



Confidential Maternal Death Enquiry in Ireland

Report for 2016 – 2018

December 2020



MDE

Confidential
Maternal Death Enquiry
Ireland

Confidential Maternal Death Enquiry in Ireland

Report for 2016 – 2018



MDE

**Confidential
Maternal Death Enquiry
Ireland**

Citation for this report:

O'Hare MF, Manning E, Corcoran P, Greene RA on behalf of MDE Ireland. Confidential Maternal Death Enquiry in Ireland, Report for 2016 - 2018. Cork: MDE Ireland, December 2020.

ISSN 2009-7298 (Online) ISSN 2009-728X (Print)

Copyright © Maternal Death Enquiry Ireland, 2020

Design/Artwork by Duggan 083 0071000

Printed by Hackett Reprographics

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission in writing of the copyright holder.

For rights of translation or reproduction, applications should be made to the Maternal Death Enquiry (MDE) Ireland, 5th Floor, Cork University Maternity Hospital, Wilton, Cork, Ireland, T12 YE02.

Contents

Foreword	4
Acknowledgements	5
Executive Summary	6
Confidential Maternal Death Enquiry UK and Ireland 2016-2018.....	8
The Confidential Enquiry into Maternal Deaths: Definitions and Methodology	9
Maternal Mortality in Ireland 2016-2018: Main Findings.....	14
Comparison of Maternal Mortality Rates: Ireland and the UK 2016–2018	15
Maternal Mortality in Ireland 2009-2018	16
Characteristics of women who died from direct and indirect causes: Ireland 2009-2018	19
Specific lessons learned in the Irish context 2016-2018	22
Learning Points from ‘Saving Lives, Improving Mother’s Care’ Report.....	22
Appendix 1: Assessors for MDE Ireland.....	24
Appendix 2: Membership of Working Group on Maternal Mortality in Ireland.....	25
Appendix 3: Members of the Oxford based MBRRACE-UK team	26

Foreword

Publication of this fourth Maternal Death Enquiry (MDE) Ireland report coincides with release of the 2020 report incorporating Irish data in the long-established UK Confidential Enquiry into Maternal Deaths. It covers the same timeframe as the latter, and provides an update on mortality data included in earlier MDE Ireland reports published in August 2012, February 2015 and December 2017. This report incorporates data collected during the first ten years of the existence of MDE Ireland.

A formal working relationship initially developed with CEMACH (subsequently CMACE) in 2009 has been superseded by an agreement with colleagues based at NPEU/MBRRACE-UK in Oxford. This has resulted in publication of (i) annual reports 'Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland.' Confidential Enquiries into Maternal Deaths and Morbidity; and (ii) Triennial Reports or annual Data Briefs published by MDE Ireland. It represents another and important landmark in the longstanding relationship between professional colleagues involved in maternity services in Ireland and the UK. The current practice of reporting annually on a rolling basis results in timely access to data and emerging trends.

I commend both reports to all who have any involvement or interest in the care of pregnant, or recently pregnant, women in Ireland.



Michael F O'Hare MD, FRCPI, FRCOG

Chairman

Joint Institute of Obstetricians & Gynaecologists/HSE Working Group on Maternal Mortality

Acknowledgements

The content of this report reflects the commitment and hard work of many people both within Ireland and the UK. MDE Ireland again extends sincere thanks to all healthcare professionals who have contributed data to this confidential enquiry. Their support is essential to the success of the enquiry process. In particular, we gratefully acknowledge the commitment of unit coordinators and coroners in notifying cases. Particular thanks are due to the dedicated multidisciplinary Irish assessors (see Appendix 1). Their clinical expertise in reviewing maternal death cases is invaluable in identifying actions to improve future care of all pregnant women. As with UK assessors, their work is carried out pro bono and in their own time.

We would also wish to acknowledge the members of the Working Group on Maternal Mortality in Ireland (Appendix 2) for their intellectual input and advice on the confidential enquiry process in the context of Ireland.

MDE Ireland would again acknowledge and extend sincere thanks to all members of the Oxford based MBRRACE-UK team led by Professors Jenny Kurinczuk and Marian Knight (Appendix 3). Their support and advice is much appreciated.

Executive summary

This is the fourth Maternal Death Enquiry (MDE) Ireland report, and follows on from previous reports covering the period 2009-2015. In common with the UK, reports are now produced annually and cover triennia on a rolling basis. Since its inception in 2009, MDE Ireland has used the validated and respected UK Confidential Enquiry methodology. The UK CEMD is the longest running programme and widely considered the gold standard for confidential enquiries into maternal deaths worldwide.

