6(1.7)	6(1.8)	6(1.8)	2(0.6)	1(0.3)
Hypertension	13(2.9)	9(2.6)	6(1.8)	11(3.4)	8(2.2)	12(3.4)
Renal disease	4(0.9)	3(0.9)	4(1.2)	1(0.3)	2(0.6)	6(1.7)
Haematological disorder	5(1.1)	9(2.6)	4(1.2)	4(1.2)	1(0.3)	5(1.4)
Inflammatory disorder	17(3.9)	3(0.9)	2(0.6)	4(1.2)	1(0.3)	9(2.5)
Epilepsy	5(1.1)	1(0.3)	0	2(0.6)	4(1.1)	3(0.8)
Other	65(14.7)	62(17.9)	61(18.1)	54(16.6)	75(20.8)	73(20.5)
*Any pre-existing medical problem	138(31.3)	123(35.4)	107(31.8)	100(30.8)	118(32.8)	121(34)

*Note: n(%) represents the number of women who had 'any pre-existing medical problem; more than one medical problem may apply per woman.

Delivery

Labour was induced in almost 78% of women who experienced a stillbirth (n=186 of 240, 77.5%) and in almost one third of those who experienced a neonatal death (n=35 of 117, 29.9%). A caesarean section was the planned mode of delivery for 9.6% of the women who experienced a stillbirth (n=23 of 240) and 33.3% of the women who experienced an early neonatal death (n=39 of 117).

The type of care received at delivery was known for all mothers who experienced perinatal loss (n=357). The vast majority of the babies (n=351 of 356, 98.3%) were delivered under obstetric-led care which is the predominant model of care in Ireland. Three babies (0.3%) were born before arrival at the maternity unit.
Presentation at delivery was known for all mothers who experienced perinatal loss (n=357). Over seventy-seven percent of presentations at delivery were vertex presentations (n=276 of 357, 77.3%), over one in five were breech presentation (n=78 of 357, 21.8%) and in just three cases, the presentation was compound (n=3 of 357, 0.8%).

Mode of delivery was known for all of mothers who experienced perinatal loss (Table 1.17). Spontaneous vaginal cephalic delivery was the mode of delivery for almost sixty-eight percent of stillbirths (n=163 of 240, 67.9%) and for thirty-five percent of the babies who died in the early neonatal period (n=41 of 117, 35.0%). Less than half of the deliveries in cases of neonatal death involved caesarean section (n=53 of 117, 45.3%), usually pre-labour (n=39, 33.3%). Approximately twelve percent of stillbirths involved caesarean section (n=29, 12.1%), again predominantly pre-labour (n=23, 9.6%). Among stillbirths delivered by caesarean section, almost seventy percent of the mothers (n=20 of 29, 69.0%) had a previous caesarean delivery.

In comparison to the proportion of all births occurring with assisted breech delivery in 2020 (0.5%), this type of delivery is relatively more common in stillbirths (18.3%) and neonatal deaths (4.2%).

Table 1.17: Mode of delivery for mothers who experienced perinatal loss, 2020

	Stillbirths (N=240) N(%)	Neonatal deaths (N=117) N(%)		All births 2020[45] (%)
Spontaneous vaginal cephalic	163(67.9)	41(35.0)	Vaginal birth	28541(50)
Breech; spontaneous and assisted	44(18.3)	14(12.0)	Breech; spontaneous and assisted	270(0.5)
Pre-labour caesarean section	23(9.6)	39(33.3)	Caesarean section	20417(35.7)
Caesarean section after the onset of labour	6(2.5)	14(12.0)	–	–
Ventouse	1(0.4)	5(4.3)	Ventouse	5944(10.4)
Forceps	3(1.3)	4(3.4)	Forceps	1941(3.4)

Note: Values are n(%) unless otherwise stated.

The type of caesarean section was known for all stillbirth cases delivered by caesarean section (n=29). Elective caesarean section delivery was the most common type of caesarean section delivery in stillbirths (n=14 of 29, 48.3%), followed by emergency caesarean section (n=12 of 29, 41.4%). The type of caesarean section was known for all early neonatal cases delivered by caesarean section (n=53). Emergency caesarean delivery was the most common type of caesarean delivery in neonatal deaths (n=23 of 53, 43.4%), followed by urgent caesarean section delivery, maternal or fetal compromise which is not immediately life threatening (n=19 of 53, 35.8%). One woman who had a neonatal death had a caesarean section following failed instrumental delivery.

[45]Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press].

Level of care for mothers post-delivery

For women who experienced perinatal loss in 2020, 5.9% (n=21 of 357) were admitted to a high dependency unit (HDU) and only one case (n=1 of 357, 0.3%) was admitted to an intensive care unit (ICU). Similar admission rates were reported for the years between 2015 and 2019 (Table 1.18). Admission to HDU was similar for the mother in cases of early neonatal death and in stillbirths in 2020 (6% versus 5.8%, respectively).

Deliveries by emergency caesarean section were associated with high levels of admission to the HDU. Within the cohort of women experiencing perinatal mortality (n=357), almost 29% of deliveries by emergency caesarean section were admitted to the HDU in 2020 (n=10 of 35, 28.6%). Of these ten cases that were delivered by emergency caesarean section and were subsequently admitted to the HDU, four were early neonatal deaths and six were stillbirths. Almost 14% of perinatal deaths delivered by caesarean section classified as urgent were admitted to HDU (n=3 of 22). Of these three cases, two were stillbirths and one was an early neonatal death.

Table 1.18: Post-delivery outcome for mothers who experienced perinatal loss in 2015-2020

Parity	Perinatal deaths 2015 N(%)	Perinatal deaths 2016 N(%)	Perinatal deaths 2017 N(%)	Perinatal deaths 2018 N(%)	Perinatal deaths 2019 N(%)	Perinatal deaths 2020 N(%)	Stillbirths 2020 N(%)	Neonatal deaths 2020 N(%)
Admitted to HDU	41(9.2)	20(5.4)	13(3.8)	25(7.7)	23(6.4)	21(5.9)	14(5.8)	7(6)
Admitted to ICU	9(2)	7(1.9)	1(0.3)	7(2.2)	5(1.4)	1(0.3)	0(0)	1(0.9)

Note: Values are n(%) unless otherwise stated. Location of post-delivery maternal care in HDU and ICU is presented separately for women experiencing stillbirths and neonatal deaths in 2020.

Maternal complications associated with HDU and ICU admissions

While the NPEC data collection form does not contain a specific question on the indication for admission to HDU/ICU, maternal complications and obstetric factors which caused or were associated with the perinatal death are identified.

Of the fourteen women delivering stillbirths who were admitted to HDU, placental abruption was the cause of death in four of the 14 cases (of which one case also involved a uterine rupture). Of the remaining ten cases, an associated maternal disorder were reported in six cases; hypertensive disorder of pregnancy (n=3), sepsis (n=1), diabetes (n=1), placenta increta (n=1). In four cases of women delivering stillbirths who were admitted to HDU, a maternal complication was not associated with the cause of stillbirth.

In contrast, of the seven women experiencing an early neonatal death, maternal / obstetric complications associated with HDU admission in 2020 included hypertensive disorder of pregnancy (n=3), placental abruption (n=1), gestational diabetes (n=1) and grand mal epilepsy (n=1). For one case, a maternal complication was not associated with the neonatal death. In the one woman experiencing an early neonatal death who was admitted to ICU, placental abruption and uterine rupture were the reported antecedent factors associated with the perinatal death. Further, additional information noted the woman experienced a major obstetric haemorrhage in the post-natal period.

Infant characteristics

The findings presented below are based on stillbirths and early neonatal deaths born with a birthweight ≥500g or having achieved a gestational age ≥24 weeks.

Sex

There were two perinatal deaths among the stillbirth cases for which the sex of the baby was indeterminate (Table 1.19). Of the 357 perinatal deaths, 51.5% were male (n=184). In the overall population of births in 2020, 51.5% were male and 48.5% female. Male babies outnumbered female babies among stillbirths and early neonatal deaths.

Table 1.19: Sex of baby in stillbirths and neonatal deaths in 2020

	Stillbirths N(%)	Early neonatal deaths N(%)	All births 2020[46] N(%)
Male	120(50)	64(54.7)	29390(51.5)
Female	118(49.2)	53(45.3)	27710(48.5)
Indeterminate	2(0.8)	0(0)	14(0)

Multiple births

As with previous years, an increased risk of perinatal mortality associated with multiple pregnancy compared to singleton pregnancy was found in 2020. There were 29 perinatal deaths from multiple births, making up 8.1% of all perinatal deaths in 2020 (Table 1.20). This is around two times the proportion of multiples among all births in 2020 (3.6%).

Table 1.20: Perinatal deaths from singleton and multiple births, 2020

	Stillbirths N(%)	Early neonatal deaths N(%)	Perinatal deaths N(%)		All births 2020[47] (%)
Singleton	225(93.8)	103(88)	328(91.9)	Singleton	55040(96.4)
Twin	14(5.8)	14(12)	28(7.8)	Multiple	2074(3.6)
Triplet	1(0.4)	0(0)	1(0.3)		

In 2020, the perinatal mortality rate for babies in multiple pregnancies was 2.35 times higher at 13.98 per 1,000 births (p<0.001) (Table 1.21).

Table 1.21: Comparing the rate ratio of perinatal mortality by single and multiple births among mothers, 2020

Parity	Rate per 1,000 95% CI	Rate Ratio 95% CI	P-Value
Singleton	5.96(5.33-6.64)	1.00 (reference)	–
Multiple	13.98(9.38-20.02)	2.35(1.61-3.43)	<0.001

Note: 95% CI=Exact Poisson 95% confidence intervals.

[46]Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press].

[47]Healthcare Pricing Office. Perinatal Statistics Report 2020. Dublin: Health Service Executive. [in press].

The 29 perinatal deaths from multiple births comprised of 15 stillbirths and 14 early neonatal deaths. The majority (n=8, 57.1%) of the 14 early neonatal deaths from multiple births were due to major congenital anomalies; the remaining six deaths were due to respiratory disorders, (n=3, 21.4%), neurological disorders (n=2, 14.3%) and gastrointestinal disease (n=1, 7.1%).

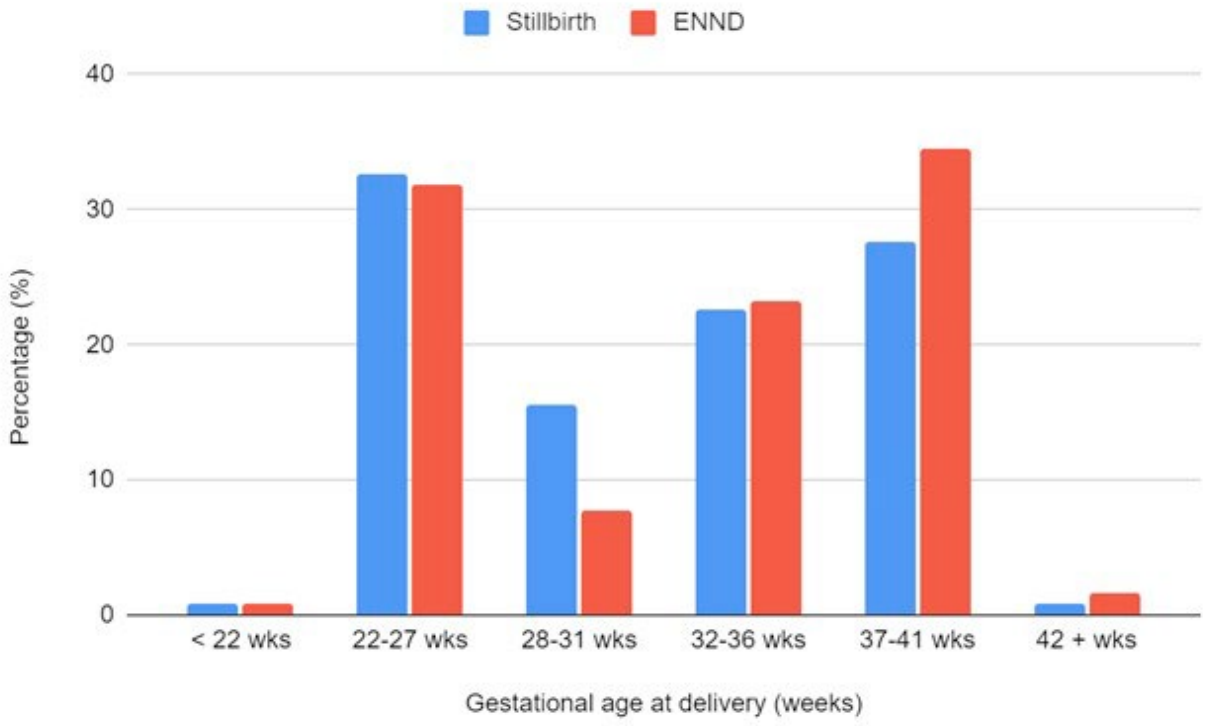
The main cause of death for the 15 stillbirths from multiple births were specific fetal conditions (n=7, 46.7%), specific placental conditions (n=3, 20.0%), major congenital anomalies (n=2, 13.3%), associated obstetric factors (n=2, 13.3%) and mechanical factors (n=1, 6.7%). There were no stillbirth cases from multiple pregnancies where the cause of death was unexplained in 2020.

Chorionicity was reported for all the perinatal deaths from multiple births. The majority were cases with monochorionic diamniotic (n=16, 55.2%). The remaining cases were dichorionic diamniotic (n=10, 34.5), monochorionic monoamniotic (n=2, 6.9%) and trichorionic (n=1, 3.4%).

In 2020, there were 28 cases where one twin died, and one set of triples where one triplet died, representing a total of 29 perinatal losses.

Gestation

The vast majority of perinatal deaths in 2020 were associated with delivery before 37 weeks gestation (n=245 of 355, 69.0%, missing information for two cases). This was the case for 71.5% of stillbirths (n=171 of 239, missing information for one case) and 63.8% of early neonatal deaths (n=74 of 116, missing information for one case). The majority of these cases delivered at 22-27 weeks gestation (Figure 1.8). A slightly higher proportion of extremely preterm delivery (i.e., delivery at 22-27 weeks gestation) was more often associated with cases of stillbirth than cases of early neonatal death (32.8% versus 33.5%, respectively).



Note: Data on gestational age was unknown for one stillbirth and one early neonatal death.

Figure 1.8: Distribution of gestational age at delivery in stillbirths and neonatal deaths, 2020

Birthweight

The most represented birthweight in cases of perinatal death was in the range 500-999 grams (n=102 of 357, 28.6%) (Figure 1.9 and Table 1.22). In approximately sixty-seven percent of perinatal deaths (n=239, 66.9%) the birthweight was less than 2,500 grams. For stillbirths, 67.9% had a birthweight below 2,500g (n=163 of 240) and 65.0% of neonatal deaths (n=76 of 117) also registered weight below this value.

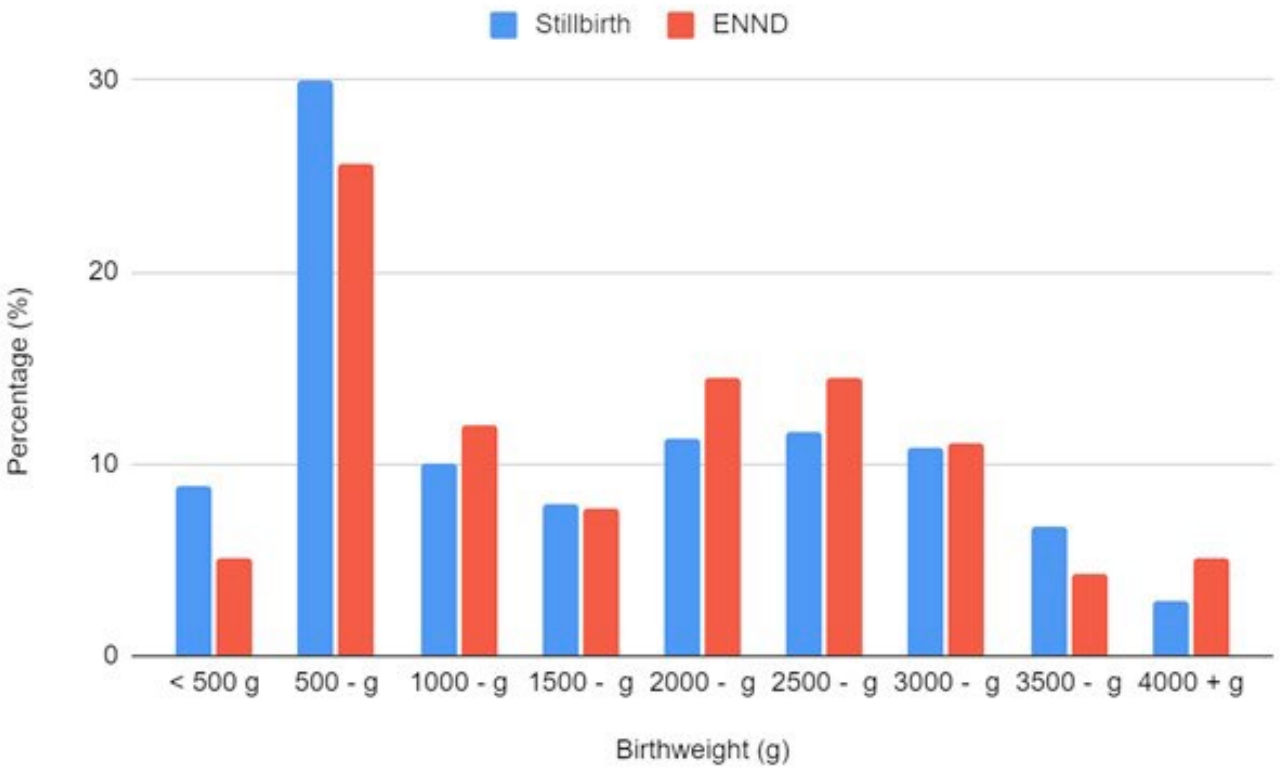


Figure 1.9: Distribution of birthweight in stillbirths and neonatal deaths, 2020

Table 1.22: Distribution of birthweight in stillbirths and neonatal deaths, 2020

	Stillbirths N=240	Early neonatal deaths N=117	Total N=357
< 500g	21(8.8)	6(5.1)	27(7.6)
500 - 999g	72(30)	30(25.6)	102(28.6)
1000 - 1499g	24(10)	14(12)	38(10.6)
1500 - 1999g	19(7.9)	9(7.7)	28(7.8)
2000 - 2499g	27(11.3)	17(14.5)	44(12.3)
2500 - 2999g	28(11.7)	17(14.5)	45(12.6)
3000 - 3499g	26(10.8)	13(11.1)	39(10.9)
3500 - 3999g	16(6.7)	5(4.3)	21(5.9)
4000 or more g	7(2.9)	6(5.1)	13(3.6)

Birthweight centiles

An increased risk of perinatal death has been associated with failure of fetal growth in utero. We have produced charts to highlight this issue in relation to the stillbirths and early neonatal deaths that occurred in Ireland in 2020. To do so, we used the Gestation Related Optimal Weight (GROW) software[48] and coefficients derived from the multiple regression analysis of data on 11,072 births in six maternity units in Dublin, Galway, Limerick and Belfast in 2008-2009.[49]

The regression analysis determined the Term (i.e. 40 weeks) Optimal Weight (TOW) in Ireland to be 3,490.7g. The normal range (i.e. the range from the 10th centile weight to the 90th centile weight) around the TOW was then calculated and the recommended proportionality growth function was applied to the TOW, the 10th centile term weight and the 90th centile term weight in order to determine the optimal weight and normal range at all gestations (21-44 weeks for stillbirths and early neonatal deaths in Ireland in 2020). These steps are described in detail in the GROW documentation.

The optimal weight and normal range for all gestations are plotted with the actual birthweights of the stillbirths in 2020 in (Figure 1.10) with the birthweights for cases of early neonatal death in 2018 (Figure 1.11). For stillbirths across all gestational ages, a high proportion were below the lower limit of the normal range (10th centile). In cases of early neonatal death, the birthweight was often below the normal range for births after 32 weeks gestation. However, low birthweight was observed less often than for cases of stillbirth.

Figures (1.12 and 1.13) have the limitation of plotting actual birthweights against the optimal weight and normal range adjusted only for gestational age. There is no adjustment for other factors affecting birthweight, namely, maternal height, weight, parity and ethnic group and infant sex. The use of centiles customised for maternal and infant characteristics affecting birthweight identifies small babies at higher risk of mortality better than population centiles.[50] Small-for-gestational-age (SGA) refers to birthweights below the 10th centile and severely SGA refers to birthweights less than the 3rd centile.[51]

[48] Gardosi J, Francis A. Customised Weight Centile Calculator. GROW version 8.0.6.1(IE), 2021 Gestation Network, www.gestation.net

[49] Unterscheider J, Geary MP, Daly S, McAuliffe FM, Kennelly MM, Dornan J, Morrison JJ, Burke G, Francis A, Gardosi J, Malone FD. The customized fetal growth potential: a standard for Ireland. Eur J Obstet Gynecol Reprod Biol 2013; 166(1):14-7

[50] Clausson B, Gardosi J, Francis A, Cnattingius S. Perinatal outcome in SGA births defined by customised versus population–based birthweight standards. BJOG 2001;108:830–4.