In 2013, governance of the UK CEMD (formerly CEMACH, laterally CMACE) was transferred to MBRRACE-UK, (Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries). MBRRACE-UK is led from the National Perinatal Epidemiology Unit (NPEU) at the University of Oxford.

Publication of this report coincides with the latest report from MBRRACE-UK, 'Saving Lives, Improving Mothers' Care: Lessons learned to inform maternity care from the UK and Ireland. Confidential Enquiries into Maternal Death and Morbidity 2016 – 2018'.¹ During the same triennium, a total of 13 maternal deaths, occurring during or within 42 days of pregnancy end, were reported to MDE Ireland. Of these 13 deaths, 4 were classified as direct maternal deaths (due to obstetric causes), 6 as indirect maternal deaths (due to pre-existing medical or mental disorders exacerbated by pregnancy), and the remaining 3 were attributed to coincidental causes (not due to direct or indirect causes). There was no evidence of clustering in any one maternity hospital.

Taking account of the relatively small number of maternal deaths in Ireland, fluctuation in the Maternal Mortality Rate (MMR) is inevitable and must be interpreted with caution. For the triennium 2016 – 2018, the MMR in Ireland was 5.4 per 100,000 maternities (95% CI 2.6-10.0). The MMR rates for 2011 - 2013 and 2013 - 2015 were 10.4 and 6.5 per 100,000 maternities respectively. The MMR in Ireland for the triennium 2016 - 2018 does not differ statistically from previous reported years, or the currently reported UK MMR of 9.71 per 100,000 maternities for 2016-2018.

For the years 2016-2018 case ascertainment by MDE Ireland (direct, indirect and coincidental) was again somewhat greater than that by the civil death registration system.² This issue is not unique to Ireland, and underestimation of maternal deaths using civil death registration systems, even in developed countries, has been acknowledged by the World Health Organisation (WHO).

The majority of deaths in the years 2016 - 2018 were again from indirect causes, i.e. from pre-existing disorders exacerbated by pregnancy. The proportion of maternal deaths due to direct and indirect causes was 40 and 60 per cent respectively. This reflects findings in the UK and underscores the importance of preconception counselling for all women of childbearing years with pre-existing medical and mental health disorders. It also serves to emphasise the importance of a comprehensive history being documented at the first booking visit to a maternity unit.

1 Knight M, Bunch K, Tuffnell D, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2016-18. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2020.

2 Central Statistics Office. [2020] Vital Statistics Annual Report 2018. Cork. Available at: <https://www.cso.ie/en/releasesandpublications/ep/p-vsar/vitalstatisticsannualreport2018/infantmortalitystillbirthsandmaternalmortality2018/>

In the context of a small cohort of patients, the evidence presented suggests a non-statistically significant increasing risk of maternal death with increasing maternal age and non-Irish ethnicity. Multiparous patients were, however, at statistically significant increased risk compared with nulliparous patients.

Specific lessons in an Irish context are:

- Cardiac disease remains the largest single cause of all maternal deaths for the years 2009 – 2018 in Ireland. However, it is gratifying that, in the triennium 2016-2018, there were no maternal deaths (up to 42 days postpartum) attributable to cardiac disease.
- Thromboembolism remains a leading cause of direct maternal death in Ireland.
- The higher rate of indirect maternal deaths compared with direct deaths highlights on-going challenges for maternity services in caring for women with pre-existing medical and mental health disorders.
- Suicide is now classified as a direct cause of maternal death, of which it is a leading cause.
- It is noteworthy that, in the decade 2009 - 2018, there were no maternal deaths in Ireland attributable to anaesthesia.

A number of learning points are also reproduced, for ease of reference, from the report 'Saving Lives, Improving Mother's Care' for UK and Ireland (2020) under the headings (i) Causes and Trends; and (ii) New Recommendations to Improve Care.

The findings of this report in conjunction with the 'Saving Lives, Improving Mother's Care' report for 2016 – 2018 highlight the need for continuing vigilance and ongoing enquiries into maternal deaths in Ireland in order to identify key factors impacting on adverse maternal outcomes. It is imperative that lessons are learned from such deaths to inform continuing improvements in maternity services.

Confidential Maternal Death Enquiry UK and Ireland 2016-2018

The Confidential Maternal Death Enquiry (CEMD) was initiated in England and Wales in 1952 and became UK - wide in the 1980s. Ireland became a participant in the Enquiry in 2009. Learning points from successive CEMD reports have informed practice in maternity services for over six decades. Their overwhelming strength has been the impact of their findings on improving standards of care and clinical governance in the UK maternity services, and further afield, including Ireland.

The aim of the Enquiry is to investigate why some women die during or shortly after pregnancy, and to learn how such tragedies might be avoided in the future. We can thus ensure that all pregnant and recently delivered women receive safe, high quality care delivered in settings appropriate to their individual needs, and also ensure that women with pre-existing disorders have had their treatment optimised prior to conception.

In 2013, governance of the UK CEMD was transferred to MBRRACE-UK, (Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries).

MBRRACE-UK is led from the National Perinatal Epidemiology Unit (NPEU) at the University of Oxford by Professors Jenny Kurinczuk and Marian Knight. With the support of the HSE and the Institute of Obstetricians and Gynaecologists, MDE Ireland has entered into agreement with MBRRACE-UK to ensure continuing Irish involvement with the UK based Enquiry. MBRRACE-UK revised and updated the process for data collection

and analysis on maternal deaths including 'late' maternal deaths, and reports are now published annually rather than triennially. Topic-specific chapters on individual causes of death now appear once every three years on a cyclical basis, alongside a surveillance chapter reporting three years of statistical data for the UK. Importantly, the focus is not on attributing blame, but on improving future mothers' care.

The first MBRRACE-UK report, covering the years from 2009 to 2012 was published in December 2014. For the first time in the sixty year history of the UK CEMD, this report included detailed Confidential Enquiries into the care of women who died during or after pregnancy in Ireland. For consistency and comparability with previous CEMD reports, surveillance data on maternal mortality rates and trends does not include Irish data. However, MDE Ireland continues to analyse and publish surveillance data on maternal mortality occurring in Ireland independently. The current report incorporates data collected during the first ten years of the existence of MDE Ireland.

The themed review topics in the 2020 MBRRACE-UK report include neurological conditions, medical and general surgical disorders, anaesthesia, haemorrhage and amniotic fluid embolism, and sepsis. A chapter on severe maternal morbidity resulting from sepsis is also included.³ The recommendations and lessons contained within this report are available at: <https://www.npeu.ox.ac.uk/mbrrace-uk/reports>

³ Knight M, Bunch K, Tuffnell D, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2016-18. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2020.

The Confidential Enquiry into Maternal Deaths: Definitions and Methodology

Definitions and classification of maternal deaths used by the UK CEMD are outlined in Table 1. In recognition of the importance of maternal suicide and its direct link to pregnancy, most recent WHO guidance on classification of maternal mortality (ICD-MM, WHO 2012) has recommended that maternal deaths due to suicide are classified as direct rather than indirect maternal deaths.⁴ MBRRACE-UK and MDE Ireland have adopted the changed classification.

Table 1: Definitions of Maternal Deaths: (World Health Organisation 2012)

Maternal Death	Deaths of women while pregnant or within 42 days of the end of the pregnancy* from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes
Direct	Deaths resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above.
Indirect	Deaths resulting from previous existing disease, or disease that developed during pregnancy and which was not the result of direct obstetric causes, but which was aggravated by the physiological effects of pregnancy.
Late	Deaths occurring between 42 days and 1 year after the pregnancy end* that are the result of Direct or Indirect maternal causes.
Coincidental †	Deaths from unrelated causes which happen to occur in pregnancy or the puerperium.
* Includes giving birth, ectopic pregnancy, miscarriage or termination of pregnancy. † Termed "Fortuitous" in the International Classification of Diseases (ICD)	

⁴ The WHO Application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD-MM. World Health Organisation, 2012

Table 2: WHO ICD-MM classification and groups of underlying causes of death during pregnancy, childbirth and the puerperium⁵