[51] Royal College of Obstetrics and Gynaecologists. The investigation and management of the small-for-gestational age fetus. RCOG Green Top Guideline 2013 (No.31). Available at: www.rcog.org.uk/files/rcog-corp/22.3.13GTG31SGA_ExecSum.pdf

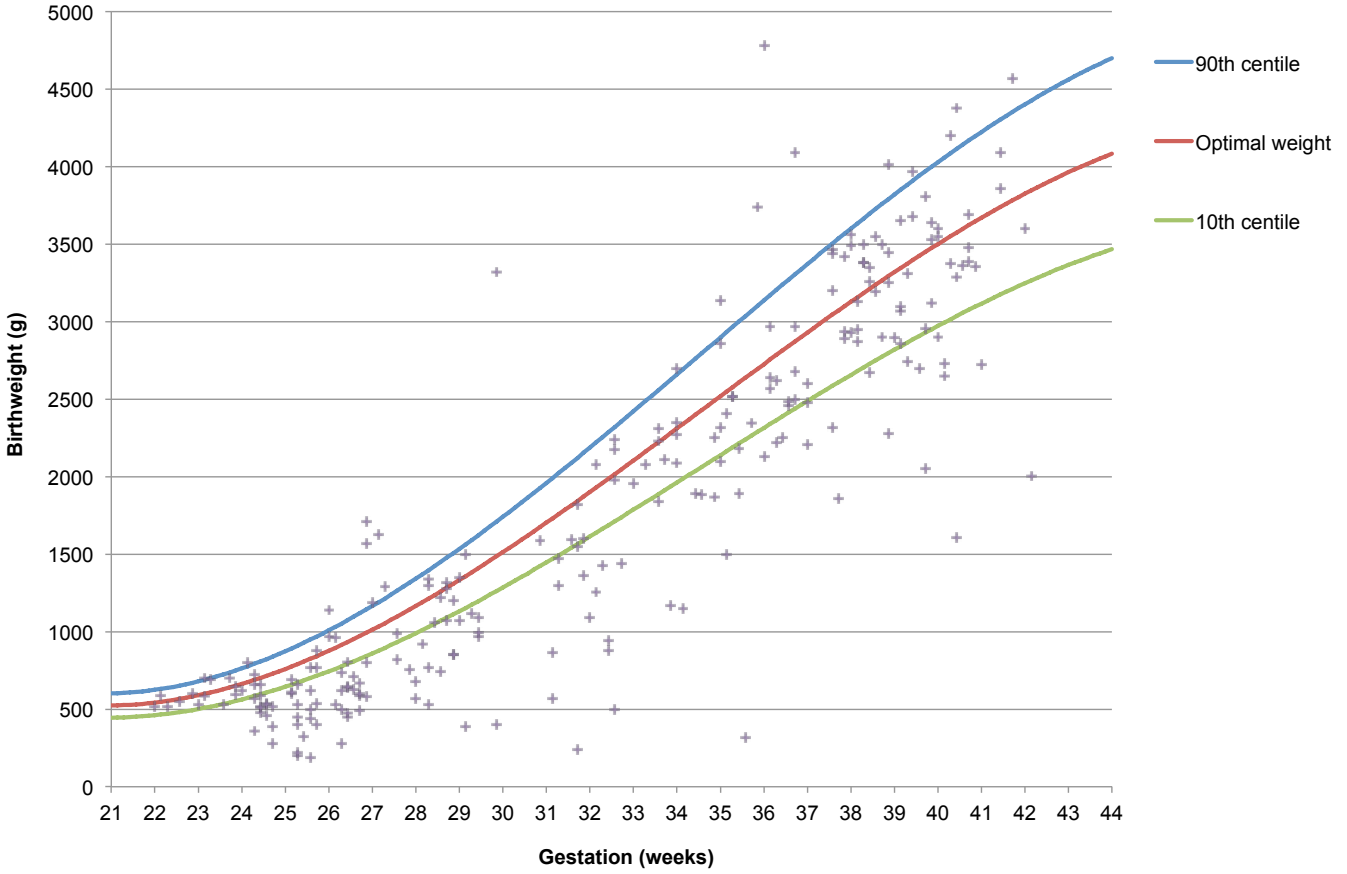


Figure 1.10: Optimal birthweight and normal range compared to actual birthweights of stillbirths, 2020

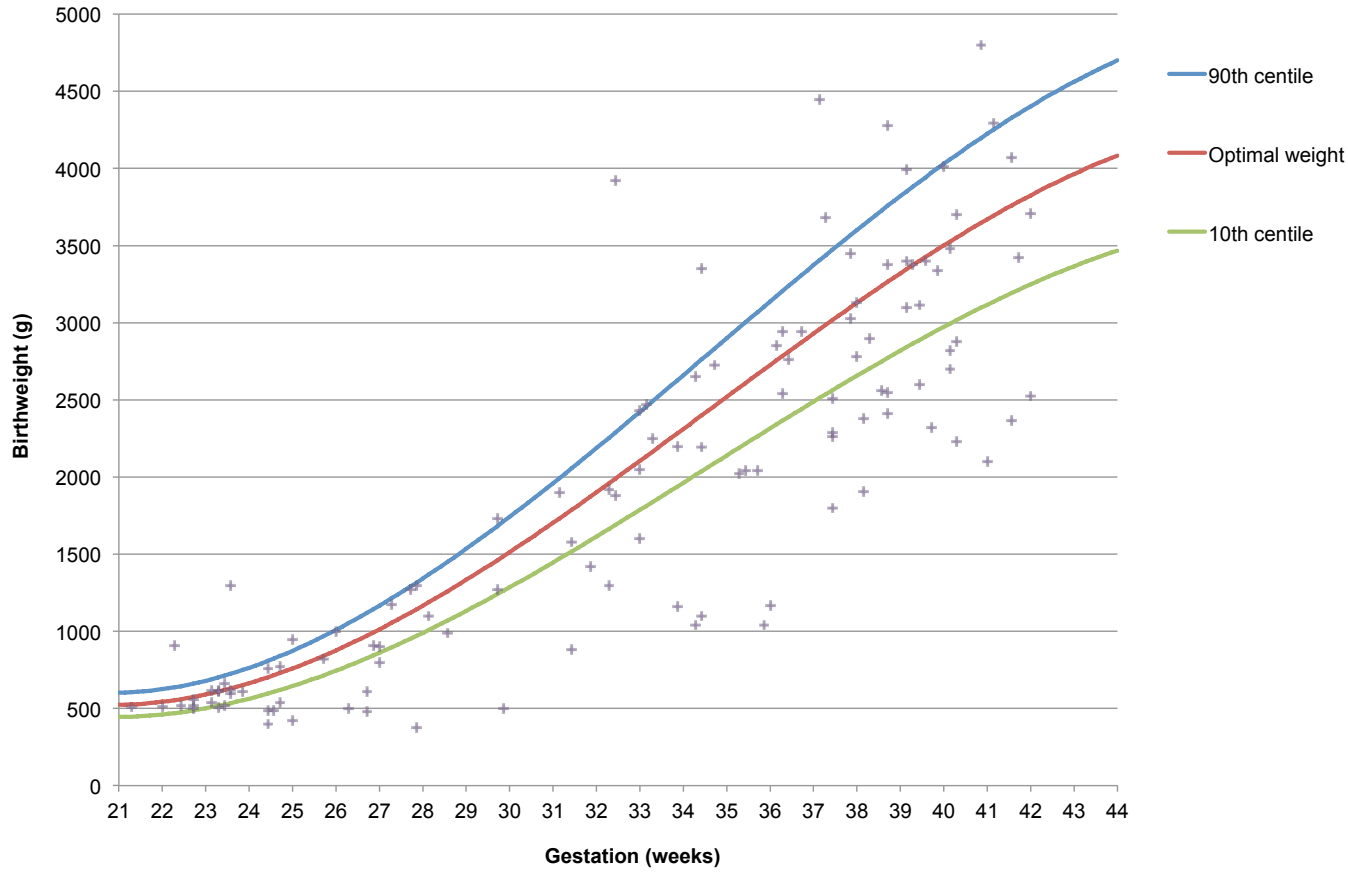


Figure 1.11: Optimal birthweight and normal range compared to actual birthweights in early neonatal deaths, 2020

Customised birthweight centiles were derived using the GROW software.[52] There was missing data for maternal height (n=28, 7.8%) and weight (n=26, 7.3%) of cases. For these cases, we used the median height and weight of the mothers with complete data. The GROW software also provides estimated customised birthweight centiles in cases with missing data. Ultimately, customised birthweight centiles were calculated for 355 of the 357 perinatal deaths in 2020.

The distribution of customised birthweight centiles at all gestations is illustrated for stillbirths (Figure 1.12) and for early neonatal deaths (Figure 1.13). At all gestations, there were cases spanning the full range of birthweight centiles (i.e. 0-100th) but there was a concentration of cases at or near centile zero.

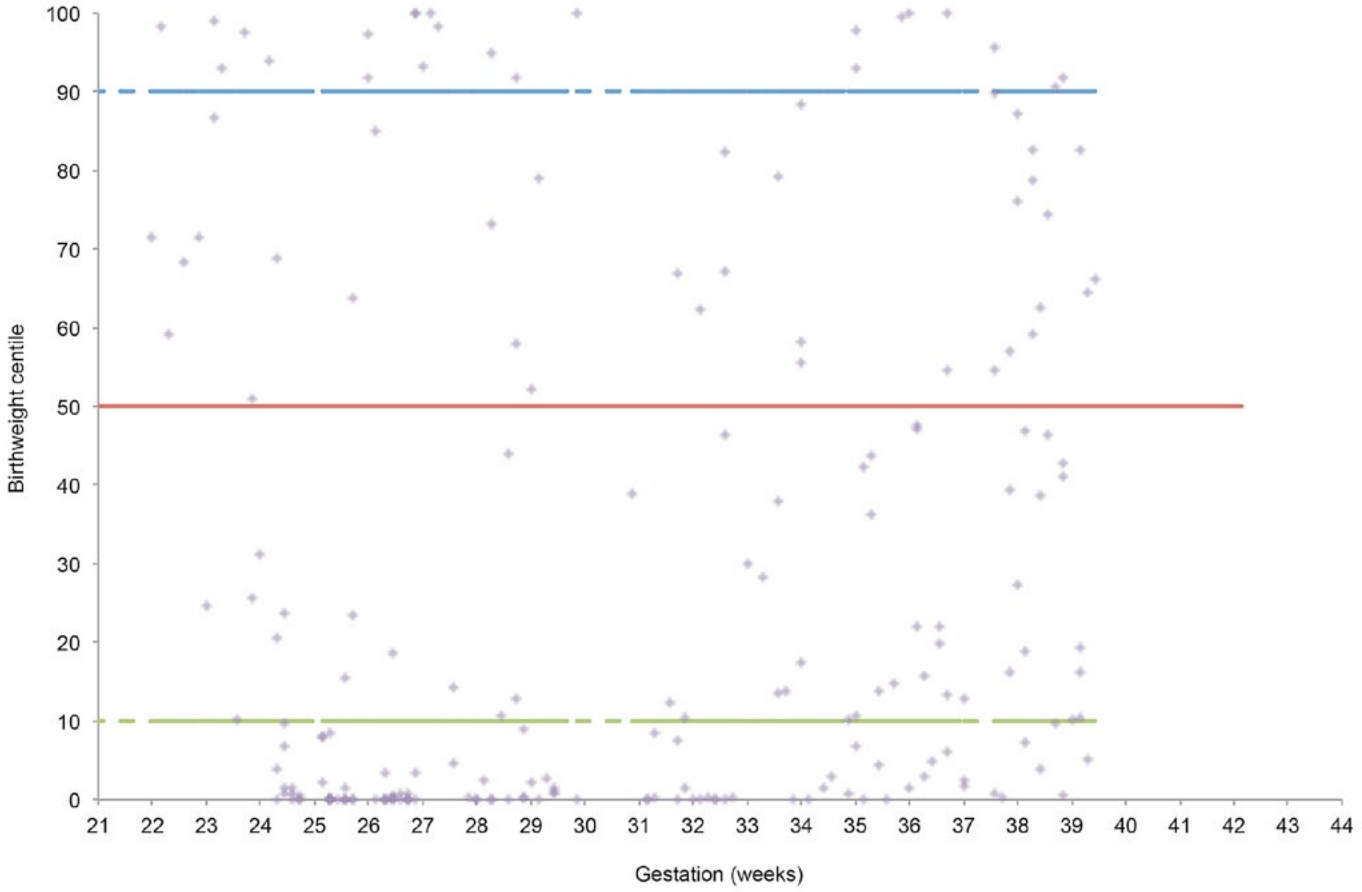


Figure 1.12: Distribution of customised birthweight centiles for stillbirths, 2020

[52] Gardosi J, Francis A. Customised Weight Centile Calculator. GROW version 8.0.6.1(IE), 2021 Gestation Network, www.gestation.net

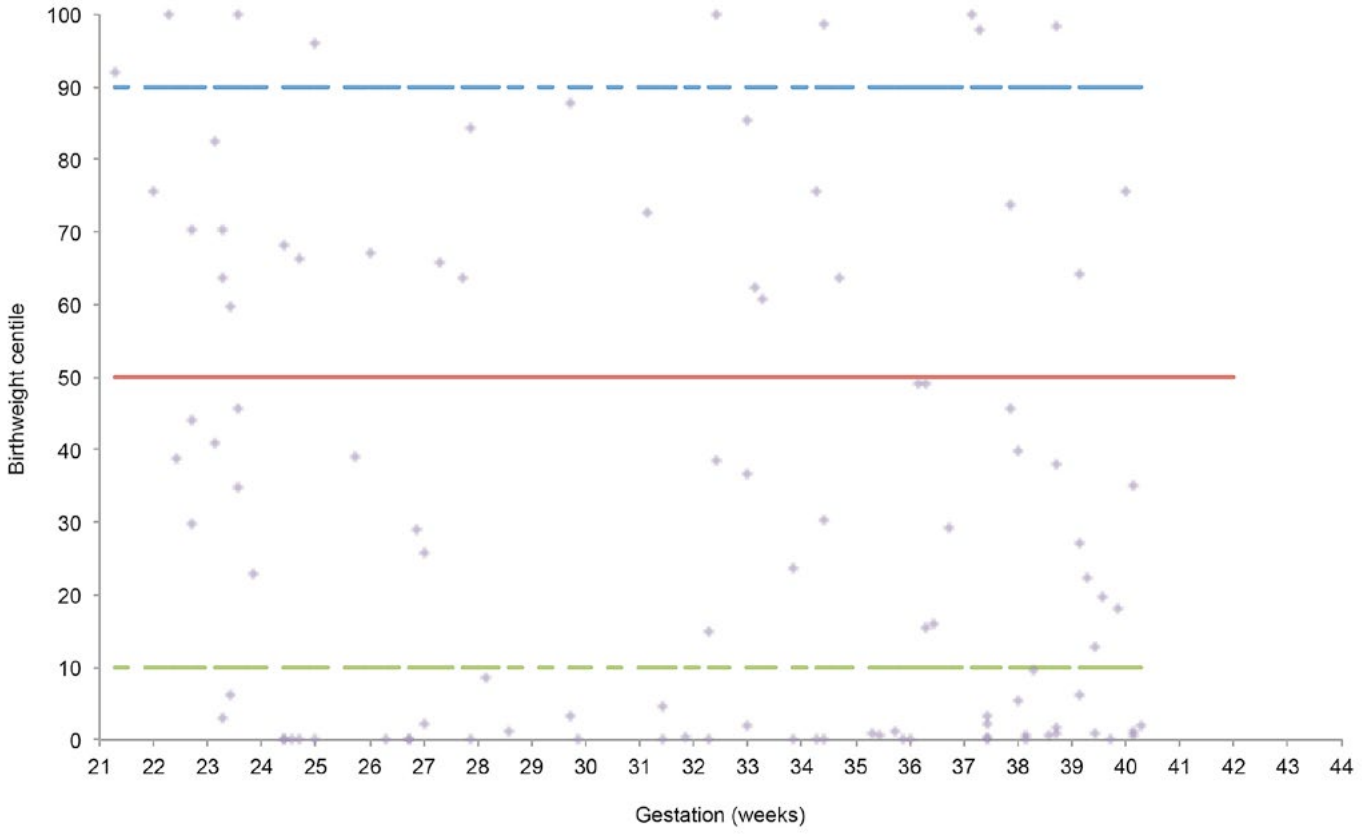


Figure 1.13: Distribution of customised birthweight centiles for early neonatal deaths, 2020

Table 1.23 details the number and percentage of stillbirths and early neonatal deaths within specific ranges of customised birthweight centiles. Low birthweight centiles were associated with both groups but particularly with stillbirths. Thirty-five percent (34.7%) of all stillbirths were classified as severely small for gestational age (SGA), i.e <3rd customised birthweight centile and over forty-five percent (45.2%) were SGA (<10th customised birthweight centile) compared to 36.2% and 43.1% of the cases of early neonatal death, respectively.

There was little difference in the prevalence of SGA and severe SGA between stillbirths and early neonatal deaths in 2020 as shown in Table 1.23. In previous years, the prevalence was higher among stillbirths. SGA may be more prevalent among stillborn babies because they may have died some days or weeks before being delivered. We do not record whether there was evidence of maceration in cases of stillbirth but there was support for this hypothesis. The customised birthweight centile of the stillborn baby was lower when there was more than one week between confirmation of death and delivery.

Table 1.23: Distribution of customised birthweight centiles, 2020

Centile	Stillbirth (N=239 of 240) N%	Neonatal death (N=116 of 117) N%
< 3rd	83(34.7)	42(36.2)
< 10th*	108(45.2)	50(43.1)
10-49th	61(25.5)	31(26.7)
50-89th	44(18.4)	24(20.7)
90th+	26(10.9)	11(9.5)

Note:*Includes cases from the category <3rd Centile. Values are n (%) unless otherwise stated. Centiles could not be calculated for one stillbirth, and one neonatal death. Severely SGA is defined as less or equal to the 3rd customised birthweight centile, and SGA is defined as less or equal to the 10th customised birthweight centile.

Cases of stillbirth and early neonatal death were at significantly lower birthweight centiles when the cause of death was attributed to major congenital anomaly (Table 1.24). Over 41% of the 79 stillbirths due to congenital anomaly (n=33, 41.8%) were severely SGA in comparison to 31.3% of the stillbirths due to other causes (n=50, 31.3%). Similarly, almost forty-five percent of the 67 early neonatal deaths due to congenital anomaly (n=30, 44.8%) were severely SGA compared to just twenty five percent (n=12, 24.5%) of the 49 early neonatal deaths due to other causes.

Table 1.24: Distribution of customised birthweight centiles of perinatal deaths with and without major congenital anomaly, 2020

Centile	Stillbirth (N=239 of 240)		Neonatal death (N=116 of 117)	
	Cause of death: major congenital anomaly		Cause of death: major congenital anomaly	
	Yes(n=79) N(%)	No(n=160) N(%)	Yes(n=67) N(%)	No(n=49) N(%)
< 3rd	33(41.8)	50(31.3)	30(44.8)	12(24.5)
< 10th*	42(53.2)	66(41.3)	35(52.2)	15(30.6)
10-49th	16(20.3)	45(28.1)	14(20.9)	17(34.7)
50-89th	6(7.6)	38(23.8)	11(16.4)	13(26.5)
90th+	15(19)	11(6.9)	7(10.4)	4(8.2)

Note: *Includes cases from the category <3rd Centile. Values are n (%) unless otherwise stated. Centiles could not be calculated for one stillbirth, and one neonatal death.

Diagnosis of fetal growth restriction (FGR)

Data on diagnosis of fetal growth restriction (FGR) were recorded for 348 of the 357 perinatal deaths; FGR diagnosis unknown for seven stillbirths, and two neonatal deaths. A diagnosis of FGR was reported for 57 (16.4%) of the 348 deaths, 42 (18.0%) stillbirths and 15 (13.0%) early neonatal deaths. An antenatal diagnosis of FGR (as opposed to diagnosis based on observation at delivery or post-mortem) was reported for 41 perinatal deaths (n=41 of 348, 11.8%), 28 stillbirths (12.0%) and 13 early neonatal deaths (11.3%).

For stillbirths and cases of early neonatal death that were severely SGA (<3rd customised birthweight centile), approximately 24.8% (n=31 of 125) had an antenatal diagnosis of FGR (Table 1.25). The level of antenatal diagnosis of FGR was lower for stillbirths and early neonatal death that were SGA (stillbirths = 21.3%, neonatal deaths = 26.0%) compared to stillbirths and early neonatal death that were severely SGA (stillbirths = 25.3%, neonatal deaths = 23.8%).

Table 1.25: Antenatal diagnosis of fetal growth restriction (FGR) for small-for-gestational-age (SGA) and severely SGA perinatal deaths in 2020

		Antenatal diagnosis of FGR n of N (%)
Stillbirth	Severely SGA (<3rd centile)	21 of 83 (25.3%)
	SGA (<10th centile)*	23 of 108 (21.3%)
Neonatal death	Severely SGA (<3rd centile)	10 of 42 (23.8%)
	SGA (<10th centile)*	13 of 50 (26.0%)

Note: SGA cases include severely SGA cases; *Includes cases from the category <3rd Centile. FGR diagnosis unknown for seven stillbirths, and two neonatal deaths.

- **Recommendation:** Standardised approach to improved antenatal detection of fetal growth restriction (FGR) with timely delivery is a potential preventative strategy to reduce perinatal mortality.[1]

  – One option, used previously in other centres, is the generation of customized birth weight centile charts for every woman during pregnancy and concomitantly, staff are trained in risk assessment, plotting of symphysial fundal height (SFH) with appropriate pathways to scan weight estimates; identifying fetuses at risk through Intrauterine growth Restriction and management to reduce stillbirths in Ireland. Based on feedback to the NPEC, other methodologies could be considered.

A multidisciplinary working group should be developed to address a national standardised approach to the detection of FGR. A national approach should also evaluate the use of a standard growth curve and management options across all Irish maternity units. Owner; the NWIHP and the IOG.

Perinatal mortality following termination of pregnancy

Since January 2019, the change in the Irish legislation following the 'Repeal of the Eighth amendment' legalised termination of pregnancy (TOP) in the Republic of Ireland (ROI) in certain circumstances. Abortion in the ROI is regulated by the Health Regulation of Termination of Pregnancy Act 2018. Abortion is permitted in early pregnancy, when there is a risk to the life, or of serious harm to the health, of the pregnant woman and for a condition likely to lead to death of foetus either before or within 28 days of birth.[53]

In 2020, eleven percent (n=39, 10.9%) of all the 357 perinatal deaths with a birthweight ≥500g and/or gestation at delivery ≥24 weeks reported to NPEC resulted from a TOP (stillbirths; n=29 of 240, 12.1% and neonatal deaths; n=10 of 117, 8.5%).

Major congenital anomaly was associated with all cases of stillbirths delivered following TOP (n=29, 100%). The majority of stillbirths delivered following TOP most commonly occurred between the gestational ages of 22 to 27 weeks (n=23 of 29, 79.3%). Major congenital anomaly was associated with all but two cases of neonatal death following TOP (n=8, 80.0%). For the remaining two cases of early neonatal death, ascending infection was the reported underlying obstetric antecedent complication. Early neonatal deaths following TOP most commonly occurred between the gestational ages of 22 to 27 weeks (n=9 of 10, 90.0%).

While not included in the calculation of the perinatal mortality rates, the NPEC asks for notification of deaths in the early neonatal period of live born babies born before 24 weeks gestation and weighing less than 500g. In 2020, twenty such deaths following TOP were reported to the NPEC. Major congenital anomaly was associated with twelve of the twenty cases (missing information for three cases), and chorioamnionitis was the reported underlying obstetric antecedent complication for the other five remaining cases.

[53] Health (Regulation of Termination of Pregnancy) Act 2018. Available at: http://www.irishstatutebook.ie/eli/2018/act/31/enacted/en/html

Investigations to determine the cause of death

Autopsy

Current practice guidelines recommend that parents should be offered a full post-mortem examination of the stillborn infant to help explain the cause of death. When a cause is found it can crucially influence care in a future pregnancy.[54] Data on autopsy uptake was reported for 354 of the 357 perinatal deaths, of which 52.3% (n=185) underwent an autopsy. The rate of autopsy uptake in 2020 is higher than the rate of 49.2% reported in 2019 and rates reported in previous years with the exception of one year (54.4% in 2017). The trend in the perinatal autopsy rate is illustrated in Figure 1.14. The autopsy uptake rate in stillbirths continues to be higher than in cases of early neonatal death.

In Ireland in 2020, an autopsy was undertaken following 59.2% of stillbirths (n=142 of 240) and 37.7% of early neonatal deaths (n=43 of 114, unknown for three cases), see Figure 1.16. These figures are higher than in the United Kingdom as a whole in 2019 (full autopsy for 44.9% of stillbirths and 26.2% of early neonatal deaths).[55]

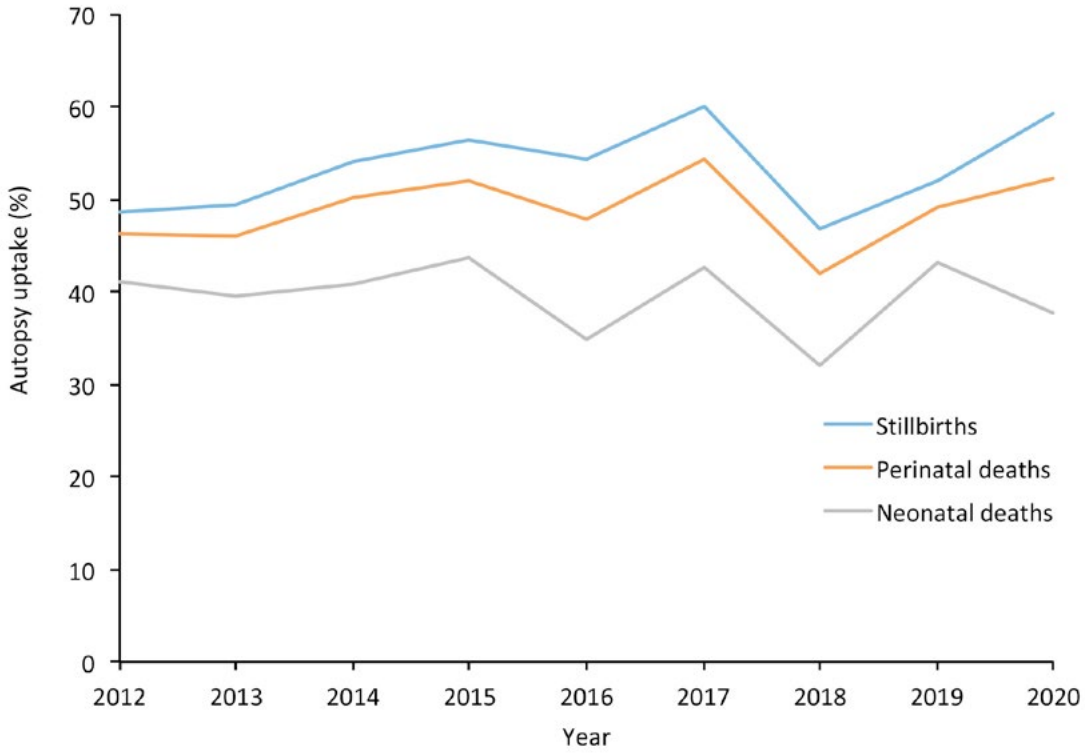


Figure 1.14: Autopsy uptake percentage, 2012-2020

[54] Clinical Practice Guideline No 4 (2011). Investigation and management of late fetal intrauterine death and stillbirth: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive. 'Due for update in 2022'.

[55] Draper ES, Gallimore ID, Kurinczuk JJ, Smith PW, Boby T, Smith LK, Manktelow BN, on behalf of the MBRRACE-UK Collaboration. MBRRACE-UK Perinatal Mortality Surveillance Report, UK Perinatal Deaths for Births from January to December 2019. Leicester: The Infant Mortality and Morbidity Studies, Department of Health Sciences, University of Leicester. 2021. Available at: https://www.npeu.ox.ac.uk/assets/downloads/mbrrace-uk/reports/perinatal-surveillance-report-2019/MBRRACE-UK_Perinatal_Surveillance_Report_2019_-_Tables_and_Figures_V1.pdf

The variation in the rate of autopsy across the 19 maternity units in 2020 is illustrated in Figure 1.15. This may reflect variation in access to dedicated perinatal pathology services across units. There was some variation found across the four large maternity units, with rates of 27.9%, 34.6%, 58.1% and 68.9% being found across the four units in 2020. However, as detailed in Figure 1.16 and Table 1.26, in the vast majority of cases where an autopsy was not performed, an autopsy was offered but presumably declined by the parents (n=139, 82.2% of 169 cases, unknown if offered in 3 cases). As such, variation in autopsy rates across units may be influenced by parental consent to the procedure.

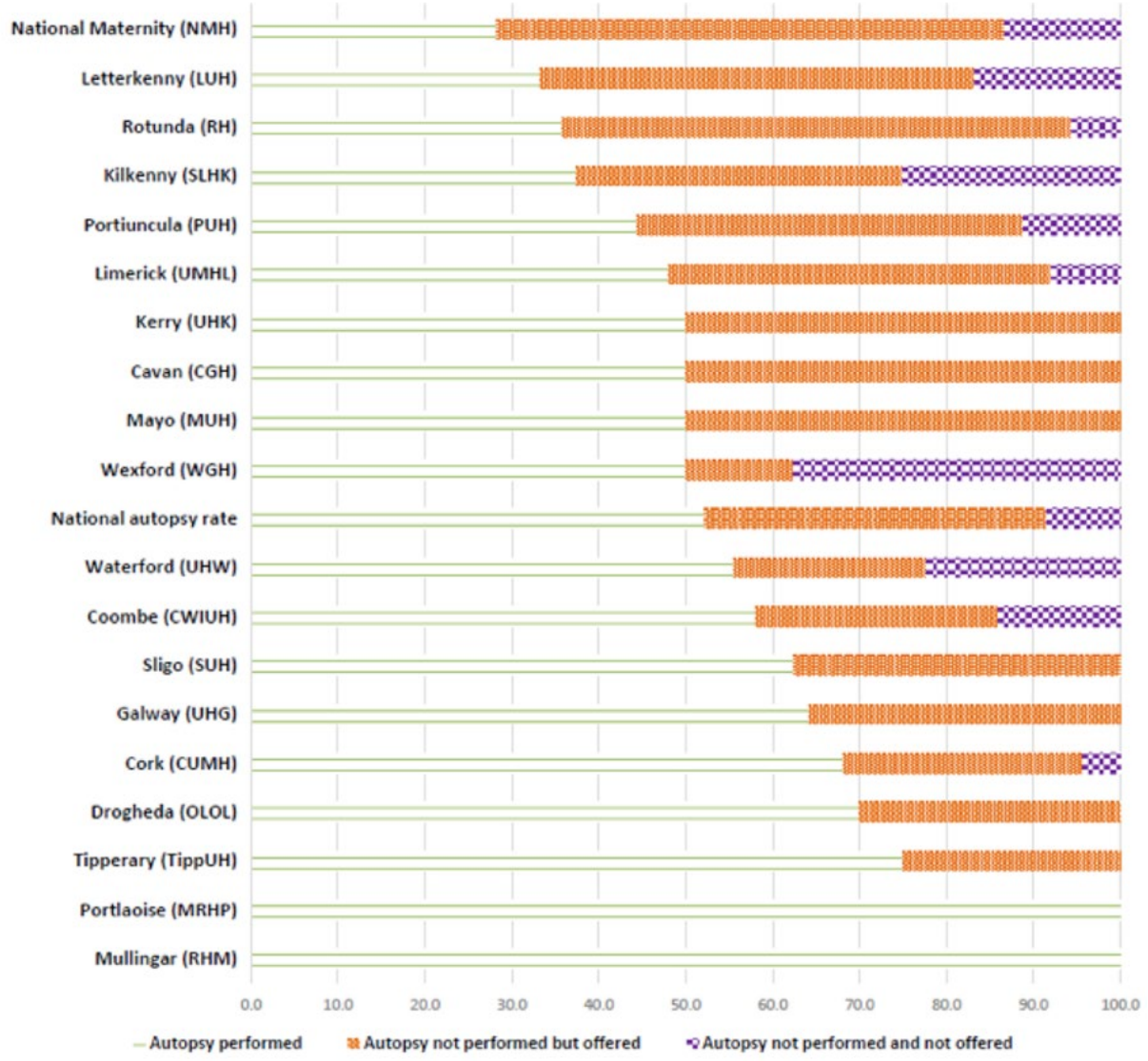


Figure 1.15: Percentages of autopsy uptake and offer of autopsy in the 19 Irish maternity units, 2020

Figure 1.16 details the autopsy-related steps following the 354 perinatal deaths in 2020 (autopsy uptake unknown for three early neonatal death cases). A total of 185 (52.3%) autopsies were performed on cases of perinatal death, and almost half of the perinatal deaths did not receive an autopsy in 2020 (n=169, 47.8%). Autopsies were more often performed among stillbirth cases (n=142 of 240, 59.2%) compared to early neonatal death cases (n=43 of 114, 37.7%). For the vast majority of the 169 cases that did not receive an autopsy, an autopsy was offered and presumably declined by parents in over 80% of the cases (n=139 of 169, 82.2%). An autopsy was declined almost equally in cases of early neonatal deaths (57 of 71, 80.3%) and stillbirths (82 of 98, 83.7%). Consequently, for 2020, of the 354 cases where data on autopsy uptake were reported, there were 30 perinatal deaths for which an autopsy was not offered (n=30 of 169, 17.8%). Corresponding figures for the years 2018-2019 was 19.4% and 2017 was 9.8%.

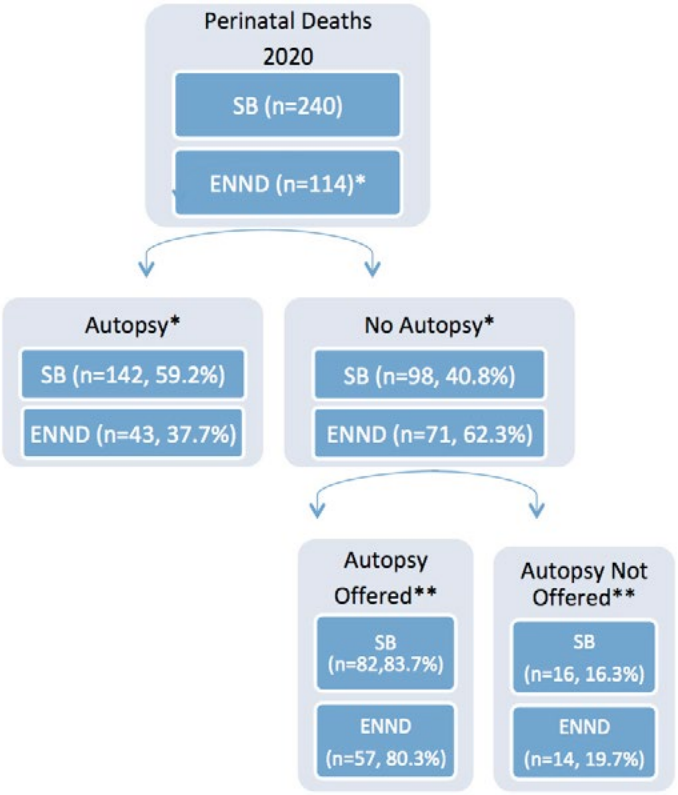


Figure 1.16: Flowchart outlining autopsy-related steps taken after 354 perinatal deaths, 2020

Note:* There were three early neonatal deaths, where it was reported that an autopsy was not performed but it was not known whether an autopsy was offered. Values are n (%) unless otherwise stated.

The decision not to offer to undertake an autopsy may be influenced by the clinical scenario and the antenatal diagnosis. There was evidence to support this in relation to major congenital anomaly. The proportion of cases when an autopsy was not offered was higher if the perinatal death was due to a major congenital anomaly than if it the death was due to another cause (Table 1.26).

For the reporting year 2020, feedback from units highlighted a delay in returns of coronial autopsy reports, which was exacerbated due to the impact of the Covid 19 pandemic.

As recommended in previous NPEC reports, engagement with the Coroner Society to explore the timeliness of autopsy reports provided to the maternity units (impacting negatively on care of bereaved families and clinical audit) has been progressed via the Department of Health. In October 2021, a Submission document to the Department of Health regarding the Coroner's (Amendment) Act 2019 was made on behalf of the NPEC, the NWIHP, the NOCA and the PMNCAGC.

Table 1.26: Uptake and offer of autopsy of perinatal deaths with and without a major congenital anomaly, 2020

Autopsy	Stillbirth (N=240)		Neonatal death (N=114 of 117)	
	Cause of death: major congenital anomaly		Cause of death: major congenital anomaly	
	Yes (n=79) N(%)	No (n=161) N(%)	Yes (n=66) N(%)	No (n=48) N(%)
Performed	27(34.2)	115(71.4)	18(27.3)	25(52.1)
Offered	38(48.1)	44(27.3)	36(54.5)	21(43.8)
Not offered	14(17.7)	2(1.2)	12(18.2)	2(4.2)

Note: *There were three other cases, where it was reported that an autopsy was not performed but it was not known whether an autopsy was offered. Values are n (%) unless otherwise stated.

Placental examination

The value of placental examination in determining cause of perinatal death is well documented.[56] In 2020, placental histology examinations were conducted for almost all stillbirths (n=236 of 240, 98.3%) and for 96.1% of early neonatal deaths (n=107 of 117). These figures are slightly lower than those reported for stillbirths (99.1%) and for early neonatal deaths (97.8%) in 2018/2019. However, the 2020 rate of placental examinations compare favourably with the levels of placental histology examinations reported for stillbirths in the United Kingdom as a whole in 2019 (93.0%).[57]

Specific placental conditions

Abnormal placental findings have been classified in line with recommendations from the publication from the international consensus meeting of pathology.[58] These are presented under the following broad categories: Maternal vascular malperfusion, Fetal vascular malperfusion, Cord pathology, Cord pathology with distal disease, Delayed villous maturation, Chorioamnionitis, Villitis, Fetal Vasculitis and 'Other' placental pathology.

Specific placental conditions were generally more prevalent among stillbirths than among cases of early neonatal death. (Table 1.27). In the case of stillbirths in 2020, conditions within the maternal vascular malperfusion, fetal vascular malperfusion and cord pathology categories were most commonly reported.

Table 1.27: Placental histology findings for stillbirths and early neonatal deaths, 2020

	Stillbirth (n=240) N(%)	Neonatal death (n=117) N(%)
Fetal vascular malperfusion	68(28.3)	20(17.1)
Maternal vascular malperfusion	64(26.7)	22(18.8)
Cord pathology	64(26.7)	11(9.4)
Delayed villous maturation	16(6.7)	6(5.1)
Chorioamnionitis	22(9.2)	23(19.7)
Cord pathology with distal disease	32(13.3)	4(3.4)
Fetal vasculitis	7(2.9)	9(7.7)
Villitis	17(7.1)	5(4.3)
Other placental condition*	43(17.9)	20(17.1)
Any placental condition	180(75)	61(52.1)

Note: More than one placental condition was present for some cases. *Includes conditions such as Placental disease due to massive perivillous fibrin deposition, Mesenchymal dysplasia, Diffuse chorionic hemosiderosis and Chronic histocytic intervillositis.

[56] Korteweg FJ, Erwich JJ, Timmer A, van der Meer J, Ravise JM, Veeger NJ, Holm JP. Evaluation of 1025 fetal deaths: proposed diagnostic workup. Am J Obstet Gynecol 2012 206:53.e1-53.e12

[57] Draper ES, Gallimore ID, Smith LK, Fenton AC, Kurinczuk JJ, Smith PW, Boby T, Manktelow BN, on behalf of the MBRRACE-UK Collaboration. MBRRACE-UK Perinatal Mortality Surveillance Report, UK Perinatal Deaths for Births from January to December 2019., Department of Health Sciences, University of Leicester. 2021.

[58] Khong TY, Mooney EE et al (2016). Sampling and definition of placental lesions. Arch Pathol Lab Med 2016 Jul;140 (7):698-713

Other examinations performed

External examinations were performed for almost fifty percent of the perinatal deaths in 2020 (49.0%) compared to forty-three percent (42.8%) in 2019 (Table 1.28). Computerised tomography scans (CT scan) and magnetic resonance imaging (MRI) tests were rarely undertaken. X-Ray examinations were carried out more often following cases of stillbirth rather than for cases of early neonatal death in 2020.

Table 1.28: Other examinations performed in investigating perinatal deaths, 2019-2020

Examination	Perinatal deaths 2019 N(%)	Stillbirths 2020 N(%)	Neonatal Deaths 2020 N(%)	Perinatal deaths 2020 N(%)
External	154(42.8)	116(48.3)	59(50.4)	175(49)
X-Ray	111(30.8)	86(35.8)	26(22.2)	112(31.4)
CT scan	0(0)	9(3.8)	1(0.9)	10(2.8)
MRI	1(0.3)	0(0)	1(0.9)	1(0.3)

Note: Values are n (%) unless otherwise stated. CT=Computerised tomography, MRI=magnetic resonance imaging. Categories are not mutually exclusive.

Genetic investigation in chromosomal disorders

Cytogenetic analysis is an important investigation in the diagnosis of chromosomal abnormalities. Some abnormalities are potentially recurrent and can be tested for in future pregnancies.[59] In the event of a chromosomal disorder, a specific question on the NPEC Perinatal Death Notification form (Appendix E) asks how the diagnosis was made.

In 2020, a chromosomal disorder was the most commonly reported major congenital anomaly causing death (64 perinatal deaths: 40 stillbirths and 24 early neonatal deaths). In over forty percent of these cases (n=27 of 64, 42.2%), the diagnosis was made by cytogenetic analysis (n=21 of 40 stillbirths, 52.5%; n=6 of 24 neonatal deaths, 25.0%).

[59] Clinical Practice Guideline No 4 (2011). Investigation and management of late fetal intrauterine death and stillbirth: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

2. Invited Commentary: The role of maternal health and maternal obesity in perinatal mortality. Dr Sarah Petch and Professor Fionnuala McAuliffe.

Introduction

A perinatal death is a death of an infant during pregnancy and up to the first seven days of life, weighing >500g or with a gestational age of ≥24 weeks at delivery, including deaths related to congenital anomaly.

Adjusted perinatal mortality is defined as the number of perinatal deaths (early neonatal deaths and stillbirths from 24 weeks gestation or weighing >500g) excluding deaths due to a major congenital anomaly. The 2020 NPEC report showed a perinatal mortality rate of 6.25 per 1,000 and an adjusted perinatal mortality rate of 3.68 per 1,000 births.[1] These increased from the 2019 figure of 6.04 per 1,000 and 3.73 per 1,000 births respectively.[1]

The World Health Organisation (WHO) definition of obesity is the 'abnormal or excessive fat accumulation that presents a risk to health'. The Body Mass Index (BMI), which measures the weight in kilograms divided by the square of the height in metres (kg/m^2), is the most widely used measure of overweight and obesity. A healthy BMI is between 18.5-24.9, overweight refers to a BMI of between 25-29.9 and obesity is defined as a BMI of greater than 30.

Obesity rates are rising globally. Almost 21% of women in the world are predicted to have a BMI of greater than 30 by 2025.[2] Ireland has the second highest prevalence of obesity in the European Union, according to Eurostat data, finding that 25% of women and 26% of all adults in Ireland live with obesity, higher than the European Union (EU) average of 16%.[3] The same survey, conducted in 2019, found that 56% of adults and 49% of women in Ireland are classified as overweight.[3] It is estimated that more than half of women who become pregnant are overweight or obese at the time of booking.[4] A study from a large Irish maternity hospital found an increase in obesity rates amongst pregnant women from 16% to 18.9% between 2010 and 2017.[5]

NPEC BMI data

The most recent data from the National Perinatal Epidemiology Centre (NPEC) records the BMI at booking of the mothers who suffered a stillbirth or early neonatal death between 2011 and 2020, see Table 2.1. Thirty percent of women were overweight and 25.4% of women were obese. The perinatal mortality rate amongst women who were living with overweight, and obesity was 6.08 per 1,000 and 8.4 per 1,000 respectively in 2020. There was a statistically significant increased rate ratio for perinatal mortality of 1.3 for mothers who are overweight and 1.8 for mothers with obesity, see Table 2.2.

Table 2.1. Woman's BMI at time of her booking appointment in Ireland; 2011-2020

	2011-2019	2020	2011-2020	n(%)
Underweight (<18.5)	38	2	40	40(1.2)
Healthy (18.5-24.9)	1311	119	1430	1430(43.3)
Overweight (25.0-29.9)	888	105	993	993(30.1)
Obese (>30.0)	740	98	838	838(25.4)
Total	2977	324	3301	3301(100)
Not recorded	691	33	724	724(18)
All	3668	357	4025	4025(100)

Table 2.2. Perinatal Mortality rate relative to maternal BMI in Ireland; 2020

BMI Category (kg/m²)	Rate per 1,000	Rate Ratio	P-Value
	(95% CI)	(95% CI)	
Underweight (<18.5)	2.69(0.33-9.69)	0.58(0.14-2.33)	0.439
Healthy (18.5-24.9)	4.67(3.87-5.59)	1.00 (reference)	-
Overweight (25.0-29.9)	6.08(4.97-7.35)	1.3(1-1.69)	0.05
Obese (≥ 30.0)	8.4(6.83-10.23)	1.8(1.38-2.35)	<0.001

Note: 95% CI=Exact Poisson 95% confidence interval. Rate ratio compares risk of experiencing perinatal loss for women in each BMI category to the risk for women in the healthy BMI category.

Obesity, maternal morbidity, and perinatal mortality

Mothers living with obesity are more likely to present with reduced fetal movements and the risk of stillbirth increases with increasing maternal BMI.[6] Additionally, the odds of infant death are higher for mothers with BMI > 30 (OR 1.42) and the risk appears to increase with increasing maternal BMI (OR 2.03 for women with BMI>35).[7] Maternal obesity is also associated with subfertility, an increased risk of miscarriage and congenital anomaly, and a higher risk of pregnancy complications such as gestational diabetes, hypertensive disorders of pregnancy, caesarean birth and postpartum haemorrhage.[8] Women with obesity are more likely to be deficient in micronutrients such as B12, vitamin D and iron.[9] This is also identified in the NPEC national clinical audit of severe maternal morbidity (SMM) in Ireland which showed that obesity was associated with a doubling of the risk of SMM compared to women with a healthy BMI in 20201 (see Table 2.3). High BMI was particularly associated with major obstetric haemorrhage, ICU/CCU admission, peripartum hysterectomy and pulmonary embolism.

Table 2.3: Risk of severe maternal morbidity (SMM) by body mass index (BMI) in Ireland; 2020

BMI category (kg/m²)	Maternities	SMM cases (N=310)*	SMM rate (95% CI)	Rate ratio (95% CI)
Underweight (<18.5)	473(1.3)	1(0.3)	1.34(0.05-11.78)	0.30(0.04-2.17)
Healthy (18.5-24.9)	16,219(46.2)	113(36.5)	4.43(5.74-8.38)	1.00(ref.)
Overweight (25.0-29.9)	11,002(31.3)	93(30.0)	5.37(6.82-10.36)	1.21(0.92-1.60)
Obese (≥30.0)	7,428(21.1)	103(33.2)	8.81(11.32-16.82)	1.99(1.52-2.60)

*BMI was not known for 19 women who experienced SMM in 2020.

Guidelines on obesity in pregnancy

Healthcare providers have an essential role to play in tackling the rising rates of maternal obesity. In 2019 the International Federation of Gynaecology and Obstetrics (FIGO) launched the Pregnancy Obesity and Nutrition Initiative (PONI).[10] The aims are to provide clear messages in tackling malnutrition and obesity before, during and after pregnancy, encouraging frontline healthcare providers to 'Think Nutrition and Weight First at Every Contact'.

FIGO have published a guideline to assist Obstetricians & Gynecologists in the management of women with obesity.[11] There are three time points for clinicians to intervene to improve outcomes for mother and baby- pre pregnancy, during pregnancy and postpartum (interpregnancy). A summary of these guidelines is shown below in Table 2.4.

Table 2.4. FIGO committee guideline for the management of prepregnancy, pregnancy and postpartum obesity

Prepregnancy	• All women should have their weight and height measured and their body mass index (BMI, calculated as weight in kilograms divided by height in meters squared) calculated. Consider ethnic differences. • All women with a BMI of ≥30 should be advised of the effect of obesity on fertility, the immediate risks of obesity during pregnancy and childbirth, and the subsequent long-term health effect of obesity including the higher risk of noncommunicable diseases for them and their children. • All women with obesity should be encouraged to lose weight through diet and adopting a healthy lifestyle including moderate physical activity. If indicated and available, other weight management interventions might be considered, including bariatric surgery. • All women with obesity should be advised to take up to 5 mg folic acid supplementation daily for at least 3 months before conception.
Pregnancy	• All women should have their weight and height measured and their BMI calculated at the first antenatal visit. Consider ethnic differences. Advise on appropriate gestational weight gain. • All women should receive information on diet and lifestyle appropriate to their gestation including nutrient supplements, weight management, and regular physical activity. • All women with obesity should be advised of the risks of obesity and excess gestational weight gain on pregnancy, childbirth, and long-term health including risk of noncommunicable diseases for them and their children. • All antenatal healthcare facilities should have well-defined multidisciplinary pathways for the clinical management of pregnant women with obesity including the identification and treatment of pregnancy-related complications.
Postpartum	• All women with prepregnancy obesity should receive support on breastfeeding initiation and maintenance. • All women with obesity and pregnancy complications should receive appropriate postnatal follow-up in line with local resources, care pathways, and in response to the individual health requirements of each woman and her children. • All women with obesity should be encouraged to lose weight postpartum with emphasis on healthy diet, breastfeeding if possible, and regular moderate physical activity. They should be advised of the importance of long-term follow-up as they and their children are at increased risk for noncommunicable diseases. • Maternal obesity should be considered when making the decision regarding the most appropriate form of postnatal contraception.