Type	Group number/name	Examples of potential causes of death
Maternal death: direct	1.Pregnancy with abortive outcome	Abortion, miscarriage, ectopic pregnancy and other conditions leading to maternal death and a pregnancy with abortive outcome
Maternal death: direct	2.Hypertensive disorders in pregnancy, childbirth and the puerperium	Oedema, proteinuria and hypertensive disorders in pregnancy, childbirth or the puerperium
Maternal death: direct	3.Obstetric Haemorrhage	Obstetric diseases or conditions directly associated with haemorrhage
Maternal death: direct	4.Pregnancy related infection	Pregnancy-related, infection-based diseases or conditions
Maternal death: direct	5.Other obstetric complications	All other direct obstetric conditions not included in groups 1-4
Maternal death: direct	6.Unanticipated complications of management	Severe adverse effects and other unanticipated complications of medical and surgical care during pregnancy, childbirth or the puerperium
Maternal death: indirect	7. Non-obstetric complications	<p>Non-obstetric conditions</p> <ul style="list-style-type: none"> · Cardiac disease (including pre-existing hypertension) · Endocrine conditions · Gastrointestinal tract conditions · Central nervous system conditions · Respiratory conditions · Genitourinary conditions · Autoimmune disorders · Skeletal diseases · Psychiatric disorders · Neoplasms · Infections that are not a direct result of pregnancy
Maternal death: unspecified	8. Unknown/undetermined	Death in pregnancy, childbirth and the puerperium where the underlying cause is unknown or was not determined
Death in pregnancy, childbirth and the puerperium	9.Coincidental	Death in pregnancy, childbirth and the puerperium due to external causes

⁵ The WHO Application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD-MM. World Health Organisation, 2012

Calculating Maternal Mortality Rates

Maternal mortality rates (MMR) are based on maternal deaths due to direct or indirect causes and do not include deaths due to coincidental causes. It is international practice to use the number of live births as the denominator for MMR, whereas the number of maternities is used by the UK and Ireland CEMD to calculate rates, as this represents a figure closer to the true number of women at risk. The total of estimated maternities

(including miscarriage, ectopic pregnancy and therapeutic termination) is sometimes used as a denominator. However, this denominator is inaccurate and underestimated. In view of this, MDE Ireland has calculated MMR using published national data of maternities, i.e. women giving birth to a livebirth or stillbirth with birth weight of $\geq 500\text{g}$.⁶ These data were also used to calculate age and parity specific mortality rates.

Identifying Maternal Deaths in Ireland

MDE Ireland has adopted a proactive approach to case ascertainment similar to that used historically by UK CEMD. This includes a nationwide network reporting directly to MDE Ireland from a variety of sources. The majority of cases are reported directly by the maternity unit responsible for the woman's care during pregnancy. Additional sources include general hospitals, coroners, pathologists, general practitioners and other healthcare professionals in the community. Historically, the overall number of maternal deaths identified by the UK CEMD methodology has always exceeded twice the number of those officially reported by the UK Office of National Statistics (ONS). This is because not all maternal deaths are recorded as such on death certificates. In Ireland, the Central Statistics Office (CSO)

collates statistics on deaths from death registration data gathered by the General Register Office (GRO). Since the inception of the Enquiry in 2009, the number of maternal deaths identified by MDE Ireland (direct, indirect and coincidental) has also been somewhat greater than the number identified by death registration alone.⁷ However, underestimation of maternal mortality rates by civil death registration systems alone is not unique to Ireland and the UK. In Europe, underestimation of maternal deaths has been reported to vary between 30% and 50%.⁸ In acknowledgement of issues affecting MMR as reported by civil death registration systems globally, WHO has proposed systematically weighting the official statistics reported by developed countries by a factor of 1.5.⁹

6 Healthcare Pricing Office. [2020] Perinatal Statistics Reports 2016- 2017. Hospital In-Patient Enquiry Scheme Report 2018. Dublin: Health Service Executive. Available at www.hpo.ie