Addressing maternal obesity

Healthcare professionals know the importance of weight and nutrition but often find this subject difficult to broach with women. Communication around weight, the adverse effects of obesity and advice about gestational weight gain (GWG) and nutrition provided to women by healthcare providers is often inconsistent.[12] Midwives, general practitioners (GPs) and obstetricians may shy away from addressing weight for fear of upsetting women.[13] Furthermore, a recent systematic review identified that there is a 'significant gap' in knowledge about GWG amongst healthcare professionals.[14] How women perceive the risks of obesity in pregnancy is influenced by the counselling they receive from healthcare professionals and if this is not approached sensitively women report feeling stigmatised and penalised for their weight.[15]

The FIGO Nutrition Checklist is a brief validated nutritional questionnaire designed to facilitate a discussion around weight and nutrition between women and their healthcare providers.[16,17] It takes just two minutes to complete and a pilot study, using the checklist in a tertiary referral maternity unit, showed that women have a strong desire for nutrition and weight to be addressed by clinicians during antenatal visits.[18] Women found the checklist quick to complete, though Obstetricians felt there may be insufficient time to discuss the checklist in routine practice.[19] However, if the checklist were to become part of routine antenatal care for every woman, it can be a useful resource to identify those at risk of malnutrition and obesity without stigmatising only overweight and obese women.

Other resources that can be useful to direct women to include smartphone applications such as the HOLLESTIC app recently launched by the UCD Perinatal Research Centre and the National Maternity Hospital Dublin. This evidence-based app, based on robust randomised controlled data that showed benefit in reducing excessive gestational weight gain with improved nutritional intake, is specifically devised for pregnant women, and provides nutritional and pregnancy advice as well as recipes and meal suggestions.[20] It is available to download for free from google app store and currently has over 3000 users across 5 countries worldwide. The use of mobile apps to support lifestyle interventions in pregnancy has been found to be simple to follow, affordable and enjoyable for women.[21]

Figure 2.1. 'Hollestic' Nutritional App; UCD Perinatal Research Centre and the National Maternity Hospital Dublin

Lifestyle changes form the cornerstone of any health promoting intervention and include access to affordable, healthy food, adaptation of local diets and recipes to promote a healthy weight, and the creation of environmental opportunities for physical activity, such as safe parks and open spaces.

Call to action

All healthcare providers who have contact with women of reproductive age have a responsibility to help tackle maternal obesity. Obstetricians, GPs and midwives should see every interaction with a woman as an opportunity to address weight, nutrition and lifestyle to optimise her health.

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3. Stillbirths: Specific findings

Cause of death in stillbirths

Major congenital anomaly was the most common cause of death in stillbirths in 2020 (n=79 of 240, 32.9%) (Figure 3.1 and Figure 3.2). This is in line with findings in 2018 and 2019 when major congenital anomaly accounted for 30.9% and 30.6%, respectively (Table 3.1). There was a chromosomal disorder in over half of the stillbirths in 2020 due to congenital anomaly (n=40 of 79, 50.6%), as shown in Figure 3.2. In the cases with a chromosomal disorder, just under a half (n= 36, 45.6%) were diagnosed by cytogenetic analysis, and almost 90.0% (n=69 of 77, unknown for two cases) had an antenatal diagnosis made by a consultant fetal medicine specialist either in the unit of reference (n=51) or in another unit (n=18).

In 2020, multiple anomalies (n=12), anomalies of the cardiovascular system (n=7), central nervous system (n=6), musculo-skeletal (n=4) and gastro-intestinal (n=4) systems, respiratory system (n=1) and urinary tract (n=1) collectively led to 35 (44.3% of 79) stillbirths. The remaining four cases were due to 'other' major congenital anomalies.

Table 3.1 shows further detail of the cause of death for stillbirths. Specific placental conditions was the second most common cause of death in stillbirths in 2020 (n= 73 of 240, 30.4%). The most commonly occurring placental condition was maternal vascular malperfusion (n=19 of 73, 26.0%), followed by fetal vascular malperfusion (n=14 of 73, 19.2%). Specific mechanical cause of death, most commonly due to the umbilical cord around the baby's neck or another entanglement or knot in the umbilical cord, was the next most common cause of stillbirth (n=19 of 240, 7.9%). Antepartum or intrapartum haemorrhage, most commonly involving placental abruption, accounted for 13 stillbirths (5.4%). Infection, was the main cause of death in 4.2% of stillbirths in 2020, lower than the rate of 6.6% reported in 2019, but is almost double the percentage reported in 2018 (2.8%).

In 2020, for almost eleven percent of stillbirths (n=26 of 240, 10.8%), the cause of death was unexplained. While this is slightly higher than the proportion in 2019 (n=23, 9.5%), it is lower than reported rates since 2015 (Table 3.1). As detailed in Table 3.1, in 2020, for almost sixty percent of the stillbirths with an unexplained cause of death, it was reported that the maternity unit was pending post-mortem results or other investigations for these cases (n=15 of 26, 57.7%). A cause of death may be identified when the post-mortem reports are available. In the majority of these cases where the unit was pending post-mortem results or other investigations, almost all were Coronial cases (n=12 of 15, 80.0%). In over twenty percent of the unexplained cases, it was reported that there were no antecedent or associated obstetric factors (n=6 of 26, 23.1%). For the vast majority of these unexplained stillbirths, an autopsy was performed (n=25 of 26, 96.2%). For the remaining unexplained stillbirth an autopsy was offered and presumably declined (n=1 of 26, 3.9%).

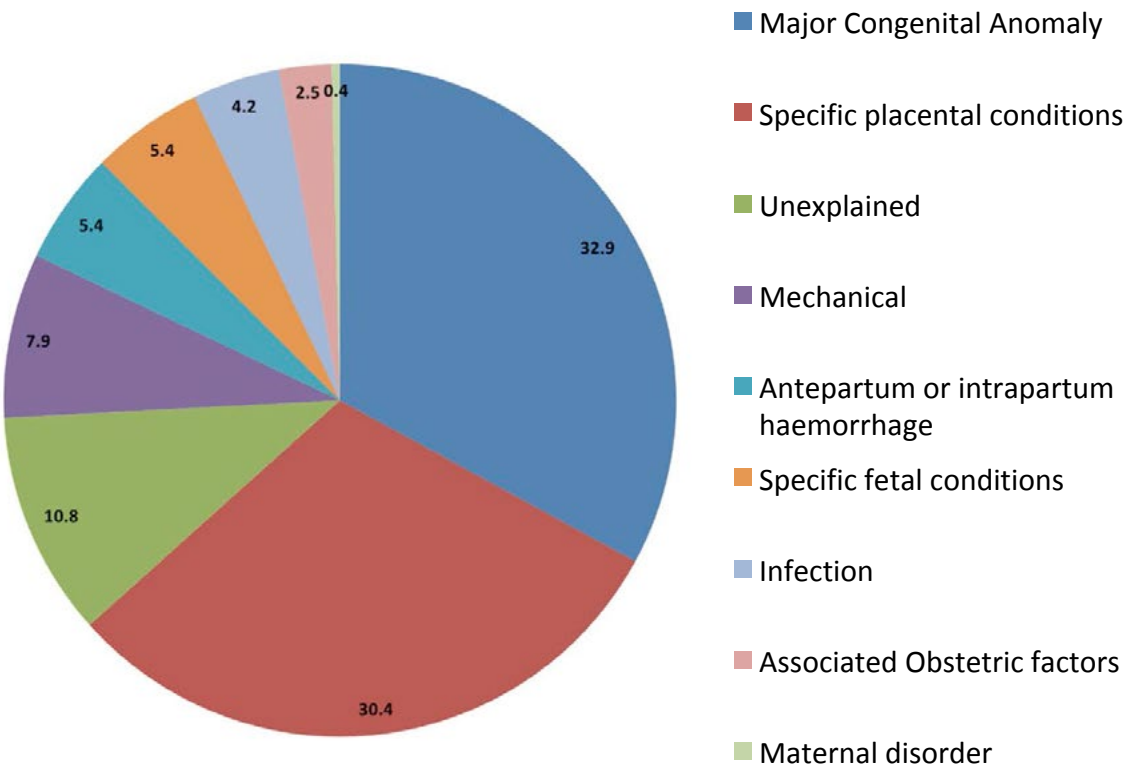

Figure 3.1: Main cause of death in stillbirths, 2020

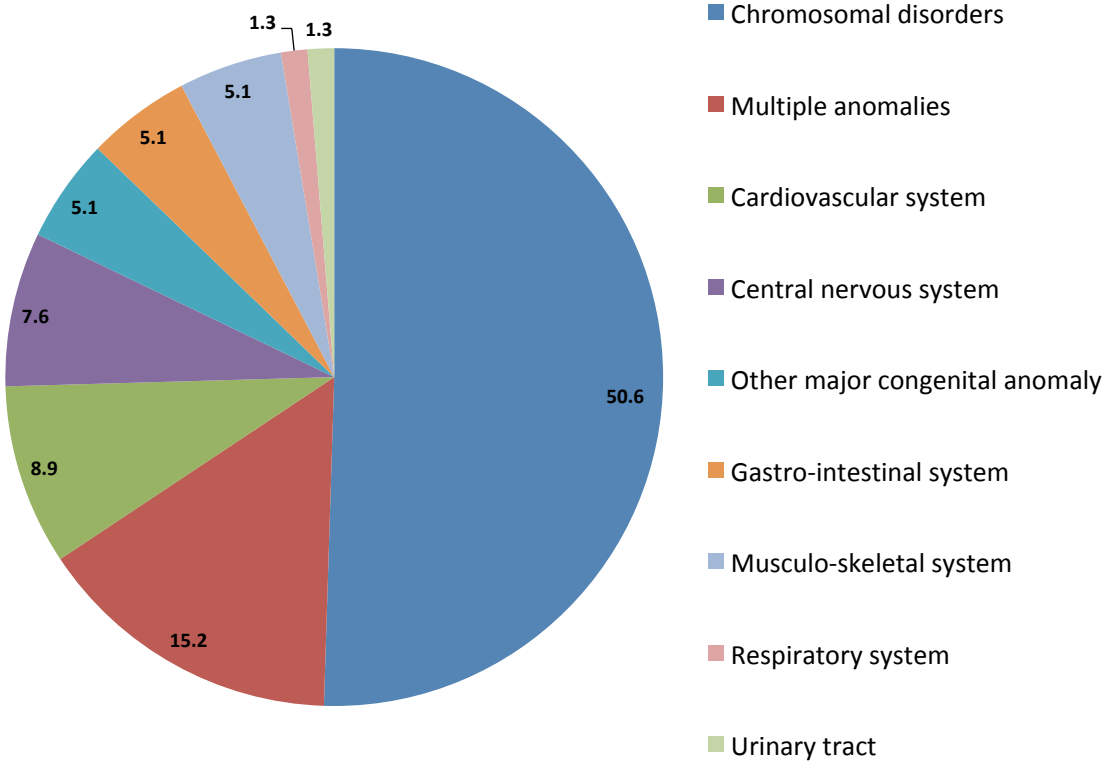

Figure 3.2: Detailed cause of death in cases of major congenital anomaly in stillbirths, 2020

Table 3.1: Stillbirth main cause of death in 2015-2020, NPEC Classification System

	2015 N=287	2016 N=250	2017 N=235	2018 N=217	2019 N=242	2020 N=240
Major congenital anomaly	**76 (26.5%)**	**78 (31.2%)**	**64 (27.2%)**	**67 (30.9%)**	**74 (30.6%)**	**79 (32.9)**
Chromosomal disorders	51	50	38	37	40	40
Central nervous system	3	5	3	9	4	6
Cardiovascular system	3	3	5	5	11	7
Urinary tract	2	3	5	1	2	1
Multiple anomalies	3	6	6	7	8	12
Gastro-intestinal system	0	3	2	0	1	4
Musculo-skeletal system	3	3	1	2	2	4
Respiratory system	0	1	0	2	3	1
Metabolic disorders	0	0	1	0	0	0
Other major congenital anomaly	11	4	3	4	3	4
Specific placental conditions[1]	**71 (24.7%)**	**70 (28.0%)**	**76 (32.3%)**	**57 (26.3%)**	**73 (30.2%)**	**73 (30.4)**
Maternal vascular malperfusion	26	24	28	16	25	19
Fetal vascular malperfusion	18	15	17	13	12	14
Cord pathology	15	15	15	10	11	12
Cord pathology with distal disease	0	9	0	7	14	17
Delayed villous maturation[2]	8	2	5	6	3	8
Chorioamnionitis	0	0	0	0	0	0
Villitis	3	0	1	4	2	2
Other placental condition	1	5	10	1	6	1
Mechanical	**19 (6.6%)**	**20 (8.0%)**	**12 (5.1%)**	**9 (4.1%)**	**18 (7.4%)**	**19 (7.9)**
Prolapse cord	3	2	0	1	0	1
Cord around neck	11	10	8	4	11	10
Uterine rupture before labour	0	1	0	3	0	1
Mal-presentation	0	0	0	0	0	0
Shoulder dystocia	0	0	0	0	1	0
Other cord entanglement or knot	5	7	4	1	6	7
Antepartum or intrapartum haemorrhage	**21 (7.3%)**	**18 (7.2%)**	**21 (8.9%)**	**12 (5.5%)**	**22 (9.1%)**	**13 (5.4)**
Praevia	1	0	0	1	0	0
Abruption	20	18	21	10	21	13
Uncertain haemorrhage	0	0	0	0	1	0
Cause of haemorrhage other				1	0	0
Infection	**25 (8.7%)**	**9 (3.6%)**	**6 (2.6%)**	**6 (2.8%)**	**16 (6.6%)**	**10 (4.2)**
Bacterial	0	1	0	0	1	1
Syphilis	0	0	0	0	0	1
Viral diseases	0	1	0	0	0	0
Group B Streptococcus	0	1	0	0	1	0
Other maternal infection	2	0	0	0	1	0
Chorioamnionitis	23	4	5	5	13	8
Other ascending infection	0	2	1	1	0	0

Note:

[1]The main placental pathology associated with perinatal death is reported.

[2]The term 'Delayed villous maturation' (DVM) has replaced conditions previously reported as 'Placental maturation defect'. DVM includes distal villous immaturity and delayed villous maturation.

Table 3.1 continued

Specific fetal conditions	**23 (8.0%)**	**9 (3.6%)**	**18 (7.7%)**	**8 (3.7%)**	**11 (4.5%)**	**13 (5.4)**
Twin-twin transfusion	10	1	5	2	2	7
Feto-maternal haemorrhage	7	3	8	3	7	5
Non immune hydrops	4	3	4	1	1	1
Iso-immunisation	0	0	0	0	0	0
Other fetal condition	2	2	1	2	1	0
Intra-uterine growth restriction	**6 (2.1%)**	**4 (1.6%)**	**1 (0.4%)**	**5 (2.3%)**	**3 (1.2%)**	**0 (0%)**
IUGR-Suspected antenatally	5	4	1	3	3	0
IUGR-Observed at delivery	0	0	0	0	0	0
IUGR-Observed at post-mortem	1	0	0	2	0	0
Associated obstetric factors	**0 (0%)**	**2 (0.8%)**	**6 (2.6%)**	**4 (1.8%)**	**1 (0.4%)**	**6 (2.5)**
Premature rupture of membranes	0	0	1	1	1	1
Prolonged rupture of membranes >24 hrs	0	0	1	1	0	1
Intrapartum asphyxia	0	2	3	1	0	0
Intracranial haemorrhage	0	0	0	0	0	0
Birth injury to scalp	0	0	0	0	0	0
Fracture	0	0	0	0	0	0
Other birth trauma	0	0	0	0	0	1
Polyhydramnios	0	0	0	0	0	0
Oligohydramnios	0	0	0	0	0	0
Spontaneous premature labour	0	0	1	0	0	1
Other obstetric factors	0	0	0	1	0	2
Maternal disorder	**2 (0.7%)**	**0 (0%)**	**3 (1.3%)**	**0 (0%)**	**0 (0%)**	**1 (0.4)**
Pre-existing hypertensive disease	0	0	0	0	0	0
Diabetes	1	0	2	1	0	1
Thrombophilias	0	0	0	0	0	0
Uterine anomalies	0	0	0	1	0	0
Other maternal disorder	1	0	1	1	1	0
Other endocrine conditions	0	0	0	0	0	0
Obstetric cholestasis	0	0	0	1	0	0
Drug misuse	0	0	0	0	0	0
Hypertensive disorders of pregnancy	**0 (0%)**	**2 (0.8%)**	**2 (0.9%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**
Pregnancy induced hypertension	0	1	0	0	0	0
Pre-eclampsia toxaemia	0	1	2	0	0	0
HELLP syndrome	0	0	0	0	0	0
Eclampsia	0	0	0	0	0	0
Unexplained	**44 (15.3%)**	**38 (15.2%)**	**26 (11.1%)**	**45 (20.7%)**	**23 (9.5%)**	**26 (10.8)**
No antecedents or associated obstetric factors	19	17	10	17	8	6
Antecedents or associated obstetric factors present	24	15	15	21	10	5
Pending post-mortem or other investigation	1	5	1	7	5	15
Very limited information available	0	1	0	0	0	0

Management of women experiencing antepartum stillbirths

Factors influencing the delivery management of women experiencing antepartum stillbirths include maternal choice, maternal wellbeing, risk of developing severe medical complications and previous obstetric history. Management of clinical care may involve planned induction of labour, awaiting spontaneous labour or in some cases elective delivery by caesarean section.[60]

In the reporting year 2020, 198 women experienced antepartum stillbirth (82.5% of all the stillbirths) (Table 3.3). The management of clinical care (i.e., whether the care involved planned induction of labour or awaiting spontaneous labour, elective delivery by caesarean section) was recorded for all the 198 women who experienced antepartum stillbirth. Labour was induced for almost eighty-five percent of the women who experienced antepartum stillbirth (n=168, 84.8%) whereas labour was spontaneous for 10.1% (n=20).

As shown in Figure 3.3, the time from diagnosis of fetal demise to delivery was different for women whose labour was induced from the delivery time for women whose labour was spontaneous in 2020. The confirmation of death and delivery took place on the same day for 80.0% (n=16 of 20) of the women whose labour was spontaneous. For women whose labour was induced, it was common for up to three days to pass between diagnosis and delivery. As can be observed from Figure 3.3, a very small number of antepartum stillbirths were delivered more than 10 days after confirmation of fetal demise, both were from multiple births with a liveborn twin.

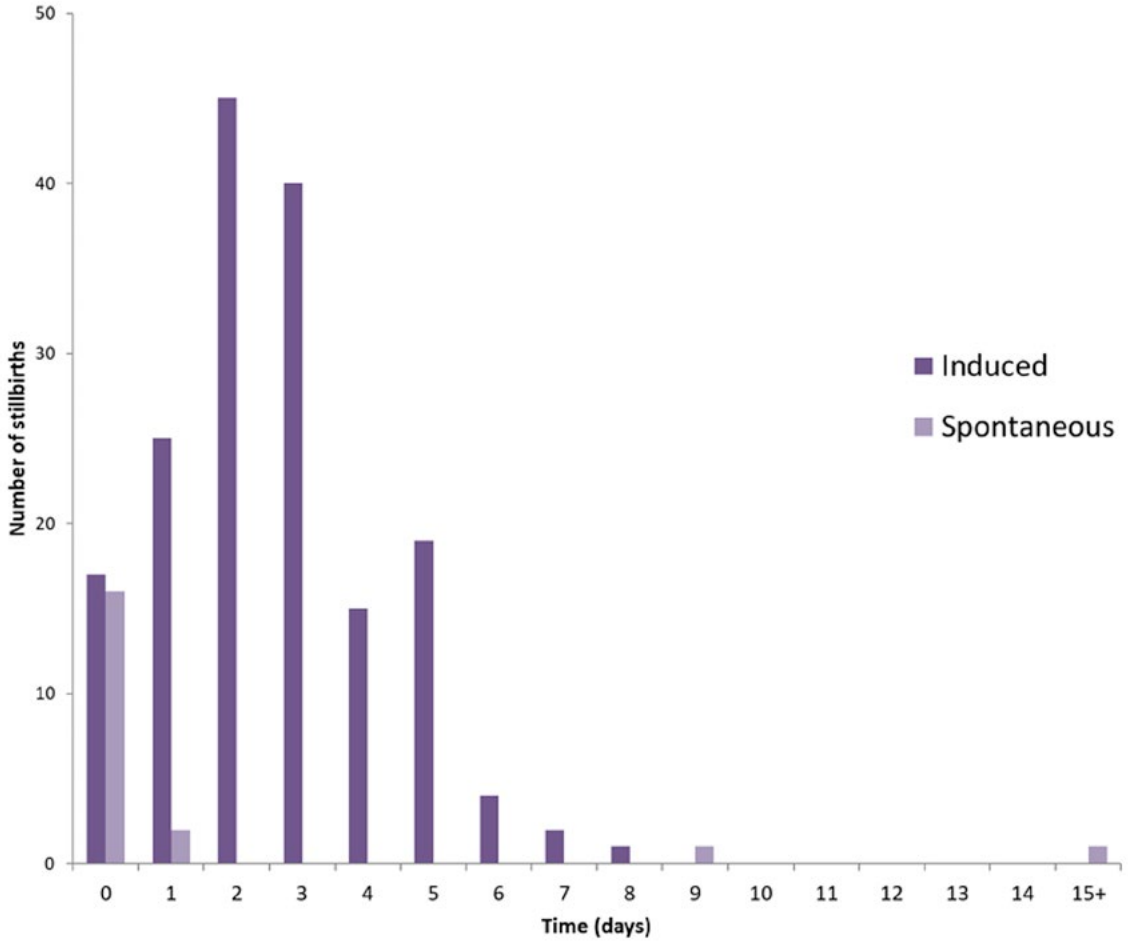

Figure 3.3: Time from confirmation of fetal demise to delivery for women who experienced antepartum stillbirth, 2020

[60] Clinical Practice Guideline No 4 (2011). Investigation and management of late fetal intrauterine death and stillbirth: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

Vaginal birth is the recommended mode of delivery for most women experiencing antepartum stillbirth, but caesarean section may be clinically indicated in some cases.[61] Vaginal cephalic delivery was the most common mode of delivery in cases of antepartum stillbirth in 2020 (n=148, 74.7%).

In 20 cases of antepartum stillbirth the intended mode of delivery was a planned caesarean section and ultimately, caesarean section was the mode of delivery for 14 women (10 pre-labour caesarean sections and 4 caesarean sections performed after onset of labour). Of these 14 women delivered by caesarean section, the procedure was classified as 'elective' in 50.0% of the cases, 7.1% were 'urgent' and 42.9% were 'emergency' (Table 3.2). Over three quarters (n=11, 78.6%) of these 14 women had previously had a caesarean section, and over eighty five percent (n=12, 85.7%) had a multiple delivery, both of these were factors that may have influenced the mode of delivery.

Table 3.2: Indication for caesarean section in women experiencing antenatal stillbirth, 2020

Indication for caesarean section	N(%)
Elective: At a time to suit the woman or the maternity team	7(50.0)
Urgent: Maternal or fetal compromise which is not immediately life threatening	1(7.1)
Emergency: Immediate threat to life of woman or baby	6(42.9)

Note: Values are N (%) unless otherwise stated.

Intrapartum stillbirths

It has been suggested that the comparatively low proportion of intrapartum stillbirths in high-income countries indicates that fetal deaths occurring in labour, in non-anomalous babies, are most likely preventable with quality intrapartum care.[62] Intrapartum deaths in this audit were identified by a specific question on the NPEC Perinatal Death Notification Form (Appendix E) as to whether the baby was alive at the onset of care in labour. This was not known in 15 cases in 2020 (Table 3.3). Of these 15 cases, one case was born before arrival at the maternity unit. In all of the remaining 14 cases, there was an antenatal diagnosis of major congenital anomaly and the majority (n=12, 85.7%) of babies were delivered following TOP.

There were 13 cases of stillbirths where the baby was known to be alive at the onset of care in labour. Thus, intrapartum deaths accounted for 5.4% of stillbirths in the Republic of Ireland in 2020 (Table 3.3). This was slightly lower than the proportion of intrapartum deaths reported in Ireland in the combined years 2018-2019 (5.7%), in 2017 (6.8%) and 2016 (7.2%). It was also lower than the most recently published 2019 figures in the United Kingdom, ranging from 8.2 % in Northern Ireland, 7.8% in England to 6.3% in Scotland. The rate of intrapartum deaths was similar in Wales (5.8%).[63]

[61] Clinical Practice Guideline No 4 (2011). Investigation and management of late fetal intrauterine death and stillbirth: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

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[63] Draper ES, Gallimore ID, Kurinczuk JJ, Smith PW, Boby T, Smith LK, Manktelow BN, on behalf of the MBRRACE-UK Collaboration. MBRRACE-UK Perinatal Mortality Surveillance Report, UK Perinatal Deaths for Births from January to December 2019. Leicester: The Infant Mortality and Morbidity Studies, Department of Health Sciences, University of Leicester. 2021.

Table 3.3: Life status of baby at the onset of care in labour for stillbirths, 2020

Type of Stillbirth case	Description	n (%)
Antepartum	Baby not alive at onset of care in labour (Antepartum Stillbirth)	198(82.5)
	Never in labour	14(5.8)
Intrapartum	Baby alive at onset of care in labour	13(5.4)
Unattended		1 (0.4)
***Not known**		14(5.8)

Note: Three of the antepartum stillbirths and one of the intrapartum stillbirths were not booked to a maternity unit. One stillbirth, who was unattended, was also a born before arrival (BBA) at maternity unit. *Life status unknown for 14 cases includes; 12 babies delivered following TOP and 2 babies with an antenatal diagnosis of major congenital anomaly who presumably were not monitored in labour.

Major congenital anomaly was the main cause of death for over thirty percent of the 13 intrapartum deaths (n=4, 30.8%). The next most common causes of death were infection (n=2), associated obstetrics factors (n=2) and specific placental conditions (n=2). A 'specific fetal condition' caused one further stillbirth. The cause of death was unexplained in two cases (n=2). There was no clustering of intrapartum deaths by hospitals due to causes other than congenital anomaly.

Section 5 of this report provides further details on perinatal deaths associated with intrapartum events in babies with a gestational age of at least 34 weeks gestation and a birthweight of at least 2,500g who were alive at the onset of labour and whose death was not due to congenital anomaly or infection. However, while the NPEC perinatal mortality audit provides the best national data available on intrapartum deaths and unexpected neonatal deaths, a more formal confidential inquiry-based system is necessary to fully appraise these cases.[64] As in previous reports, we make a recommendation in this area.

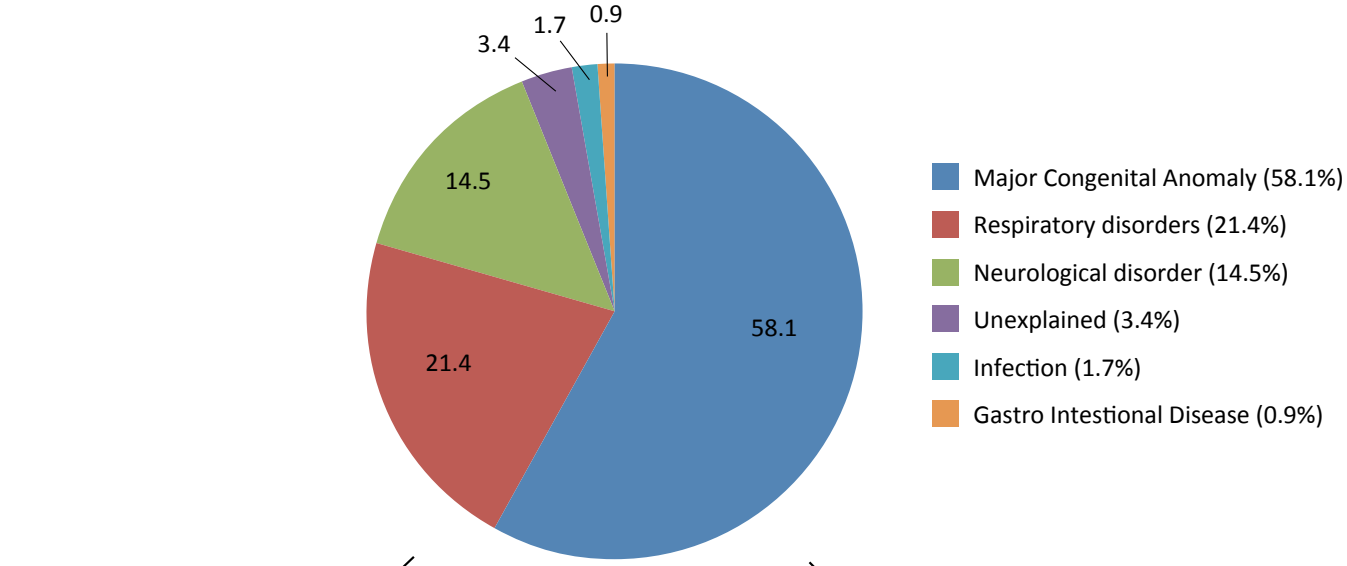
[64] McNamara K, O'Donoghue K, Greene RA. Intrapartum fetal deaths and unexpected neonatal deaths in the Republic of Ireland: 2011 - 2014; a descriptive study. BMC Pregnancy Childbirth. 2018 Jan 4;18(1):9. doi: 10.1186/s12884-017-1636-6. PMID: 29301489; PMCID: PMC5755435.

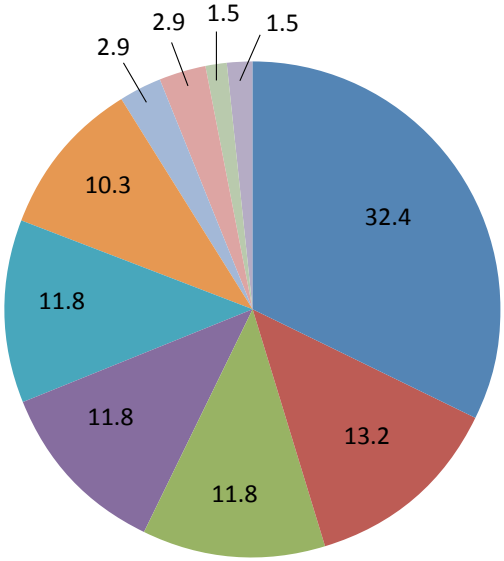
4. Early neonatal deaths: Specific findings

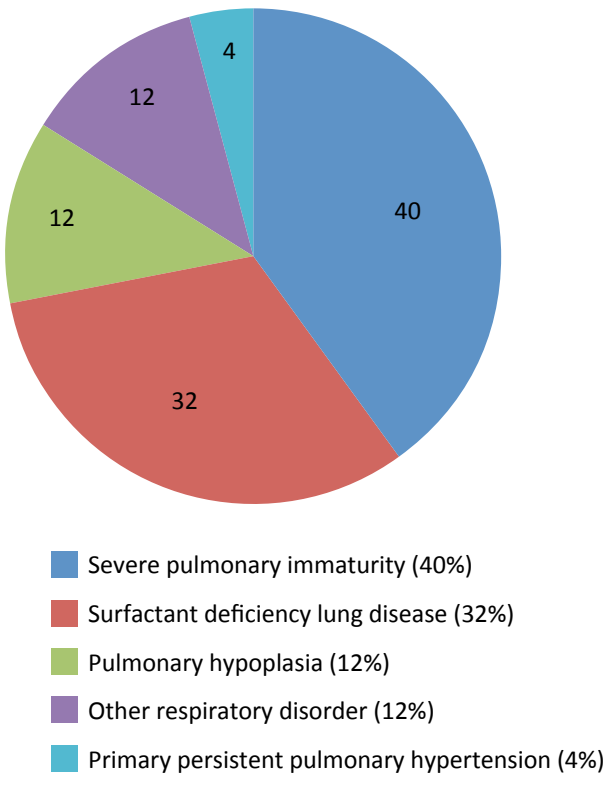
Cause of early neonatal death

The cause of early neonatal deaths in 2020 was classified using both the NPEC Neonatal Classification System and the NPEC Maternal and Fetal Classification System in order to identify both the primary neonatal condition causing the death and the underlying main antecedent or obstetric factor associated with the death.

Major congenital anomaly was the most common cause of early neonatal death in 2020 (n=68 of 117, 58.1 %) followed by respiratory disorder, accounting for more than one in five of early neonatal deaths (n=25, 21.4%) (Figure 4.1). Neurological disorder was the next most common cause of death (n=17, 14.5%), which was higher than the rate (12.7%) in 2019 and (12.0%) in 2018. Four deaths (3.4%) were unexplained pending post-mortem or other investigation. All of them were Coronial cases. A detailed listing of the main cause of death for the 117 early neonatal deaths occurring in 2020 is given at the end of this section of the report (Table 4.3).







Upper centre: **Figure 4.1: Main cause of early neonatal death, 2020**

Lower left: **Figure 4.2: Detailed cause of death in cases of major congenital anomaly in neonatal deaths, 2020**

Lower right: **Figure 4.3: Detailed cause of death in cases of respiratory disorder in neonatal deaths, 2020**

Major congenital anomalies

The types of major congenital anomalies which caused 68 of the 117 neonatal deaths in 2020 are illustrated in Figure 4.2. Chromosomal disorders were most common type of congenital anomaly, occurring in almost one third of neonatal deaths due to major congenital anomaly (n=22, 32.4%). The second most frequent anomalies were respiratory disorders occurring in thirteen percent of the cases within the major congenital anomaly group (n=9, 13.2%). Multiple anomalies, cardiovascular system and urinary tract disorders each accounted for eight (11.8%) of deaths in this cohort. Other anomalies included anomalies of the central nervous system (n=7, 10.3%) and metabolic disorders (n=2, 2.9%). Musculo-skeletal system and gastro-intestinal system each accounted for one (1.5%) death in this cohort. Two cases were categorised as having 'other' major congenital anomalies (2.9%).

Data on whether the diagnosis of a major congenital anomaly was confirmed/suspected by a consultant fetal medicine specialist was recorded for all but one of the 68 neonatal deaths that occurred in 2020. In the vast majority of these 67 cases a diagnosis was confirmed/suspected by a consultant fetal medicine specialist (n=56, 83.6%). Among the 22 neonatal deaths attributed to a chromosomal disorder, a number of diagnostic investigations were carried out: cytogenetic analysis in 77.3% (n=17 of 22), ultrasound in 63.6% (n=14 of 22) and clinically in 36.4% (n=8 of 22). Overall, nine neonatal deaths were diagnosed using one of these diagnostic procedures, six using two, and another six neonatal deaths using the three diagnostic procedures (i.e. clinical, cytogenetic analysis and ultrasound).

Respiratory disorders

Figure 4.3 details causes of death in cases of respiratory disorders in neonatal deaths in 2020. Of the early neonatal deaths caused by respiratory disorder, the majority (n=10, 40.0%) were due to severe pulmonary immaturity. Surfactant deficiency lung disease occurred in eight cases (32.0%). Pulmonary hypoplasia and other respiratory disorders each accounted for three deaths (12%). For one early neonatal death, the main cause of death was attributed to primary persistent pulmonary hypertension (4%).

Table 4.1 shows the gestational age distribution at delivery in neonatal deaths in 2020 by main cause of death, missing data for one early neonatal death. All but three of the 25 early neonatal deaths attributed to respiratory disorder occurred in babies delivered before 28 weeks gestation. This pattern of gestational age was in marked contrast to the early neonatal deaths due to major congenital anomaly and to those due to all other causes. While early neonatal deaths due to major congenital anomaly occurred in babies delivered from 22 weeks gestation, the majority (n=49, 72%) were delivered between 32- and 41-weeks' gestation, of which almost forty percent (n=27, 39.7%) were delivered at term (37-41 weeks gestation).

Table 4.1: Gestational age distribution in neonatal deaths by main cause of death, 2020

	<22 weeks N(%)	22-27 weeks N(%)	28-31 weeks N(%)	32-36 weeks N(%)	37-41 weeks N(%)	≥42 weeks N(%)
Respiratory disorder	0(0)	22(59.5)	2(22.2)	1(3.7)	0(0)	0(0)
Major congenital anomaly	1(100)	10(27)	6(66.7)	22(81.5)	27(67.5)	1(50)
All Other	0(0)	5(13.5)	1(11.1)	4(14.8)	13(32.5)	1(50)

Note: Values are n (%) unless otherwise stated. Data missing for one ENND.

Neurological disorders

A neurological disorder was attributed as the main cause of death in 17 (14.5%) early neonatal deaths in 2020. For fifteen of these 17 cases, the condition involved was hypoxic ischaemic encephalopathy (HIE) and for two cases death was due to intraventricular/periventricular haemorrhage (IVH/PVH). Table 4.2 details the gestational age, customised birthweight centile and main antecedent or obstetric factor associated with the 17 early neonatal deaths attributed to neurological disorders. Ten of these 17 cases occurred in babies with a gestational age of 37-41 weeks. Fourteen of these 17 early neonatal deaths had an autopsy performed and all of them became Coronial cases.

Table 4.2: Details of early neonatal deaths due to neurological disorders, 2020

Neurological disorder	Gestational age (weeks)	Birthweight centile	Main antecedent or obstetric factor associated with the death	Autopsy Performed (Yes/No)	Coroner case (Yes/No)
IVH/PVH	27	63.6	Spontaneous premature labour	Autopsy not performed but offered	No
IVH/PVH	25	0	IUGR - Suspected antenatally	Autopsy not performed but offered	No
HIE	42	28	Pending results of post mortem or other investigations	Autopsy performed	Yes
HIE	41	90.5	No Antecedent or Associated Obstetric Factors	Autopsy performed	Yes
HIE	41	62.1	Pending results of post mortem or other investigations	Autopsy performed	Yes
HIE	41	12.2	fetal vascular malperfusion	Autopsy performed	Yes
HIE	40	97.8	Pending results of post mortem or other investigations	Autopsy performed	Yes
HIE	40	35.2	Abruption	Autopsy not performed but offered	No
HIE	39	27.2	Abruption	Autopsy performed	Yes
HIE	39	0.8	Cord pathology with distal disease	Autopsy performed	Yes
HIE	38	1.8	Pending results of post mortem or other investigations	Autopsy performed	Yes
HIE	38	38.1	fetal vascular malperfusion	Autopsy performed	Yes
HIE	37	100	Diabetes	Autopsy performed	Yes
HIE	36	15.4	Other fetal condition	Autopsy performed	Yes
HIE	33	62.3	Prolapse cord	Autopsy performed	Yes
HIE	26	29	Spontaneous premature labour	Autopsy performed	Yes
HIE	25	39.1	Abruption	Autopsy performed	Yes

Note: IVH/PVH = Intraventricular/periventricular haemorrhage; HIE = hypoxic ischaemic encephalopathy.

Table 4.3: Early neonatal main cause of death in 2015-2020, NPEC Classification System

	2015 N=166	2016 N=124	2017 N=111	2018 N=108	2019 N=118	2020 N=117
Major congenital anomaly	**98 (59.0%)**	**68 (54.8%)**	**62 (55.9%)**	**62 (57.4%)**	**64 (54.2%)**	**68 (58.1%)**
Chromosomal disorders	17	18	26	12	15	22
Cardiovascular system	16	9	10	9	7	8
Central nervous system	11	7	7	12	8	7
Urinary tract	19	11	4	7	8	8
Multiple anomalies	11	8	4	14	12	8
Musculo-skeletal system	5	6	3	4	3	1
Respiratory system	1	3	2	2	5	9
Gastro-intestinal system	4	0	1	0	0	1
Metabolic disorders	1	3	0	0	0	2
Other major congenital anomaly	13	3	5	2	6	2
Pre-viable (<22 weeks)	**1(0.6%)**	**0(0%)**	**2(1.8%)**	**0(0)**	**0(0)**	**0(0)**
Respiratory disorders	**41 (24.7%)**	**36 (29.0%)**	**24 (21.6%)**	**25 (23.1%)**	**28 (23.7%)**	**25 (21.4%)**
Severe pulmonary immaturity	31	25	13	18	20	10
Surfactant deficiency lung disease	1	4	6	3	0	8
Pulmonary hypoplasia	4	5	3	2	3	3
Primary persistent pulmonary hypertension	1	0	0	1	1	1
Meconium aspiration syndrome	0	0	0	0	1	0
Chronic lung disease/bronchopulmonary	0	0	0	0	0	0
Other respiratory disorder	4	2	2	1	3	3
Gastro-intestinal disease	**0 (0%)**	**1 (0.8%)**	**4 (3.6%)**	**0 (0%)**	**1 (0.8%)**	**1 (0.9%)**
Necrotising enterocolitis	0	1	4	0	1	1
Other gastro-intestinal disease	0	0	0	0	0	0
Neurological disorder	**17 (10.2%)**	**8 (6.5%)**	**9 (8.1%)**	**13 (12%)**	**15 (12.7%)**	**17 (14.5%)**
Hypoxic ischaemic encephalopathy	13	5	6	7	9	15
Intraventricular/periventricular haemorrhage	4	3	3	6	6	2
Other neurological disorder	0	0	0	0	0	0
Infection	**3 (1.8%)**	**4 (3.2%)**	**1 (0.9%)**	**2 (1.9%)**	**2 (1.7%)**	**2 (1.7%)**
Sepsis	0	4	1	1	1	0
Pneumonia	1	0	0	1	0	0
Meningitis	0	0	0	0	0	0
Other infection	2	0	0	0	1	2
Injury/Trauma	**2 (1.2%)**	**2 (1.6%)**	**5 (4.5%)**	**1 (0.9%)**	**5 (4.2%)**	**0 (0%)**
Malignancies/tumours	0	0	0	0	0	0
Other specific causes	2	2	5	1	5	0
Sudden unexpected deaths	**1 (0.6%)**	**0 (0%)**	**1 (0.9%)**	**1 (0.9%)**	**0 (0%)**	**0 (0%)**
Sudden infant death syndrome (SIDS)	1	0	1	1	0	0
Infant deaths - Cause unascertained	0	0	0	0	0	0
Unexplained	**3 (1.8%)**	**5 (4.0%)**	**3 (2.7%)**	**4 (3.7%)**	**3 (2.5%)**	**4 (3.4%)**
Pending post-mortem or other investigations	3	5	2	3	2	4
Antecedents or associated obstetric factors present	0	0	1	1	0	0
No antecedents or associated obstetric factors present	0	0	0	0	1	0
Very limited information available	0	0	0	0	0	0

Condition and management at birth

The NPEC Perinatal Death Notification Form (Appendix E) records the condition, in terms of respiratory activity and heart rate shortly after delivery, of babies who die in the early neonatal period. For most of these early neonatal deaths that occurred during 2020 (n=62 of 112, 55.4%, unknown for five cases) spontaneous respiratory activity was absent or ineffective at five minutes following delivery and for over one third (n=43 of 110, 39.1%, unknown for seven cases) the heart rate was persistently less than 100 beats per minute.

In 2020, active resuscitation was offered in the delivery room in over half of early neonatal deaths (n=61 of 115, 53.0%, unknown for two case). Of the early neonatal deaths not receiving resuscitation (n=54), the majority (n=44, 81.5%) were associated with a major congenital anomaly (Table 4.4). Most (n=8, 80%) early neonatal cases born without major congenital anomaly and not offered resuscitation were delivered prematurely less than 27 weeks gestation.

Table 4.4: Early neonatal deaths due to major congenital anomaly not offered resuscitation, 2020

Gestation at delivery	<22 weeks N(%)	22-27 weeks N(%)	28-31 weeks N(%)	32-36 weeks N(%)	37-41 weeks N(%)	≥42 weeks N(%)	Total N
Total early neonatal deaths not offered resuscitation	1(1.9)	17(31.5)	3(5.6)	10(18.5)	22(40.7)	1(1.9)	54(100%)
Death due to major congenital anomaly not offered resuscitation	1(2.3)	9(20.5)	3(6.8)	10(22.7)	20(45.5)	1(2.3)	44(100%)
Death without major congenital anomaly not offered resuscitation	0(0)	8(80)	0(0)	0(0)	2(20)	0(0)	10(100%)

Note: Values are n(%) unless otherwise stated.

In 2020, over fifty percent of babies who died in the early neonatal period were admitted to a neonatal unit in the hospital of delivery (n=61 of 117, 52.1%) and almost fifteen percent (n=17, 14.5%) were transferred to another unit. Such admission and transfer depended on whether active resuscitation had been offered in the delivery room. Admission to a neonatal unit followed over eighty percent of the cases offered active resuscitation (n=51 of 59, 86.4%, missing information for two cases) compared to almost fourteen percent not offered active resuscitation who were admitted to NICU (n=8 of 51, 13.6%) (Table 4.5). Over one in five cases offered active resuscitation were transferred to another unit (n=11 of 16, 68.8%).

Table 4.5: Management at birth of babies who died within the first week of birth, 2020

		Baby admitted to neonatal unit n= 59, N(%)	Baby transferred to another unit n=16, N(%)
Resuscitation	Yes (n=54)	51(86.4)	11(68.8)
	No (n=61)	8(13.6)	5(31.3)

Note: Values are N (%) unless otherwise stated. Active resuscitation in the delivery room includes BMV, PPV, intubation, cardiac massage. Data on active resuscitation and baby being transferred was unknown for two cases, respectively.

Age of neonate at death

Almost fifty-five percent of the early neonatal deaths occurred within 24 hours of delivery (Table 4.6). Within this cohort, major congenital anomaly (n=43 of 64, 67.2%) and respiratory disorders (n=14 of 64, 21.9%), mainly severe pulmonary immaturity, were the main cause of death, followed by neurological disorder (n=5, 7.8%) and unexplained (n=2, 3.1%).

Table 4.6: Age of neonate at death, 2020

Completed days	0	1	2	3	4	5	6	7
Number	64	23	8	11	3	3	2	3
%	54.7	19.7	6.8	9.4	2.6	2.6	1.7	2.6
Cumulative %	54.7	74.4	81.2	90.6	93.2	95.7	97.4	100.0

Note: Values are n(%) unless otherwise stated.

Location of neonatal death

The vast majority of early neonatal deaths in 2020 occurred either in the neonatal unit, the labour ward, or in another maternity unit ward (Table 4.7). A very small proportion of deaths occurred in a paediatric centre or theatres.

Table 4.7: Location of neonatal death, 2020

Place of death	n(%)
Neonatal Unit	52(44.4)
Labour Ward	37(31.6)
Ward of the maternity unit	10(8.5)
Theatre	7(6)
Paediatric Centre	7(6)
*At home	4(3.4)

Note: Values are n(%) unless otherwise stated. *All 4 babies who died at home were discharged from the maternity unit with a known major congenital anomaly.

All but one of 37 neonatal deaths that occurred in the labour ward occurred within 24 hours of delivery. These 36 deaths in the labour ward accounted for over fifty-six percent of the neonatal deaths that occurred within the first day of the birth (n=36 of 64, 56.3%). In 2020, of the 36 deaths in the labour ward that occurred within the first day, one in four resulted from a TOP (n=9 of 36, 25.0%). A further 23.4% (n=15 of 64) of first day neonatal deaths occurred in a neonatal unit. As detailed in Table 4.6, the daily number of neonatal deaths was significantly lower once 24 hours had elapsed after delivery. The majority of the neonatal deaths that occurred between 1-6 completed days happened in a neonatal unit (Figure 4.4).