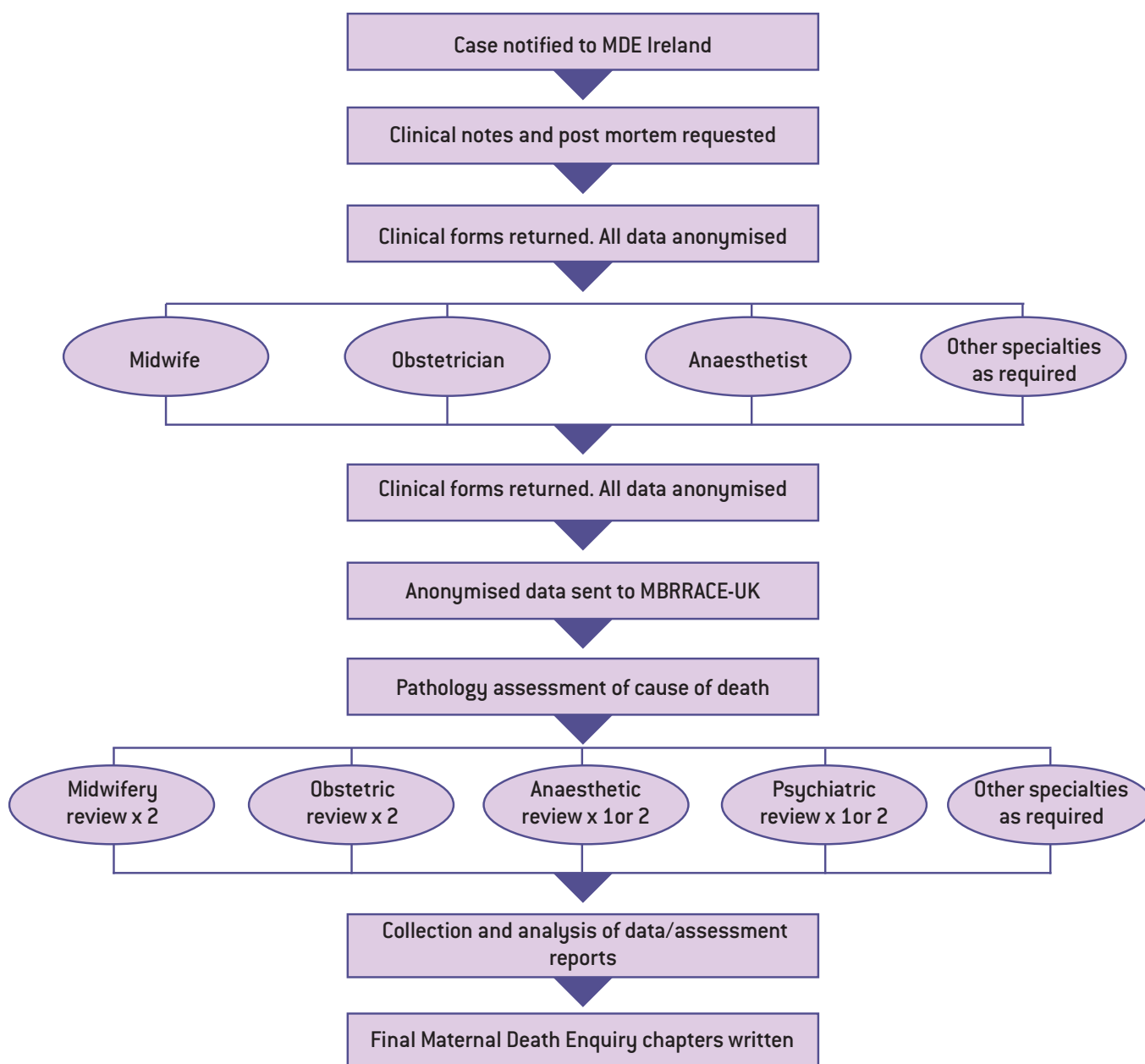
7 Central Statistics Office. [2020] Vital Statistic Annual Report 2018. Cork. Available at: <https://www.cso.ie/en/releasesandpublications/ep/v-sar/vitalstatisticsannualreport2018/infantmortalitystillbirthsandmaternalmortality2018/>

8 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 at www.europeristat.com

9 Hogan M, Foreman K, Naghavi M, Ahn S, Wang M, Makela S, Lopez AD, Lozano R, Murray CJ. Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards Millennium Development Goal 5. *Lancet*. 2010; 6736(10):1-15

Data collection and assessment processes: MDE Ireland and MBRRACE-UK

Figure 1: Data collection and assessment processes: MDE Ireland and MBRRACE-UK



Expert review

Multidisciplinary assessors are clinicians who work independently of the confidential enquiry into maternal deaths but contribute to the enquiry process in both Ireland and the UK. In Ireland, assessors have been nominated by the relevant professional bodies and bring a wide range of clinical expertise and experience to the enquiry from the following disciplines: Obstetrics, Midwifery, Anaesthesia, Perinatal Pathology

and Perinatal Psychiatry (Appendix 1). The role of assessors is to identify quality of care given according to criteria set by MBRRACE-UK as detailed in Box 1. All assessors have undergone training and are provided with guidance detailing standards of care against which deaths are assessed. The assessment process and its findings are strictly confidential and all assessors are required to sign a confidentiality agreement.