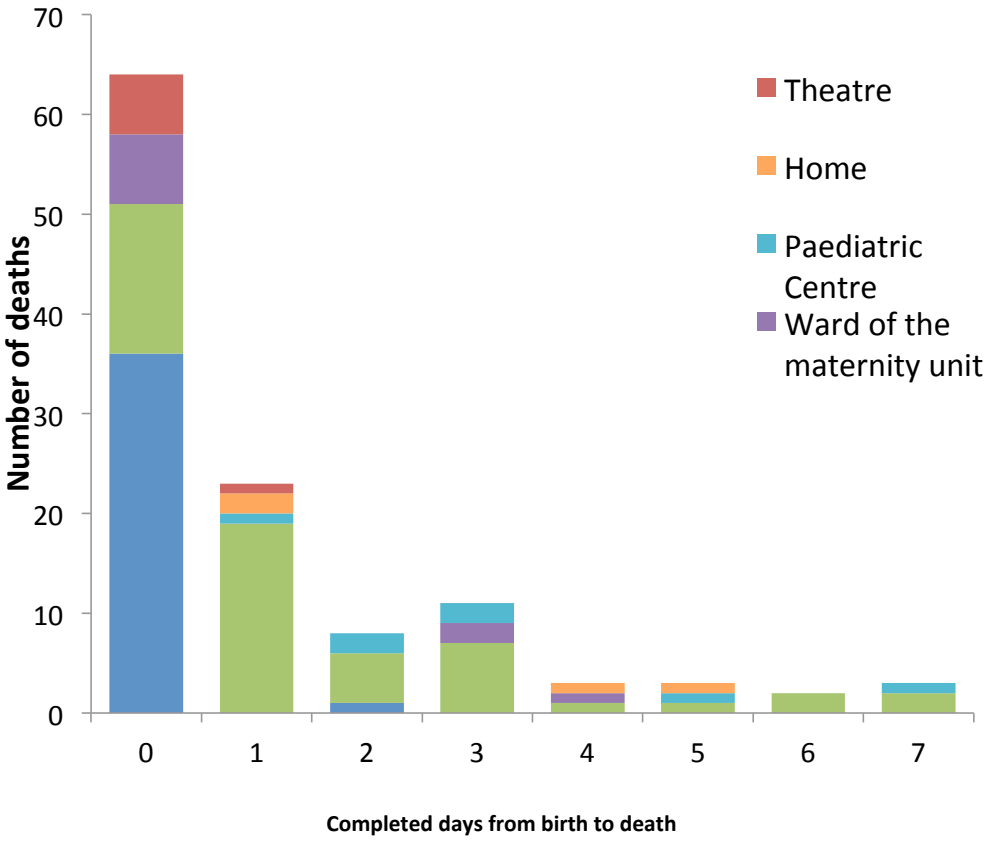


Figure 4.4: Place of neonatal death 0-6 complete days after birth, 2020

5. Perinatal deaths associated with intrapartum events

The investigation of perinatal deaths due to intrapartum events is valuable in assessing quality of care. These deaths are unexpected and include stillbirths alive at the onset of professional care in labour and neonatal deaths. Traditionally intrapartum deaths referred to babies who were alive at onset of labour but stillborn. The inclusion of neonatal deaths facilitates the assessment of all perinatal deaths that may have an intrapartum origin.

As in previous reports, we reviewed perinatal deaths reported in 2020 focusing on cases with a gestational age of at least 34 weeks and a birthweight of at least 2,500g who were alive at the onset of care in labour and whose death was not due to major congenital anomaly (or infection). Babies who were delivered by pre-labour caesarean section were not included.

In 2020, there were 29 cases of perinatal death with a gestational age of at least 34 weeks and a birthweight of at least 2,500g who were alive at the onset of care in labour (n=5 stillbirths and n=24 early neonatal). Of these 29 cases, over half were due to due to major congenital anomaly (n=16 of 29, 55.2%). A further two cases were excluded from the cohort as death was due to infection (Group B Streptococcus, n=1 and Chorioamnionitis, n=1).

In total, there were eleven perinatal deaths (three stillbirths and eight early neonatal deaths) associated with intrapartum events with a gestational age of at least 34 weeks and a birthweight of at least 2,500g who were alive at the onset of labour and whose death was not due to major congenital anomaly or infection. All of the eleven deaths were Coronial cases. In order to preserve confidentiality, limited details of the cases are outlined in Table 5.1 below.

Table 5.1: Details of perinatal deaths in 2020 associated with intrapartum events

Type of perinatal death	Gestational age (range in weeks)	Birthweight centile	Main antecedent or obstetric factor associated with the death	Neonatal cause of death	Autopsy Performed
SB	40 - 43	>90th	Shoulder dystocia Pending post-mortem report		Yes (Coroner case)
SB	40 - 43	10 – 49th	Placental disease: Cord pathology		Yes (Coroner case)
SB	37 - 40	50 – 89th	Pending post-mortem report		Yes (Coroner case)
END	40 – 43	>90th	Uterine rupture during labour.	HIE. Pending post-mortem report	Yes (Coroner case)
END	38 - 40	10 – 49th	Placental disease: Fetal vascular malperfusion	HIE	Yes (Coroner case)
END	38 - 40	<3rd	Placental disease: Cord pathology with distal disease	HIE	Yes (Coroner case)
END	40 - 43	10 – 49th	Pending post-mortem report	HIE Pending post-mortem report	Yes (Coroner case)
END	40 - 43	50 – 89th	Pending post-mortem report	HIE Pending post-mortem report	Yes (Coroner case)
END	40 - 43	10 – 49th	Placental disease: Fetal vascular malperfusion	HIE	Yes (Coroner case)
END	40 - 43	<3rd	IUGR	HIE	Yes (Coroner case)
END	40 - 43	50-89th	Pending post-mortem report	HIE Pending post-mortem report	Yes (Coroner case)

Note: SB=Stillbirth; END=Early neonatal death; HIE=hypoxic ischaemic encephalopathy.

6. Late neonatal deaths: Specific findings

For the purposes of this clinical audit, data were reported to the NPEC relating to 35 late neonatal deaths that occurred among babies born in 2020. This figure is in line with the numbers reported in previous years.

On average, 32 late neonatal deaths per year were reported for 2015-2019 and the annual number ranged from 28 to 35. The NPEC figures are similar but not identical to those reported by the Central Statistics Office (CSO). For 2015-2019, an average of 33 late neonatal deaths per year was reported by the CSO and the annual number ranged from 31 to 38.

Maternity hospitals may not be notified of the late neonatal death of a baby delivered in their unit if the baby was transferred to a paediatric unit or discharged home. The NPEC is working with colleagues in the relevant hospitals (maternity and paediatric) to address this issue. Further, it is envisaged that future collaboration with the NOCA National Paediatric Mortality Register (NPMR) will provide a validated, robust data source to inform the NPEC audit on late neonatal deaths.

Given the notification issue and the limited number of late neonatal deaths reported, this section of the report provides a brief summary of the submitted data as well as the detailed listing of the main cause of the 35 deaths occurring in 2020, according to the NPEC Classification System.

Table 6.1 describes a range of characteristics of the babies who died in the late neonatal period. While values fluctuate from year to year, slightly more babies who died in the late neonatal period were male for the reporting years 2015 to 2018. This was not the case in 2020 and 2019 when slightly more babies who died in the late neonatal period were female (51.4% and 56.3%, respectively).

For the reporting year 2020, over thirty percent of the babies who died in the late neonatal period were born by vaginal cephalic delivery (n=11, 31.4%) and sixty percent were delivered by pre-labour caesarean section (n=21, 60%). Most had a gestational age between 22-27 weeks (n=10, 28.6%) or 37-41 weeks at birth (n=14, 40%), and almost sixty percent of the babies (n=20; 57.1%) had a birthweight less than 2,500 grams. Forty percent of babies were small for gestational age (SGA; <10th centile n=15, 42.9%).

Similar to previous reports, the proportion of late neonatal deaths was found to decrease across the second, third and fourth weeks of life in 2020. For example, in 2020, the proportion of late neonatal deaths decreased from 51.4% in week two to 31.4% in week three, and to 17.1% in week four. In contrast, for the reporting year 2019, the majority (75%) of late neonatal deaths occurred in week two and a further 12.5% of deaths occurred in both week three and week four.

Almost 55% percent of late neonatal deaths in 2020 occurred in the neonatal unit and almost thirty-five percent died in a paediatric centre (n=19, 54.3% and n=12, 34.3%, respectively). This is similar to the late neonatal deaths in 2019, which half of them occurred in the neonatal unit, and forty percent died in a paediatric centre (n=16, 50.0% and n=13, 40.6%, respectively). The rising number of late neonatal deaths occurring in paediatric centres, coupled with the notification issues of late neonatal deaths to the NPEC perinatal mortality audit as previously discussed, highlight the need for good communication between the referring maternity units and paediatric centres, specifically in relation to cause of late neonatal death and autopsy uptake. Feedback from maternity units have indicated a need for improvement in communications with paediatric centres.

Table 6.1: Characteristics of late neonatal deaths in 2015-2020

	2015 N=28 N(%)	2016 N=33 N(%)	2017 N=35 N(%)	2018 N=30 N(%)	2019 N=32 N(%)	2020 N=35 N(%)
Infant sex						
Male	19(73.1)	19(57.6)	18(51.4)	18(60)	14(43.8)	17(48.6)
Female	7(26.9)	14(42.4)	17(48.6)	12(40)	18(56.3)	18(51.4)
Mode of delivery						
Vaginal cephalic delivery	11(42.3)	11(33.3)	13(37.1)	12(40)	10(31.3)	11(31.4)
Vaginal breech delivery	1(3.8)	3(9.1)	3(8.6)	4(13.3)	3(9.4)	0(0)
Pre-labour caesarean section	9(34.6)	9(27.3)	11(31.4)	9(30)	13(40.6)	21(60)
Caesarean section after onset of labour	3(11.5)	6(18.2)	6(17.1)	4(13.3)	3(9.4)	3(8.6)
Forceps	0(0)	1(3)	1(2.9)	1(3.3)	0(0)	0(0)
Assisted breech	1(3.8)	2(6.1)	0(0)	0(0)	2(6.3)	0(0)
Ventouse	1(3.8)	1(3)	1(2.9)	0(0)	1(3.1)	0(0)
Gestational age at delivery						
22-27 weeks	8(28.6)	12(36.4)	15(42.9)	13(43.3)	13(40.6)	10(28.6)
28-31 weeks	2(7.1)	3(9.1)	3(8.6)	5(16.7)	1(3.1)	6(17.1)
32-36 weeks	7(25)	6(18.2)	4(11.4)	4(13.3)	3(9.4)	5(14.3)
37-41 weeks	10(35.7)	12(36.4)	13(37.1)	8(26.7)	15(46.9)	14(40)
42+ weeks	1(3.6)	0(0)	0(0)	0(0)	0(0)	0(0)
Birthweight						
<500g	1(3.6)	1(3)	0(0)	2(6.7)	2(6.3)	0(0)
500<1000g	8(28.6)	14(42.4)	15(42.9)	13(43.3)	10(31.3)	8(22.9)
1000<1500g	2(7.1)	2(6.1)	2(5.7)	3(10)	2(6.3)	7(20)
1500<2000g	2(7.1)	2(6.1)	2(5.7)	4(13.3)	0(0)	3(8.6)
2000<2500g	4(14.3)	5(15.2)	3(8.6)	1(3.3)	6(18.8)	2(5.7)
2500<3000g	3(10.7)	1(3)	4(11.4)	2(6.7)	1(3.1)	8(22.9)
3000<3500g	5(17.9)	6(18.2)	4(11.4)	3(10)	5(15.6)	4(11.4)
3500<4000g	3(10.7)	2(6.1)	4(11.4)	2(6.7)	5(15.6)	3(8.6)
4000g+	0(0)	0(0)	1(2.9)	0(0)	1(3.1)	0(0)
Customised birthweight centile category						
<3rd	10(35.7)	10(30.3)	7(20.0)	10(33.3)	6(18.8)	12(34.3)
<10th*	11(39.3)	11(33.3)	11(31.4)	12(40)	10(31.3)	15(42.9)
10-49th	8(28.6)	15(45.5)	13(37.1)	7(23.3)	9(28.1)	10(28.6)
50-89th	9(32.1)	6(18.2)	8(22.9)	7(23.3)	11(34.4)	10(28.6)
90th+	0(0)	1(3)	3(8.6)	4(13.3)	2(6.3)	0(0)
Timing of death						
2nd week of life	17(60.7)	15(45.5)	17(48.6)	17(56.7)	24(75)	18(51.4)
3rd week of life	7(25)	9(27.3)	11(31.4)	7(23.3)	4(12.5)	11(31.4)
4th week of life	4(14.3)	9(27.3)	7(20.0)	6(20)	4(12.5)	6(17.1)
Location of death						
Neonatal unit	14(50)	22(66.7)	21(61.8)	21(70)	16(50)	19(54.3)
Ward of the maternity unit	0(0)	1(3.0)	0(0)	0(0)	1(3.1)	1(2.9)
Paediatric centre	9(32.1)	7(21.2)	10(29.4)	5(16.7)	13(40.6)	12(34.3)
Home	4(14.3)	3(9.1)	3(8.8)	4(13.3)	2(6.3)	3(8.6)
In transit/home	1(3.6)	0(0)	0(0)	0(0)	0(0)	0(0)

Note: Data was missing for the following variables: In 2017, place of death not known for one case, in 2015 gender not known for two cases and mode of delivery was not known for two cases. *Includes cases from the category <3rd Centile.

As shown in Table 6.2, major congenital anomaly was the most common cause of death in 2020 (n=18, 51.4%). The next most common causes were infection and neurological disorders, each disorder accounting for five deaths (n=5, 14.3%). Other causes of death in 2020 included gastro-intestinal disorders (n=4, 11.4%). Respiratory disorders and sudden infant death syndrome accounted for one death each (n=1, 2.9%). One further death was unexplained pending post-mortem or other investigation (n=1, 2.9%).

Table 6.2: Late neonatal main cause of death in 2015-2020, NPEC Classification System

	2015 N=28 N(%)	2016 N=33 N(%)	2017 N=35 N(%)	2018 N=30 N(%)	2019 N=32 N(%)	2020 N=35 N(%)
Major congenital anomaly	**15 (53.6%)**	**15 (45.5%)**	**13 (37.1%)**	**12 (40.0%)**	**12 (37.5%)**	**18 (51.4)**
Central nervous system	1	1	0	0	0	0
Cardiovascular system	5	2	5	3	5	5
Respiratory system	1	0	0	1	0	3
Gastro-intestinal system	1	1	0	0	0	1
Musculo-skeletal system	0	0	0	1	0	0
Multiple anomalies	0	2	2	0	0	1
Chromosomal disorders	0	1	0	6	2	4
Metabolic disorders	7	6	6	1	0	1
Urinary tract	0	1	0	0	1	1
Other major congenital anomaly	0	1	0	0	4	2
Respiratory disorders	**3 (10.7%)**	**10 (30.3%)**	**5 (14.3%)**	**3 (10.0%)**	**6 (18.8%)**	**1 (2.9)**
Severe pulmonary immaturity	3	3	3	1	2	0
Surfactant deficiency lung disease	0	6	1	1	2	0
Pulmonary hypoplasia	0	0	0	0	0	0
Meconium aspiration syndrome	0	0	0	0	0	0
Primary persistent pulmonary hypertension	0	0	0	0	0	0
Chronic lung disease/bronchopulmonary dysplasia	0	0	0	0	0	0
Other respiratory disorder	0	1	1	1	2	1
Gastro-intestinal disease	**3 (10.7%)**	**3 (9.1%)**	**8 (22.9%)**	**5 (16.7%)**	**3 (9.4%)**	**4 (11.4)**
Necrotising enterocolitis	3	3	7	4	3	4
Other gastro-intestinal disease	0	0	1	1	0	0
Neurological disorder	**2 (7.1%)**	**4 (12.1%)**	**5 (14.3%)**	**4 (13.3%)**	**3 (9.4%)**	**5 (14.3)**
Hypoxic-ischaemic encephalopathy	1	3	5	1	2	4
Intraventricular/periventricular haemorrhage	1	1	0	3	1	0
Other neurological disorder	0	0	0	0	0	1
Infection	**4 (14.3%)**	**0 (0%)**	**1 (2.9%)**	**4 (13.3%)**	**3 (9.4%)**	**5 (14.3)**
Sepsis	1	0	1	4	3	0
Pneumonia	0	0	0	0	0	0
Meningitis	2	0	0	0	0	0
Other infection	1	0	0	1	0	0
Injury/Trauma	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**
Other specific causes	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**1 (3.1%)**	**0 (0%)**
Malignancies/tumours	0	0	0			
Other specific cause	0	0	0	0	1	
Sudden unexpected deaths	**1 (3.6%)**	**1 (3.0%)**	**1 (2.9%)**	**1 (3.3%)**	**2 (6.3%)**	**1 (2.9)**
Sudden infant death syndrome (SIDS)	1	1h	1	1	2	1
Infant Deaths - Cause Unascertained	0	0	0	0	0	0
Unexplained	**0 (0%)**	**0 (0%)**	**2 (5.7%)**	**0 (0%)**	**2 (6.3%)**	**1 (2.9)**
No antecedents or associated obstetric factors	0	0	0	0	0	0
Antecedents or associated obstetric factors present	0	0	0	0	0	0
Very limited information available	0	0	0	0	0	0
Pending results of postmortem or other investigations	0	0	2	0	2	1

7. Early neonatal deaths with a birthweight <500g and a gestational age at delivery <24 weeks

While not included in the calculation of perinatal mortality rates in the Republic of Ireland (ROI), we ask for notification of deaths in the early neonatal period of live born babies delivered before 24 weeks gestation and weighing less than 500g. The collation of this data on these perinatal events by the NPEC provides vital information surrounding adverse pregnancy outcomes in all registered live births in the ROI. For 2020, 48 such deaths were reported. Given the limited number of such deaths, a brief summary of the submitted NPEC audit data for 2020 is provided in Table 7.1.

For the reporting year 2020, the majority (n=29, 60.4%) of the 48 deaths occurred in babies delivered between 20- and 22-weeks' gestation, a third (n=16, 33.3%) delivered less than 20 weeks gestation, and 3 deaths occurred in babies after 22-weeks' gestation. The birthweights of babies born in 2020 were in the range of 37g to 495g. Details of the 48 early neonatal deaths born before 24 weeks gestation and weighing less than 500g are provided in Table 7.1.

Similar to previous reports, using the NPEC Neonatal Classification System, the assigned neonatal cause of death was pre-viable (<22 weeks) for the majority of cases in 2020 (n=36, 75.0%). The second most common neonatal cause of death was major congenital anomaly (n=10, 20.8%) of which the majority were attributed to chromosomal disorders (n=7, 14.9%). Severe pulmonary immaturity and necrotising enterocolitis accounted for one death each (2.1%).

In 2020, all but three babies died within 24 hours of being delivered (n=45, 93.8%). Most of the 45 babies who died within 24 hours died in another ward of the maternity unit (n=24, 53.3%) and almost 45% died in the labour ward (n=20 of 45, 44.4%). One further baby (2.2%) died at home. The location of death in 2020 of babies dying within 24 hours of delivery is in contrast to that reported in previous years (2013-2019) where the location of death in the vast majority of cases was the labour ward. Among the cases that died after 24 hours in 2020, one baby died in the labour ward, another in the ward at the maternity hospital and the third one at the neonatal unit.

In 2020, an autopsy was performed in only a small number of cases (n=5, 10.4%). However, an autopsy was offered in a further 43.8% (n=21), and in remainder, an autopsy was not performed and not offered (n=22, 45.8%).

A recurrent issue raised by maternity units relates to the registration of live babies born before the age of viability. Correspondence from the General Registers Office (GRO) has confirmed the current legislation on registration of such births: if an infant is born with signs of life, regardless of birthweight or gestational age at delivery, the birth is registered as a live birth and if the subsequent death of the infant occurs during the perinatal period, the death should then also be registered as a neonatal death.[65]

Ongoing communication between the NPEC and maternity units identified a need for clarification on two counts: (1) reportable perinatal deaths to the NPEC audit following termination of pregnancy (TOP) and (2) in light of recent guidelines on the resuscitation of normally formed babies at the cusp of viability, the calculation of perinatal mortality rates at unit level. In response to these queries, the NPEC disseminated a communique to all maternity units following communication with the NWIHP (see Appendix J). Briefly summarised, all perinatal deaths meeting the inclusion criteria for this audit and registerable with the Civil Registration System by law, should be notified to the NPEC perinatal mortality audit.

In the ROI, the legal definition of stillbirths ('a child born weighing 500 grammes or more or having a

[65] Smith B, Assistant Registrar General 2016, personal communication, 12th October.

gestational age of 24 weeks or more who shows no sign of life.'),[66] is not consistent with international definitions (generally using the criterion of ≥ 22 weeks gestational age at delivery) in the developed world.[67] This not only has economic and psychosocial ramifications but impacts on potential learning for clinicians and hampers robust international comparison.[68] As an initial step, perhaps there is a need to align data collection on perinatal deaths with international findings. A review of current legal definitions of perinatal deaths in the ROI should also be considered.

According to the criteria used in this report of gestational age ≥24 weeks or birthweight ≥500g, there were 117 early neonatal deaths in 2020. There were eight early neonatal deaths of infants born at 22-24 weeks of gestation with a birthweight less than 500g in 2020. Therefore, applying the criteria of gestational age ≥22 weeks or birthweight ≥500g increases the number of early neonatal deaths by 7% (i.e. 117 to 125).

Recommendation: Defining and auditing perinatal loss.

(a) To allow for international comparison of stillbirths, maternity services should move to collecting data on fetal deaths >22 weeks and < 24 weeks for the audit of perinatal mortality in Ireland.

(b) A national working group should be convened to review the definition of perinatal mortality in the Republic of Ireland (ROI). This working group should include the NWIHP, NPEC, the General Registers Office (GRO), the Institute of Obstetrics and Gynaecology, the National Clinical Programme for Paediatrics and Neonatology and the Department of Health.

[66] Stillbirth Registration Act, 1994. Available at: https://www.irishstatutebook.ie/eli/1994/act/1/enacted/en/print#sec2

[67] Kelly K et al. A review of stillbirth definitions: A rationale for change. European Journal of Obstetrics & Gynaecology and Reproductive Health. 256 (2021) 235-245

[68] LK Smith et al. Producing valid statistics when legislation, culture and medical practices differ for births at or before the threshold of survival: report of a European workshop. BJOG (2019). DOI: 10.1111/1471-0528.15971. Available at: www.bjog.org

Table 7.1: Early neonatal deaths in 2020 with a birthweight <500g and a gestational age at delivery <24 weeks

Gestational age (weeks)	Birth Weight	Location of death	Cause of neonatal death	Autopsy	Coroner Case (Yes/No)
21	470	Ward	Pre-viable (<22 weeks)	Autopsy performed	No
23	440	Neonatal Unit	Necrotising enterocolitis	Autopsy not performed but offered	No
22	359	Labour Ward	Severe pulmonary immaturity	Autopsy not performed and not offered	No
20	330	Ward	Chromosomal disorders	Autopsy not performed and not offered	No
22	476	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
22	427	Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
21	280	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
21	409	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
21	380	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
21	415	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
21	445	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
21	350	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
21	415	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
21	410	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
21	358	Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
21	435	Labour Ward	Pre-viable (<22 weeks)	Autopsy performed	No
21	495	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
21	360	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
20	330	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
20	212	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
20	333	Ward	Pre-viable (<22 weeks)	Autopsy performed	No
20	450	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
20	270	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
20	335	Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
20	455	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
20	280	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
19	250	Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
19	257	Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
19	292	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
19	300	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
19	219	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
19	250	Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
19	280	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
18	190	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
18	230	Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
18	200	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
17	160	Labour Ward	Pre-viable (<22 weeks)	Autopsy not performed and not offered	No
17	180	Home	Pre-viable (<22 weeks)	Autopsy performed	Yes
14	37	Ward	Pre-viable (<22 weeks)	Autopsy not performed but offered	No
23	410	Labour Ward	Chromosomal disorders	Autopsy not performed and not offered	No
22	330	Labour Ward	Chromosomal disorders	Autopsy not performed and not offered	No
22	400	Labour Ward	Chromosomal disorders	Autopsy not performed and not offered	No
21	246	Ward	Chromosomal disorders	Autopsy not performed but offered	No
19	175	Ward	Chromosomal disorders	Autopsy not performed and not offered	No
18	145	Ward	Chromosomal disorders	Autopsy not performed but offered	No
21	385	Ward	Multiple anomalies	Autopsy performed	No
23	350	Labour Ward	Central nervous system	Autopsy not performed and not offered	No
15	67	Ward	Central nervous system	Autopsy not performed but offered	No

In summary

- The PMR was 6.25 per 1,000 births in 2020.
- Corrected for Major Congenital Anomaly, the PMR was 3.68 per 1,000 births in 2020.
- There is evidence of an increase in perinatal mortality in 2020 (rate ratio, RR=1.18, 95%CI=1.01-1.37, p-value=0.032). Decreasing rates of perinatal mortality were observed in Ireland in the decade prior to 2012, the PMR levelled off thereafter, however is increasing again since 2018.
- Major congenital anomaly continues to be the most common cause of both stillbirths, early neonatal deaths and late neonatal deaths.
- Similar to previous NPEC perinatal mortality reports, small for gestational age (SGA) babies at delivery were associated with perinatal deaths, particularly stillbirths. This highlights the need for a standardised approach to improve antenatal detection of fetal growth restriction (FGR) as recommended in this report.
- Recommendations in previous NPEC perinatal mortality reports have been progressed by the NWIHP. This highlights the value of on-going PM audit to identify quality improvement initiatives to improve care of the women and babies in the Irish maternity services.
- To allow for international comparison of stillbirths, maternity services should move to collecting data on fetal deaths > 22 weeks and < 24 weeks for the audit of perinatal mortality in Ireland.
- The establishment of a confidential review for stillbirths and neonatal deaths should be considered in order to enhance the learning to assist better care. This could take the format of a standardized review of specific cohorts, such as:

  – Unexpected intrapartum related deaths
  – multiple pregnancies
  – term stillbirths (in normally formed babies)

These cohorts could be reviewed on a rolling basis.