Box 1

Assessment of Quality of Care

- Good care; no improvements identified
- Improvements in care* identified which would have made no difference to the outcome
- Improvements in care* identified which may have made a difference to the outcome

*Improvements in care are interpreted to include adherence to guidelines, where these exist and have not been followed, as well as other improvements which would normally be considered part of good care, where no formal guidelines exist.

Maternal Mortality in Ireland 2016-2018:

Main findings

For the years 2016 – 2018, a total of 13 maternal deaths, occurring during or within 42 days of the pregnancy end, were identified by MDE Ireland. Of these 13 deaths, 4 were classified as direct, 6 as indirect, and the remaining 3 were attributed to coincidental causes.

During the triennium, there were eight further late maternal deaths i.e deaths due to direct or indirect causes occurring between 42 days and one year following pregnancy end.

There was no evidence of clustering in any one maternity hospital.

Causes of Maternal Deaths in Ireland 2016-2018

Direct

The four maternal deaths in 2016-2018 due to direct causes were attributed to:

- Thromboembolism (1)
- Genital Tract Infection (1)
- Amniotic Fluid Embolism (1)
- Early Pregnancy Complication (1).

Indirect

The six maternal deaths in 2016-2018 due to indirect causes were attributed to

Other indirect Causes (4)

- Cystic fibrosis (2)
- Sepsis associated with influenzal pneumonia (1)
- Psychiatric drug and alcohol related (1)*

*autopsy report awaited

Indirect Neurological Conditions (2)

- Subarachnoid haemorrhage (1)
- Dissection of carotid artery (1)

There were no indirect deaths attributed to cardiac conditions.

The proportion of causes of death due to direct and indirect causes was 40 per cent and 60 per cent respectively for 2016-2018. This is similar to recent findings in the UK.

Coincidental

Three maternal deaths in 2016-2018 were attributed to coincidental causes.

- Malignancy (1)
- Road traffic accident (1)
- Smoke inhalation (fire) (1)

Late

Eight late maternal deaths were reported in 2016-2018.

- Cardiac (3) - myocardial infarction (1); myocardial infarction secondary to coronary artery dissection (1); cardiac arrhythmia secondary to postpartum cardiomyopathy (1)
- Malignancy (2)
- Psychiatric drug and alcohol related (2)
- Sepsis complicating elective surgery (1)

Maternal Mortality Rate in Ireland 2016-2018

For the triennium 2016-2018 there were 10 direct or indirect maternal deaths among 183,797 maternities in Ireland. This gave an MMR of 5.4 per 100,000 maternities [95% CI 2.6-10.0]. Taking account of the relatively small number of maternal deaths

in Ireland, marked fluctuation in MMR is inevitable and must be interpreted with caution. The apparent improvement in MMR when compared with previous Irish data over ten years from 2009 does not reach statistical significance.

Comparison of Maternal Mortality Rates: Ireland and the UK 2016–2018

For the triennium 2016 – 2018, the Irish MMR was 5.4 per 100,000 maternities [95% CI 2.6-10.0] and the UK MMR was 9.7 per 100,000 maternities [95% CI 8.46-11.09]. This does

not represent a statistically significant difference in MMR between countries (Rate ratio 0.56, CI 0.30-1.06, $p = 0.073$).

Maternal Mortality in Ireland 2009-2018

For the years 2009 – 2018, a total of 66 maternal deaths occurring during or within 42 days of the pregnancy end were identified by MDE Ireland. There were 675,556 maternities in Ireland during these ten reporting years. Of these 66 deaths, 23 were classified as direct maternal deaths, 31 as indirect maternal deaths, and the remaining 12 were attributed to coincidental causes.