Appendix A: Hospital Co-ordinators and Contributors 2020

Hospital	Co-ordinators	Additional contributors
Cavan General Hospital	Ms Louise Dempsey	Ms Karen Malocca
Coombe Women and Infants University Hospital, Dublin	Ms Julie Sloan	
Cork University Maternity Hospital	Ms Claire Everard	Prof Keelin O'Donoghue
	Dr Brendan Murphy	
University Hospital Kerry	Ms Mary Stack Courtney	
Letterkenny University Hospital	Ms Mary Lynch	Ms Evelyn Smith
Mayo University Hospital	Ms Kathy Rava	Dr Hilary Ikele
Regional Hospital Mullingar	Ms Marie Corbett	Ms Kathryn Woods
Midland Regional Hospital Portlaoise	Ms Emma Mullins	
	Ms Ita Kinsella	
University Maternity Hospital Limerick	Ms Sandra O'Connor	Dr Roy Philip
	Ms Deirdre O'Connell	
	Ms Bernadette Toolan	
National Maternity Hospital, Dublin	Ms Fionnuala Byrne	Dr Eoghan Mooney
		Dr Lisa McCarthy
Our Lady of Lourdes Hospital, Drogheda	Ms Fiona Mulligan	Ms Siobhan Weldon
	Ms Catherine Smith	Dr Seosamh Ó Cóigligh
Portiuncula University Hospital, Ballinasloe	Ms Priscilla Neilan	Ms Sheila Melvin
	Ms Melinda O'Rourke	
Rotunda Hospital, Dublin	Ms Ruth Ritchie	
Sligo University Hospital	Ms Madeline Munnelly	
	Ms Juliana Henry	
	Ms Geraldine O'Brien	
Tipperary University Hospital	Ms Carol Dunne	
	Ms Mary O'Donnell	
St Luke's Hospital, Kilkenny	Ms Margaret Ryan	
	Ms Fiona Dalton	
University Hospital Galway	Ms Clare Greaney	
University Hospital Waterford	Ms Jill Whelan	
	Ms Paula Curtin	
Wexford General Hospital	Ms Irene Brennan	

Appendix B: Perinatal Mortality Group Membership

Ms Bridget Boyd, Assistant Director of Midwifery, Coombe Women & Infants University Hospital.
Nominated by the Deputy Nursing Services Director, HSE (until 2022)

Dr David Corcoran, Consultant Neonatologist, Rotunda Hospital.
Nominated by the Faculty of Paediatrics, RCPI (until 2022)*

Dr Emma Doyle, Consultant Histopathologist, Rotunda Hospital, Dublin.
Nominated by the Faculty of Pathology, RCPI

Dr Siobhan Gormally, Consultant Paediatrician, Our Lady of Lourdes Hospital.
Nominated by the Faculty of Paediatrics, RCPI (until 2022)*

Juliana Henry, Director of Midwifery, Sligo University.
Nominated by National Lead Midwife at NWIHP (from 2022)

Ann McIntyre, Director of Midwifery, Coombe Women and Infant University Hospital.
Nominated by National Lead Midwife at NWIHP (from 2022)

Professor John Morrison, Consultant Obstetrician & Gynaecologist, University Hospital Galway.
Nominated by the Institute of Obstetricians & Gynaecologists, RCPI

Dr Keelin O'Donoghue, Consultant Obstetrician & Gynaecologist, Cork University Maternity Hospital.
Nominated by the Institute of Obstetricians & Gynaecologists, RCPI

Ms Breda O'Donovan, Clinical Midwife Manager III from 2017, University Hospital Waterford.
Nominated by the National Lead Midwife Office of the Nursing & Midwifery Services Director

Ms Ann Rath, Assistant Director of Midwifery and Nursing, National Maternity Hospital.
Nominated by the Deputy Nursing Services Director, HSE

Dr Anne Twomey, Consultant Neonatologist, National Maternity Hospital.
Nominated by the Faculty of Paediatrics, RCPI

Ms Siobhan Whelan, Patient Representative.

Prof Richard Greene, Consultant Obstetrician & Gynaecologist, Cork University Maternity Hospital.
Chair, Director of the National Perinatal Epidemiology Centre

Ms Edel Manning, Research Midwife, National Perinatal Epidemiology Centre.
Perinatal Mortality Project Manager

Mr Paul Corcoran, PhD, Senior Lecturer in Perinatal Epidemiology, National Perinatal Epidemiology Centre.
National Perinatal Epidemiology Centre contributor

*Awaiting nominations

NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

NPEC Governance Committee Members

Chair: Dr. Michael Robson, Consultant Obstetrician and Gynaecologist, National Maternity Hospital

Deputy Chair: Professor Tom Clarke, Consultant Neonatologist, Rotunda Hospital (Retired)

Dr Linda Biesty, Senior lecturer in Midwifery at the School of Nursing & Midwifery, NUI Galway

Dr Sharon Cooley, Institute of Obstetrics and Gynaecology Representative

Ms. Marie Cregan, Patient Representative, University College Cork

Ms Marina Cronin, NOCA Head of Quality & Development, National Office of Clinical Audit

Dr. Geraldine Gaffney, Senior Lecturer, National University of Ireland, Galway

Professor Richard Greene, Consultant Obstetrician & Gynaecologist, Cork University Maternity Hospital, Director of the National Perinatal Epidemiology Centre

Professor Shane Higgins, Master, The National Maternity Hospital

Dr. Heather Langan, Consultant Obstetrician and Gynaecologist, Sligo General Hospital

Professor Fergal Malone, Master, The Rotunda Hospital

Professor Eleanor Molloy, Professor of Paediatrics & Child Health, TCD, Faculty of Paediatrics Representative

Ms Denise Malone/ Ms Jo Delaney co-chairs of the national Designated Midwifery Officer Group - Home Births

Dr Michael O'Connell, Master, Coombe Women & Infants University Hospital

Dr. Mary O'Mahony, Specialist in Public Health Medicine, HSE

Ms Margaret Quigley, National Lead for Midwifery ONMSD, HSE

Ms Angela Dunne, National Lead Midwife, National and Infants Health Programme (NWIHP)

Dr Cliona Murphy, Clinical Director, National and Infants Health Programme (NWIHP)

Appendix D: National Office of Clinical Audit (NOCA) endorsement of the Perinatal Mortality in Ireland Annual Report 2020

NOCA National Office of Clinical Audit

Prof Richard Greene,
Director,
National Perinatal Epidemiology Centre (NPEC),
5th Floor, Cork University Maternity Hospital,
Wilton,
Cork.

30/09/2022

Dear Prof Greene,

I wish to acknowledge receipt of the Perinatal Mortality National Clinical Audit in Ireland Annual Report 2020. Following your presentation to the NOCA Quality Assurance Committee on the 30th September, 2022 we are delighted to endorse this report.

On behalf of the NOCA Governance Board, I wish to acknowledge the work of NPEC on producing an excellent report. This report serves to assist healthcare providers focus on where improvement is needed through the implementation of recommendations. This reports also identifies areas for funded research which will direct further improvements in perinatal outcomes in the future. Please accept this as formal endorsement from the NOCA Governance Board.

Yours sincerely,

Dr Brian Creedon
Clinical Director
National Office of Clinical Audit

National Office of Clinical Audit
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Ardilaun House, Block B
111 St Stephen's Green
Dublin 2, D02 VN51
Tel: + (353) 1 402 8577
Email: auditinfo@noca.ie

NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

For NPEC Office use only:
CASE NUMBER

PLACE OF DEATH:

PERINATAL DEATH NOTIFICATION FORM
2020

CHOOSE Type of Case *(TICK)*

☐ **STILLBIRTH:** *A baby delivered without signs of life* from 24 weeks' gestation and/or with a birth weight of ≥ 500g.

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

OR

☐ **EARLY NEONATAL DEATH:** *Death of a live born baby occurring before 7 completed days after birth.*

OR

☐ **LATE NEONATAL DEATH:** *Death of a live born baby occurring from the 7th day and before 28 completed days after birth.*

* For the purpose of reporting, a 'live born' baby is defined as any baby born with evidence of life such as breathing movements, presence of a heart beat, pulsation of the cord or definite movement of voluntary muscles.

If a baby born at <22 completed weeks is being registered as a neonatal death, please report same to NPEC.

The National Perinatal Epidemiology Centre is sincerely grateful for your contribution to this audit.

Guidance for completing this form, with specific reference to Sections 11, 12 and 13 on Cause of Death, is outlined in the accompanying reference manual.

The National Perinatal Epidemiology Centre also acknowledges with thanks the Centre for Maternal and Child Enquiry (CMACE) UK for permission to modify and use its Perinatal Mortality Notification Proforma for use in the Irish context.

1

SECTION 1. WOMANS' DETAILS

1.1. Mother's age ☐☐

1.2. Ethnic group:

☐ White - Irish ☐ Irish Traveller

☐ Any other White background ☐ Please specify country of origin_____

☐ Asian or Asian Irish ☐ Black or Black Irish

☐ Other including mixed ethnic backgrounds: Please specify _____

☐ Not recorded

1.3. Marital status: ☐ Married ☐ Never married ☐ Separated/Divorced ☐ Widowed ☐ Unknown

1.4. Living with partner / spouse? ☐ Yes ☐ No ☐ Unknown

1.5. Woman's employment status at booking?

☐ Employed or self-employed (full or part time) ☐ Unemployed (looking for work)

☐ Student ☐ Home maker ☐ Permanently sick/disabled

☐ Other_____ ☐ Unknown

1.7. Height at booking (round up to the nearest cm): ☐☐☐

1.8. Weight at booking (round up to the nearest kg): ☐☐☐

If weight is unavailable, was there evidence that the woman was too heavy for hospital scales? ☐ Yes ☐ No

1.9. Body Mass Index at booking (BMI): ☐☐.☐

1.10.a. Did the woman smoke at booking? ☐ Yes, specify quantity smoked per day_____

☐ No ☐ Unknown

1.10.b. Did she give up smoking during pregnancy? ☐ Yes ☐ No ☐ Unknown ☐ N/A

1.11. Is there documented history of alcohol abuse?

☐ None recorded ☐ Prior to this pregnancy ☐ During this pregnancy

1.12. Is there documented history of drug abuse or attendance at a drug rehabilitation unit?

☐ None recorded ☐ Prior to this pregnancy ☐ During this pregnancy

SECTION 2. PREVIOUS PREGNANCIES

2.1. Did the woman have any previous pregnancies? *If yes, please complete questions 2.2-2.4* ☐ Yes ☐ No

2.2. No. of completed pregnancies ≥24 weeks and or with a birth weight ≥ 500g (all live and stillbirths): ☐☐

2.3. No. of pregnancies <24 weeks and with a birth weight < 500g: ☐☐

2.4. Were there any previous pregnancy problems? *If yes, please tick all that apply below* ☐ Yes ☐ No

☐ Three or more miscarriages ☐ Pre-term birth or mid trimester loss ☐ Stillbirth, *please specify number* ☐

☐ Infant requiring intensive care ☐ Baby with congenital anomaly ☐ Neonatal death, *please specify number* ☐

☐ Previous caesarean section ☐ Placenta praevia ☐ Placental abruption

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

☐ Other, please specify_____ ☐ Unknown

SECTION 3. PREVIOUS MEDICAL HISTORY

3.1. Were there any pre-existing medical problems? *If yes, please tick all that apply below* ☐ Yes ☐ No ☐ Unknown

☐ Cardiac disease (congenital or acquired) ☐ Epilepsy

☐ Endocrine disorders e.g. hypo or hyperthyroidism ☐ Renal disease

☐ Haematological disorders e.g. sickle cell disease ☐ Psychiatric disorders

☐ Inflammatory disorders e.g. inflammatory bowel disease ☐ Hypertension

☐ Diabetes ☐ Other, please specify _____

SECTION 4. THIS PREGNANCY

4.1. Final Estimated Date of Delivery (EDD): ☐☐/☐☐/☐☐ ☐ Unknown

Use best estimate *(ultrasound scan or date of last menstrual period)* based on a 40 week gestation, or the final date agreed in the notes.

4.2. Was this a multiple pregnancy at the onset of pregnancy? ☐ Yes ☐ No

4.3. Was this pregnancy a result of infertility treatment? ☐ Yes ☐ No ☐ Unknown

If yes, please specify method of fertility treatment _____

4.4 Gestation at first booking appointment: ☐☐ weeks + ☐ days ☐ Not booked ☐ Unknown

4.5 Intended place of delivery at booking: Name of unit _____

Please specify the type of unit

☐ Obstetric Unit ☐ Alongside Midwifery Unit ☐ Home ☐ Unbooked

4.6 What was the intended type of delivery care at booking?

☐ Obstetric-Led Care ☐ Midwifery-Led Care ☐ Self-Employed Community Midwife

☐ Home c/o Hospital DOMINO Scheme

4.7a Was the care of the mother transferred from another unit with the fetus in utero? ☐ Yes ☐ No

If yes please answer question 4.7 b

4.7b Gestation at time of in-utero transfer: ☐☐ weeks + ☐ days ☐ Unknown

4.8 a Did the woman undergo an anatomy scan? ☐ Yes ☐ No

If yes please answer question 4.8 b

4.8 b Gestation at time of anatomy scan: ☐☐ weeks + ☐ days

SECTION 5. DELIVERY

5.1. Onset of labour:

☐ Spontaneous ☐ Induced ☐ Never in labour

5.2. Intended place of delivery at onset of labour: Name of unit _____

Please specify the type of unit

☐ Obstetric Unit ☐ Alongside Midwifery Unit ☐ Home

5.3. What was the intended type of care at onset of labour?

☐ Obstetric-Led Care ☐ Midwifery-Led Care ☐ Self-Employed Community Midwife

☐ Home c/o Hospital DOMINO Scheme

5.4. Was the intended mode of delivery a planned caesarean section? ☐ Yes ☐ No

5.5. Place of delivery: Name of unit _____

Please specify the type of unit

☐ Obstetric Unit ☐ Alongside Midwifery Unit ☐ Other, please specify_____

5.6. What was the type of care at delivery?

☐ Obstetric-Led Care ☐ Midwifery -Led Care ☐ Born Before Arrival (BBA) - Unattended

☐ Self-Employed Community Midwife ☐ Home c/o Hospital DOMINO Scheme

5.7. Date and time of delivery/birth: **Date:** ☐☐/☐☐/☐☐ **Time:** ☐☐:☐☐

5.8. What was the lie of the fetus <u>at delivery</u>*?*

☐ Longitudinal ☐ Oblique ☐ Transverse

5.9. What was the presentation *<u>at delivery</u>*?**

☐ Vertex ☐ Breech ☐ Compound *(includes transverse and shoulder presentations)* ☐ Brow ☐ Face

5.10. What was the mode of delivery? (Please tick all that apply)

☐ Vaginal cephalic delivery ☐ Ventouse ☐ Forceps ☐ Assisted Breech delivery

☐ Vaginal Breech delivery ☐ Pre-Labour Caesarean Section ☐ Caesarean Section After Onset of Labour

CAESAREAN SECTIONS ONLY

5.11. What was the type of *or* indication for Caesarean Section?

☐ Elective - At a time to suit woman or maternity team ☐ Urgent - Maternal or fetal compromise which is not immediately life threatening

☐ Emergency - Immediate threat to life of woman or fetus ☐ Failed instrumental delivery

SECTION 6. ALL BABY OUTCOME

6.1. Sex of fetus/baby: ☐ Male ☐ Female ☐ Indeterminate

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

Birth order of this fetus/baby:

☐ Singleton

☐ Twin 1 ☐ Twin 2

☐ Triplet 1 ☐ Triplet 2 ☐ Triplet 3

☐ Other multiple birth pregnancy, please specify_____ Birth Order ☐

6.3. If from a multiple delivery, what was the chorionicity? *Please tick all that apply*

☐ Dichorionic diamniotic ☐ Monochorionic diamniotic ☐ Monochorionic monoamniotic ☐ Trichorionic

☐ Singleton ☐ Not known

6.4. Birth weight (kg): ☐.☐☐☐

6.5. Gestation at delivery: ☐☐ weeks + ☐ days ☐ Unknown

6.6. Was this a termination of pregnancy? ☐ Yes ☐ No

Please refer to the reference manual

6.7. Was a local hospital review of this case undertaken? ☐ Yes ☐ No

Please refer to the reference manual

SECTION 7. MATERNAL OUTCOME

7.1. Admission to HDU: ☐ Yes ☐ No

7.2. Admission to ICU: ☐ Yes ☐ No

7.3. Maternal Death: ☐ Yes ☐ No

SECTION 8. STILLBIRTH (If not a stillbirth, please go to Section 9)

8.1. At what gestation was death confirmed to have occurred? ☐☐ weeks + ☐ days

If known, what date was death confirmed? ☐☐/☐☐/☐☐

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

☐ Yes ☐ No ☐ Never In Labour ☐ Unattended ☐ Unknown

5

SECTION 9. NEONATAL DEATH ONLY

9.1. Was spontaneous respiratory activity absent or ineffective at 5 minutes? ☐ Yes ☐ No

If a baby is receiving any artificial ventilation at 5 minutes, the assumption is absent/ineffective activity: a 0 Apgar score indicates absent activity.

9.2. Was the heart rate persistently <100bpm? (i.e. heart rate never rose above 100bpm before death)

☐ Persistently <100bpm ☐ Rose above 100bpm

9.3. Was the baby offered *active resuscitation in the delivery room? ☐ Yes ☐ No

(*active resuscitation includes BMV, PPV, intubation, cardiac massage)

9.4. Was the baby admitted to a neonatal unit? (Includes SCBU and ICU) ☐ Yes ☐ No

9.5a. Was the baby transferred to another unit after birth? ☐ Yes ☐ No

If yes please answer 9.5 b

9.5 b. Date and Time of Transfer to other unit after birth: **Date** ☐☐/☐☐/☐☐ **Time** ☐☐:☐☐

9.6. Date and Time of Death: **Date** ☐☐/☐☐/☐☐ **Time** ☐☐:☐☐

9.7. Place of Death*: ☐ Labour Ward ☐ Neonatal Unit ☐ Ward ☐ Theatre ☐ In Transit ☐ Paediatric Centre ☐ Home

Name of unit:_____

*This question refers to where the baby actually died, e.g. 'ICU, 'at home' or 'in transit'.
Babies are deemed to have died 'at home' if there are no signs of life documented in the home even if resuscitation is attempted.
A baby is deemed to have died 'in transit' if signs of life are documented prior to transfer but the baby was either declared dead on arrival to the hospital or showed no subsequent signs of life in the hospital, despite attempted resuscitation..

SECTION 10. POST-MORTEM INVESTIGATIONS

10.1. Was this a coroner's case? *If yes, please complete question 10.2.* ☐ Yes ☐ No

10.2. Has the post-mortem report been received from the coroner's office? ☐ Yes ☐ No

10.4. Was a post-mortem performed? ☐ Yes ☐ No

If no, please complete question 10.5.

10.5. Was a post-mortem offered? ☐ Yes ☐ No

10.6. Were any of the following procedures carried out after death?

Please tick all that apply

☐ MRI ☐ X-Ray ☐ CT ☐ External Examination ☐ Genetic testing

10.7. Was the placenta sent for histology? ☐ Yes ☐ No

SECTION 11. CAUSE OF DEATH AND ASSOCIATED FACTORS - STILLBIRTH & NEONATAL DEATH

11. Please TICK ALL the maternal or fetal conditions that were present during pregnancy or were associated with the death. ***PLEASE REFER TO THE REFERENCE MANUAL.***

11.1.1. MAJOR CONGENITAL ANOMALY:

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

☐ Musculo-skeletal anomalies ☐ Multiple anomalies ☐ Urinary tract ☐ Metabolic diseases

☐ Other major congenital anomaly, please specify _____

☐ Chromosomal disorder*, please specify _____

*** In the event of a chromosomal disorder how was the diagnosis made?**

☐ Clinically ☐ Genetic analysis * ☐ Ultrasound

**See reference manual*

11.1.1 (b) Was the diagnosis of major congenital anomaly confirmed/suspected before delivery by a Consultant Fetal Medicine Specialist? ☐ No ☐ Yes, in your unit

☐ Yes, in another unit, please specify name of unit _____

11.1.2. HYPERTENSIVE DISORDERS OF PREGNANCY:

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

11.1.3. ANTEPARTUM or INTRAPARTUM HAEMORRHAGE:

☐ Praevia ☐ Abruption ☐ Other, please specify _____

11.1.4. MECHANICAL:

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

Uterine rupture: ☐ Before labour ☐ During labour

Mal-presentation: ☐ Breech ☐ Face ☐ Compound

☐ Transverse ☐ Other, please specify _____

Shoulder dystocia: ☐

11.1.5. MATERNAL DISORDER:

☐ Pre-existing hypertensive disease ☐ Diabetes ☐ Other endocrine conditions (excluding diabetes)

☐ Thrombophilias ☐ Obstetric cholestasis ☐ Uterine anomalies

☐ Connective tissue disorders, please specify_____

☐ Other, please specify_____

11.1.6. INFECTION: (confirmed by microbiology/placental histology)

Maternal infection: ☐ Bacterial ☐ Syphilis ☐ Viral diseases

☐ Protozoal ☐ Group B Streptococcus

☐ Other, please specify organism _____

Ascending infection:

☐ Chorioamnionitis ☐ Other, please specify _____

11.1.7. SPECIFIC FETAL CONDITIONS:

☐ Twin-twin transfusion ☐ Feto-maternal haemorrhage ☐ Non-immune hydrops ☐ Iso-immunisation

☐ Other, please specify_____

7

11.1.8. SPECIFIC PLACENTAL CONDITIONS:

PLEASE NOTE THERE IS NO REQUIREMENT TO COMPLETE THIS SECTION SHOULD YOU WISH TO SUMIT AN ANONYMISED COPY OF THE PLACENTAL HISTOLOGY REPORT AS AN ATTACHMENT TO THIS FORM.

Please refer to the reference manual, page 10, for guidance on completing this section.