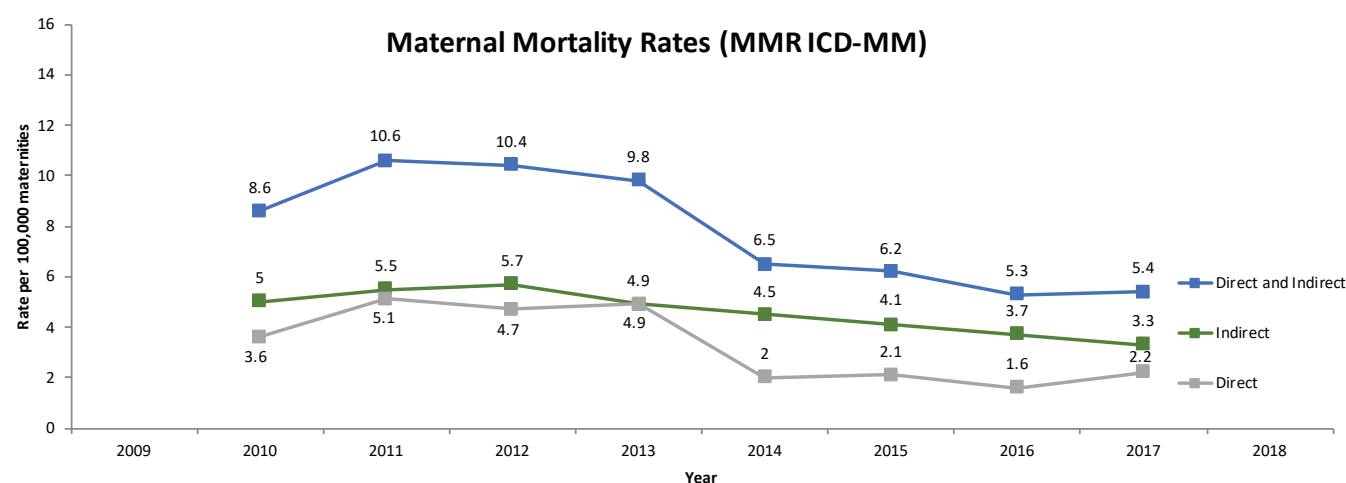
Table 3 demonstrates a rolling three-yearly MMR since the inception of MDE Ireland in 2009 using ICD-MM. Rates are plotted in the middle year of the triennium in Figure 2.

Again, observed changes in the MMR over the ten year period 2009-2018 suggest a declining rate, but which did not achieve statistical significance (Rate ratio 0.94, CI 0.85-1.03, $p = 0.199$).

Table 3: Direct and Indirect Maternal Mortality rates per 100,000 maternities in Ireland using ICD-MM classification on cause of death: rolling three year data 2009 – 2018

Triennium	Total Irish Maternities*	Direct Maternal Deaths		Indirect Maternal Deaths		Total Maternal Deaths	
		n	Rate (95%CI)	n	Rate (95%CI)	n	Rate (95%CI)
2009-2011	222,136	8	3.6 (1.6-7.1)	11	5.0 (2.5-8.9)	19	8.6 (5.2-13.4)
2010-2012	218,035	11	5.1 (2.5-9.0)	12	5.5 (2.8-9.6)	23	10.6 (6.7-15.8)
2011-2013	211,669	10	4.7 (2.3-8.7)	12	5.7 (2.9-9.9)	22	10.4 (6.5-15.7)
2012-2014	204,999	10	4.9 (2.3-9.0)	10	4.9 (2.3-9.0)	20	9.8 (6.0-15.1)
2013-2015	198,914	4	2.0 (0.5-5.2)	9	4.5 (2.1-8.6)	13	6.5 (3.5-11.2)
2014-2016	193,833	4	2.1 (0.6-5.3)	8	4.1 (1.8-8.1)	12	6.2 (3.2-10.8)
2015-2017	188,405	3	1.6 (0.3-4.7)	7	3.7 (1.5-7.7)	10	5.3 (2.6-9.8)
2016-2018	183,797	4	2.2 (0.6-5.6)	6	3.3 (1.2-7.1)	10	5.4 (2.6-10.0)

* Source: Healthcare Pricing Office. Perinatal Statistics Reports 2016- 2017. Hospital In-Patient Enquiry Scheme Report 2018. Dublin: Health Service Executive. Available at www.hpo.ie



Note: Three year moving average rates are plotted in middle year of triennium

Figure 2: Direct and Indirect Maternal Mortality rates per 100,000 maternities in Ireland using ICD-MM classification on cause of death: rolling three year data 2009 – 2018

Comparison of Maternal Mortality Rates: Ireland and the UK 2009 –2018

Figure 3 illustrates rolling three-yearly average MMR for Ireland and the UK over the ten years 2009-2018. There has been no statistically significant difference in rates between the two jurisdictions [Rate Ratio 0.56, CI 0.30-1.06, $p = 0.073$].