☐ **No abnormal histology reported**

☐ **Chorioamnionitis** → ☐ Mild ☐ Moderate ☐ Severe

☐ **Fetal vasculitis** → ☐ Arterial ☐ Venous ☐ Both

☐ **Maternal vascular malperfusion (uteroplacental insufficiency)**

Please specify pathology:

☐ Distal villous hypoplasia ☐ Placental hypoplasia

☐ Accelerated villous maturation ☐ Ischaemic villous crowding

☐ Placental infarction → Please specify approximate percentage involved _____

☐ Retroplacental haemorrhage → Please specify approximate percentage of maternal surface involved _____

☐ **Fetal vascular malperfusion:**

Please specify pathology

☐ Patchy hypoperfusion ☐ Scattered avascular villi ☐ Thrombosis in fetal circulation ☐ Fetal thrombotic vasculopathy

☐ **Cord pathology as sole finding**

Please specify pathology

☐ Hypercoiled cord ☐ Hypocoiled cord ☐ Meconium associated vascular necrosis

☐ Vasa praevia ☐ Velamentous cord ☐ Other , please specify_____

☐ **Cord pathology associated with distal disease**

please specify associated distal disease:

☐ Delayed villous maturation ☐ Thrombosis in fetal circulation

☐ **Delayed Villous maturation defect (distal villous immaturity/ delayed villous maturation)**

☐ **Villitis** → ☐ Low grade ☐ High grade ☐ With stem vessel obliteration

☐ **Other**, please specify_____

_____

11.1.9. INTRA-UTERINE GROWTH RESTRICTION DIAGNOSIS MADE: YES ☐

What was this based on? *Please tick all that apply*

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

11.1.10. ASSOCIATED OBSTETRIC FACTORS: *Please tick all that apply*

Birth trauma ☐ Intracranial haemorrhage ☐ Subgaleal haematoma

☐ Fracture, please specify_____

☐ Other, please specify_____

Intrapartum fetal blood sample result < 7.25 ☐ Yes ☐ No

☐ Polyhydramnios ☐ Oligohydramnios ☐ Premature rupture of membranes

☐ Prolonged rupture of membranes (> 24hours) ☐ Amniocentesis

☐ Spontaneous premature labour ☐ Other, please specify_____

11.1.11. WERE THERE ANY ANTECEDENT OR ASSOCIATED OBSTETRIC FACTORS PRESENT? YES ☐ NO ☐

11.1.12. UNCLASSIFIED: *Please use this category as sparingly as possible* ☐

SECTION 12. MAIN CAUSE OF DEATH: STILL BIRTH & NEONATAL DEATHS

12.1. Which condition, indicated in Section 11 as being present, was the MAIN condition or sentinel event causing or associated with the death. *Please refer to the post-mortem and placental histology reports.*

(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").

12.2. Sources of information used to determine cause of death?

Please tick all that apply

☐ Post Mortem ☐ Placental Histology ☐ Other, please specify_____

SECTION 13. NEONATAL DEATH ONLY: NEONATAL CONDITIONS ASSOCIATED WITH THE DEATH

13.1. Please TICK ALL the neonatal conditions causing and associated with the death.
PLEASE REFER TO THE REFERENCE MANUAL.

13.1.1. MAJOR CONGENITAL ANOMALY:

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

☐ Musculo-skeletal anomalies ☐ Multiple anomalies ☐ Urinary tract ☐ Metabolic diseases

☐ Other major malformation, please specify _____

☐ Chromosomal disorder*, please specify _____

*** In the event of a chromosomal disorder how was the diagnosis made?**

☐ Clinically ☐ Genetic analysis * ☐ Ultrasound
**See reference manual*

13.1.1 (b) Was the diagnosis of major congenital anomaly confirmed/suspected before delivery by a Consultant Fetal Medicine Specialist? ☐ No ☐ Yes, in your unit

☐ Yes, in another unit, please specify name of unit _____

13.1.2. PRE-VIABLE: (less than 22 weeks) ☐

13.1.3. RESPIRATORY DISORDERS:

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

☐ Primary persistent pulm. hypertension ☐ Chronic lung disease / Bronchopulmonary dysplasia (BPD)

☐ Other (includes pulmonary haemorrhage), please specify_____

13.1.4. GASTRO-INTESTINAL DISEASE:

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

13.1.5. NEUROLOGICAL DISORDER:

☐ Hypoxic-ischaemic encephalopathy (HIE)

☐ *Intraventricular / Periventricular haemorrhage, please specify highest grade (0 – 4) ☐ *

☐ Hydrocephalus*, please tick all that apply:

* ☐ Congenital ☐ Acquired ☐ Communicating ☐ Obstructive ☐ Other_____

☐ Other, please specify_____

13.1.6. INFECTION:

☐ Generalised (sepsis) ☐ Pneumonia ☐ Meningitis Please specify specific organism _____

☐ Other, specify _____

13.1.7. INJURY / TRAUMA: (Postnatal) ☐

Please specify_____

13.1.8. OTHER SPECIFIC CAUSES:

☐ Malignancies / Tumours ☐ In-born errors of metabolism, please specify _____

☐ Specific conditions, please specify_____

13.1.9. SUDDEN UNEXPECTED DEATHS:

☐ Sudden Infant Death Syndrome (SIDS) ☐ Infant death – Cause unascertained

13.1.10. UNCLASSIFIED: (Use this category as sparingly as possible) ☐

13.2. Which condition, indicated in Section 13.1 as being present, was the MAIN condition causing or associated with the death. *Please refer to the post-mortem report. In the absence of a post-mortem report, please refer to the death certificate.*

(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").

13.3. Sources of information used to determine cause of death?

Please tick all that apply

☐ Post Mortem ☐ Placental Histology ☐ Other, please specify_____

SECTION 14. DETAILS OF REPORTING UNIT (Please print)

14.1. Name of reporting unit: _____

14.2. Completed by

Name: _____

Staff Grade: _____

Work address: _____

_____

Telephone Number: _____ **E-mail Address:**_____

Date of Notification: ☐☐/☐☐/☐☐

Thank you very much for taking the time to complete this form

Please return all completed forms to:

Ms Edel Manning, Project manager perinatal mortality audit,
National Perinatal Epidemiology Centre
Department of Obstetrics and Gynaecology
5th Floor
Cork University Maternity Hospital
Wilton
Cork

If you have any queries regarding the Perinatal Death Notification Form, please contact us at the National Perinatal Epidemiology Centre

Tel: (0)21 420 5042
E-mail: npec@ucc.ie

Appendix F: Terminology for placental pathology

Pathology category	Specific placental findings
Maternal vascular malperfusion	Refers to the spectrum of findings related to shallow implantation of the placenta, often found in conjunction with PET and IUGR and often called utero placental insufficiency. Placental findings that enable this category to be applied are: **distal villous hypoplasia** **accelerated villous maturation** **ischaemic villous crowding** **placental infarction** **retroplacental haemorrhage** **placental hypoplasia**
Fetal vascular malperfusion	Refers to thrombosis or decreased flow in the fetal circulation. It may be difficult to distinguish arteries from veins in the placenta and pathology may be present in both. Findings consistent with fetal vascular malperfusion are: **patchy hypoperfusion** **villous stromal-vascular karyorrhexis** **scattered avascular villi** **thrombosis in fetal circulation** **fetal thrombotic vasculopathy / extensive avascular villi**
Cord pathology	Cord pathology may exist by itself, or may be accompanied by evidence of other disease. The findings of cord pathology include: **hypercoiled cord** (Umbilical coiling index (UCI) of ≥ 0.3) **cord stricture** **hypocoiled cord** (UCI < 0.1) **meconium associated vascular necrosis** **velamentous or marginal (<10mm) cord insertion** **Other**
Delayed villous maturation	Delayed villous maturation is the recommended term instead of **distal villous immaturity, placental maturation defect or villous maturation defect.**
Chorioamnionitis	The maternal and fetal inflammatory response should be staged and graded where possible.
Villitis	The term is used to mean villitis of unknown aetiology and assumes that the reporting pathologist has excluded infection where appropriate. Villitis is graded as either low grade or high grade and can occur with stem vessel obliteration.
Other	

Note: More than one placental category may be present.

45 Khong TY, Mooney EE et al: Sampling and definition of placental lesions. Arch Pathol Lab Med.

Appendix G: Cause of Death Guidance and Definitions

Appendix G: Guidance and Definitions for Completion of
Section 11 & 12 **STILLBIRTHS AND NEONATAL DEATHS**

DEFINITION OF TERMS	Subcategory
MAJOR CONGENITAL ANOMALY Any genetic or structural defect **arising at conception or during embryogenesis** incompatible with life or potentially treatable but causing death	Central nervous system Cardiovascular system Respiratory system Gastro-intestinal system Musculo-skeletal anomalies Multiple anomalies Chromosomal disorders Metabolic diseases Urinary tract Other
HYPERTENSIVE DISORDERS OF PREGNANCY	Pregnancy induced hypertension Pre-eclampsia HELLP syndrome Eclampsia
ANTEPARTUM OR INTRAPARTUM HAEMORRHAGE After 20 w gestation, whether revealed or not. If associated with PET, APH will be a secondary diagnosis. Ignore minor degrees of haemorrhage (e.g. 'shows', cervical polyps etc). Recurrent bleeding of uncertain origin followed by preterm labour should not be ignored.	Praevia Abruption Uncertain
MECHANICAL. Any death attributed to uterine rupture, deaths from birth trauma or intrapartum asphyxia associated with problems in labour such as cord compression, malpresentation, shoulder dystocia etc. Antepartum deaths associated with cord entanglement in the absence of strong circumstantial evidence that cord compression caused death should be classified as having no associated factor.	**Cord Compression** Prolapsecord Cord around neck Other cord entanglement or knot **Uterine Rupture** Before labour During labour **Mal-presentation** Breech / Transverse Face / Compound Other **Shoulder dystocia**
MATERNAL DISORDER. Specify hypertensive disease present before pregnancy or any other maternal disease or condition sufficient to jeopardise the baby such as diabetes, cardiac disease etc. Infection is classified separately.	Pre-existing hypertensive disease Diabetes Other endocrine conditions Thrombophilias Obstetric cholestasis Drug misuse Uterine anomalies Connective tissue disorders / Other
INFECTION. Confirmed by microbiology / placental histology. Specify maternal infections sufficient to have compromised the baby which may be associated with congenital infection of the baby. Trans-placental transmission may have occurred such as CMV, toxoplasmosis etc. Specify only those ascending infections that are a significant factor in death. Chorioamnionitis sufficient to cause preterm birth may be specified for some neonates but evidence of fetal infection may be required as an explanation of stillbirth.	**Maternal infection** Bacterial / Viral diseases Syphilis /Group B Streptoccus Protozoal Other **Ascending infection** Chorioamnionitis Other

1

SPECIFIC FETAL CONDTIONS. Document only those specific conditions **arising in the fetal period.**	Twin-twin transfusion Feto-maternal haemorrhage Non-immune hydrops Iso-immunisation Other
SPECIFIC PLACENTAL CONDITIONS. Specific placental conditions sufficient to cause death or be associated with fetal compromise such as IUGR. Cord problems associated with compression will normally be classified under 'Mechanical'**.**	Chorioamnionitis Fetal vasculitis Maternal vascular malperfusion Fetal vascular malperfusion Cord pathology Other
INTRA-UTERINE GROWTH RESTRICTION DIAGNOSIS MADE. IUGR may be suspected antenatally by abdominal circumference (AC) less than the centile threshold used to define IUGR locally, or decreased AC growth velocity, +/- oligohydramnios.	Suspected antenatally Observed at delivery Observed at post mortem
ASSOCIATED OBSTETRIC FACTORS. Factors recorded as Other Associated Obstetric Factors will be important clinical or pathological features of the pregnancy or baby but may not be an explanation of the death; they will often be secondary to other maternal or fetal conditions. Birth trauma and/or Intrapartum asphyxia should normally be classified primarily by the underlying cause (e.g Mechanical). Birth Trauma and/or other antenatal/intra-partum factors can be recorded here either as a secondary factor or when there is no underlying explanation.	**Birth Trauma** Intracranial haemorrhage Birth injury to scalp Fracture Other **Intrapartum fetal blood sample <7.25** **Other** Polyhydramnios Oligohydramnios Premature rupture of membranes Spontaneous premature labour Other
NO ANTECEDENT OR ASSOCIATED OBSTETRIC FACTORS. Deaths with no explanation or significant associated factor.	
UNCLASSIFIED. Cases where little or nothing is known about pregnancy or delivery and which cannot be fitted into any of the above categories**.** **Use as sparingly as possible**.	

Guidance and Definitions for Completion of Section 13:

NEONATAL DEATH ONLY

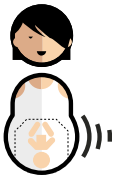
DEFINITION OF TERMS	Subcategory
MAJOR CONGENITAL ANOMALY Any genetic or structural defect arising at **conception or during embryogenesis** incompatible with life or potentially treatable but causing death.	Central nervous system Cardiovascular system Respiratory system Gastro-intestinal system Musculo-skeletal system Multiple anomalies Chromosomal disorders Metabolic disorders Urinary tract Other
PRE-VIABLE Babies (less than 22 weeks) who are non-viable at birth because of gestation but who show signs of life.	
RESPIRATORY DISORDERS Severe pulmonary immaturity will encompass those babies where structural lung immaturity is so gross as to mean ventilatory support is unsustainable at the outset. Surfactant Deficient Lung Disease may include babies with clinical or pathological evidence of hyaline membrane disease. Please note that neonatal deaths previously attributed to prematurity, would most often be captured under the subcategory of 'severe pulmonary immaturity'.	Severe pulmonary immaturity Surfactant deficiency lung disease Pulmonary hypoplasia Meconium aspiration syndrome Primary persistent pulmonary hypertension Chronic lung disease / BPD Other (includes pulmonary haemorrhage)
GASTRO-INTESTINAL DISEASE Many babies with NEC will have associated sepsis which may be given as a secondary cause.	Necrotising enterocolitis (NEC) Other
NEUROLOGICAL DISORDER HIE includes those babies with severe hypoxic-ischaemic brain injury before birth. If possible, please specify if HIE was primarily of intrapartum or antepartum origin. Specify periventricular leukomalacia only if this is a significant factor in the infant death. Birth Trauma will usually be classified here.	Hypoxic-ischaemic encephalopathy (HIE) Intraventricular/Periventricular haemorrhage Other
INFECTION Where possible specify the location of infection and whether due to bacteria, virus, fungus or other specific organism. If infection was the main cause of death please specify whether infection is congenital (i.e. acquired ante or intrapartum acquired) or neonatal in origin.	Generalised (sepsis) Pneumonia Meningitis Other
INJURY / TRAUMA Post natal trauma only including iatrogenic injury. 'Birth Trauma' will usually be classified under neurological disorder e.g. HIE; the obstetric classification identifying the timing of the injury.	
OTHER SPECIFIC CAUSES Death due to **specific fetal and neonatal conditions** such as isoimmunisation or unexplained hydrops. Neonatal conditions will include aspiration, unexplained pulmonary haemorrhage.	Malignancies/Tumours Specific conditions

SUDDEN UNEXPECTED DEATHS. SIDS should conform to the accepted definition. Unascertained are those unexpected deaths that are not explained despite a full investigation including autopsy, but do not conform to the accepted definition of SIDS.	Sudden Infant Death Syndrome (SIDS) Infant deaths – cause unascertained
UNCLASSIFIED. Cases where little or nothing is known about the pregnancy or delivery and which cannot be fitted into any of the above categories**.** **Please use this category as sparingly as possible.**	

Appendix H: The Robson Ten Group Classification System

The 10 groups of the Robson Classification [35]

GROUP 1

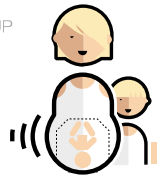


Nulliparous women with a single cephalic pregnancy, ≥37 weeks gestation in spontaneous labour

GROUP 2

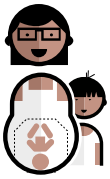
Nulliparous women with a single cephalic pregnancy, ≥37 weeks gestation who either had labour induced or were delivered by caesarean section before labour

GROUP 3



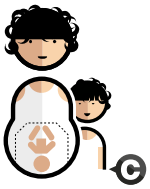
Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 weeks gestation in spontaneous labour

GROUP 4



Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 weeks gestation who either had labour induced or were delivered by caesarean section before labour

GROUP 5



All multiparous women with at least one previous uterine scar, with a single cephalic pregnancy, ≥37 weeks gestation

GROUP 6

All nulliparous women with a single breech pregnancy

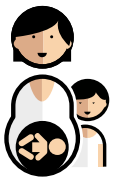
GROUP 7

All multiparous women with a single breech pregnancy, including women with previous uterine scars

GROUP 8

All women with multiple pregnancies, including women with previous uterine scars

GROUP 9



All women with a single pregnancy with a transverse or oblique lie, including women with previous uterine scars

GROUP 10

All women with a single cephalic pregnancy <37weeks gestation, including women with previous scars

35 Robson Classification: Implementation Manual. Geneva: World Health Organization; 2017. Licence: CCBY-NC-SA3.0IGO.

NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

Data Quality Statement
Perinatal Mortality National Clinical Audit

Reference Number: NPEC-DQS-NCAoPM-01.18

Revision Number: 01

Author: National Perinatal Epidemiology Centre

Approved by: Richard Greene, Director, National Perinatal Epidemiology Centre

Effective from: March 2019

Review date: March 2023

Signatures of all parties responsible

Richard A Greene, Director,
National Perinatal Epidemiology Centre

NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

Data Quality Statement
Perinatal Mortality National Clinical Audit

1.0 Introduction

Perinatal mortality is a significant measure of obstetric and neonatal care. Regular audit of perinatal mortality (e.g. stillbirths, neonatal deaths, among other) may identify modifiable risk factors which decrease the risk of perinatal mortality and which inform clinical practise. The NPEC has provided an annual national assessment of perinatal mortality in Ireland from a clinical viewpoint since 2008. It has done so with the guidance and collaboration of the PMNCAGG, a specialist multidisciplinary group, having the aim to develop a comprehensive national clinical audit system of perinatal mortality in Ireland.

2.0 Data collection for the Perinatal Mortality National Clinical Audit (PMNCA)

Data on perinatal deaths from births that occurred between January 1 of each year and December 31 of the same year are pseudonymised and submitted to the NPEC by all 19 units using a standardised notification dataset either electronically, via the secure online NPEC database, or alternatively by paper format. The notification dataset is completed using data on fetal and maternal characteristics recorded in the clinical records. Implemented nationally in 2011, the NPEC notification dataset was based on the validated Centre for Maternal and Child Enquiries (CMACE) Perinatal Death Notification Form and has been endorsed by the Clinical Advisory Group at the Institute of Obstetrics and Gynaecology, the Faculty of Paediatrics and the HSE National Obstetric Programme Working Group.

3.0 Dimensions of data quality for the Perinatal Mortality National Clinical Audit

The quality of data is defined and assessed here using the internationally accepted dimensions recommended by HIQA:

1. Relevance
2. Accuracy and reliability
3. Timeliness and punctuality
4. Coherence and comparability
5. Accessibility and clarity

3.1 Relevance

Processes are in place to regularly monitor the relevance and use of existing data in meeting the needs of data users and other stakeholders. Regular consultation with data users and other stakeholders is undertaken. These are structured consultation activities focussing on the content and the quality of the data collected, the outcomes, continuous operational improvements, future direction, and potential needs.

NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

Data Quality Statement
Perinatal Mortality National Clinical Audit

3.2 Accuracy and reliability

The population of reference is explicitly stated in all releases. Coverage rates are documented. Internal procedures and guidelines for data quality assessment exist and include data cleaning and validation procedures regarding data submitted through both the online and paper formats. The NPEC online database incorporates a suite of validation checks for accuracy. Data cleaning and correction processes are consistently applied: these include checks on the structure and integrity of the data, checks for missing data, checks that the data conforms to data source specifications and checks for outliers.

3.3 Timeliness and punctuality

The NPEC works closely with its data providers to ensure timely submission of data. The NPEC makes data providers aware of submission dates, nevertheless, data collection is done by staff without specific protected time for this purpose. Thus, at times, an extension of the submission dates may be required to allow submission of complete and accurate data.
Planned releases occur within a reasonable period from the end of the reference period. Currently within 18 months of year end of the year under audit, in line with current guidelines.

3.4 Coherence and comparability

Assessments of compliance with terminology standards are regularly undertaken to ensure the data collection is compliant with international and national standards, including clinical guidelines and current best practice.

3.5 Accessibility and clarity

The Annual Report for the PMNCA, its related lay summary and applied data collection forms are publicly available on the NPEC website:

https://www.ucc.ie/en/npec/npec-clinical-audits/perinatalmortality/

Research output from the audit is catalogued according to individual staff members and publicly available on IRIS, ResearchGate, LinkedIn or other research information systems. Methodologies are outlined in all published outputs.

NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

Data Quality Statement
Perinatal Mortality National Clinical Audit

The NPEC operates a Data Access Policy in which clear policies and procedures are outlined for data users in relation to the process of accessing and requesting data.

4.0 Further information on the Perinatal Mortality National Clinical Audit

Further information on the NPEC's Perinatal Mortality National Clinical Audit can be found at:

https://www.ucc.ie/en/npec/npec-clinical-audits/perinatalmortality/

Alternatively, please contact us at:

npec@ucc.ie

or

National Perinatal Epidemiology Centre,
Dept. of Obstetrics and Gynaecology,
5th Floor Cork University Maternity Hospital,
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Appendix J: NPEC letter to units

NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

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Professor R.A. Greene, MB, MRCOG, MRC
Director

15th March 2021

Dear Colleagues,

Regarding the National Perinatal Epidemiology Centre (NPEC) audit on Perinatal Mortality

Firstly, I would like to thank all units for your on-going commitment to submit perinatal mortality (PM) data to the NPEC. Following recent enquiries, I would like to take this opportunity to clarify definitions and inclusion criteria for this PM audit.

The inclusion criteria for the PM audit are all perinatal mortality deaths (stillbirths and neonatal deaths) that are required by law to be registered in the Irish Civil Registration Service. Definitions are as follows:

Stillbirth: Baby delivered without signs of life from 24 weeks gestation or with a birthweight ≥500g.[1]

Neonatal death: Death of a live born baby, regardless of birth weight or gestational age at time of delivery, occurring in the perinatal period.[2] The NPEC audit all neonatal deaths occurring within 28 completed days of birth.

As in previous years, the NPEC calculate the perinatal mortality rate (PMR), both nationally and at unit level, based on the number of stillbirths and neonatal deaths per 1,000 births, who delivered from 24weeks or had a birthweight ≥ 500g. A perinatal death is assigned to the unit where the baby delivered, regardless of place of death.

Neonatal deaths occurring in babies with a birthweight < 500g and delivered before 24 weeks are not included in the PMR. However, the collation of data on these perinatal events by the NPEC provides vital information surrounding adverse pregnancy outcomes in all registered live births.

[1] Stillbirths Registration Act, 1994.
[2] Smith B, Office of the Registrar General, (2016) Letter to NPEC, 12/10/2016

Recently, a specific issue has been raised with the NPEC regarding the reporting of perinatal deaths following termination of pregnancy (TOP). In such cases, if the delivered baby meets the criteria for a registered stillbirth or live born, as previously outlined, then that case should be reported to the NPEC audit. Since the inception of the PM audit, and going forward, a question in the NPEC dataset identifies if the birth occurred following a TOP.

Whether the indication for TOP is fatal fetal abnormality or in the interest of maternal health (before viability), if the birth falls within the definition of stillbirth or live birth (a small number of babies terminated before viability may show signs of life at birth), then that baby should be registered in the Civil Registration Service. These babies should be included in the unit's overall PMR (if delivered from 24 weeks or with a birth weight ≥ 500g).

It must be noted that the afore mentioned advice on definitions of perinatal deaths and calculation of PMR does not refer to the clinical viability of the fetus. A recent guidance document recommends a change in the threshold of fetal viability in Ireland from 24+0 weeks to 23+0 weeks gestation. Perinatal management and the provision of care to mothers and infants at extreme preterm births (gestation 23+0 – 24+6 weeks) should take into consideration all confounding clinical factors. [3]

I hope this clarifies any queries that may arise around this topic. Again, I would like to thank all units for your ongoing support. It is gratifying that the maternity services in Ireland, through the NPEC, are collecting data that can influence and improve patient care

Kind regards,

Professor Richard Greene
Director

[3] Perinatal Management of Extreme Preterm Birth at the Threshold of Viability
A Framework for Practice (2020): The Clinical Programme in Neonatology, The Neonatal Clinical Advisory Group, The Faculty of Paediatrics, Institute of Obstetrics and Gynaecology and the National Women and Infants Health Programme. Available at: https://www.hse.ie/eng/about/who/cspd/ncps/paediatrics-neonatology/resources/perinatal-management-of-extreme-preterm-birth-at-the-threshold-of-viability.pdf

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