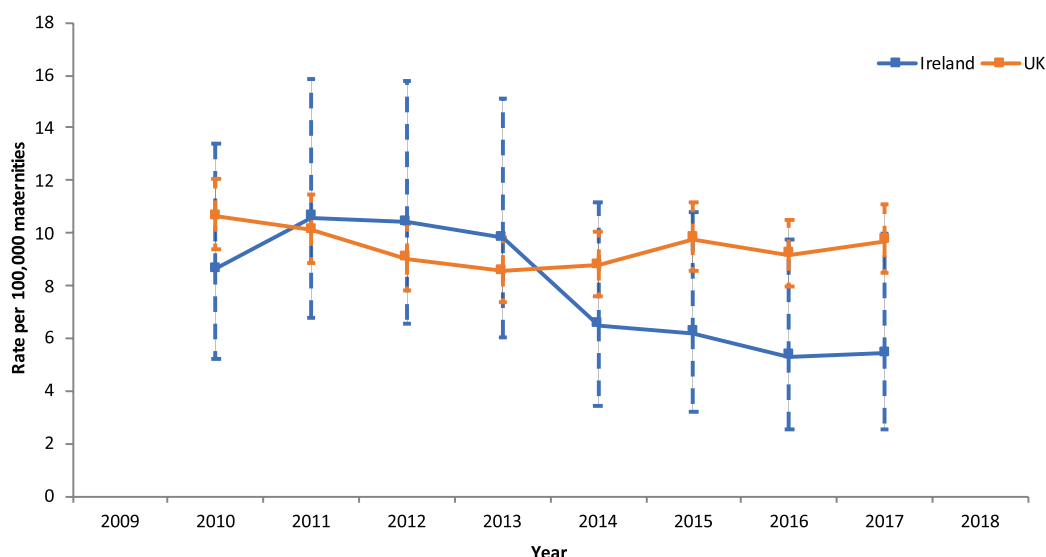


Figure 3: Maternal Mortality rates per 100,000 maternities: Ireland and the UK 2009- 2018.

Causes of Maternal Deaths in Ireland 2009-2018

Based on the ICD-MM (WHO, 2012) classification, the proportion of direct and indirect maternal deaths was 43% and 57% respectively for the decade. This reflects recent findings in the UK.

Direct and Indirect maternal deaths by cause are detailed in Tables 4 and 5. To facilitate international comparisons and comparison with UK CEMD reports, causes of maternal deaths are categorised and presented using the UK convention in Table 4 and the ICD-MM classification in Table 5. On account of the small number of cases per category in Ireland and the limited power of analysis in a small cohort, rates per category are not appropriate and have not been calculated.

As in the UK, cardiac disease was the single commonest cause of maternal death in Ireland for the decade 2009-2018, accounting

for 25.9 per cent of all direct and indirect deaths. Although no new cardiac deaths were reported in the triennium 2016-2018, the 14 deaths reported previously were attributed to:

- Coronary artery dissection (4)
- Sudden adult death syndrome (4)
- Dissection of aorta (2)
- Myocardial infarction (1)
- Peripartum cardiomyopathy (1)
- Hyperkalaemia (1)
- Aortic thrombus with multiple infarcts (1)

Venous thromboembolism and suicide continue to feature prominently as leading causes of direct maternal death.

Table 4: Causes of direct and indirect maternal deaths: Ireland 2009-2018

Cause of Maternal Death	2009-11	2012-14	2013-15	2014-16	2015-17	2016-18	2009-18
Direct Maternal Deaths	8	10	4	4	3	4	23
Thrombosis and thromboembolism	3	2	1	0	0	1	6
Pre-eclampsia and eclampsia	1	1	1	0	0	0	2
Genital Tract Sepsis*	0	1	0	0	0	1	2
Amniotic fluid embolism	1	2	1	2	1	1	4
Early pregnancy deaths	0	0	0	2	2	1	2
Haemorrhage	1	1	0	0	0	0	2
Anaesthesia	0	0	0	0	0	0	0
Deaths due to psychiatric causes	2	3	0	0	0	0	5
Indirect Maternal Deaths	11	10	9	8	7	6	31
Cardiac Disease	4	7	6	5	3	0	14
Other Indirect causes	4 [†]	1	0	0	2	4	9
Indirect neurological conditions	3 ^{**}	2	3	3	2	2	8
Indirect malignancies	0	0	0	0	0	0	0
Coincidental Maternal Deaths	6	2	2	3	3	3	12

*Genital tract sepsis deaths only, including early pregnancy deaths as the result of genital tract sepsis

**Includes 2 cases of Epilepsy

†Includes 2 deaths attributed to H1N1 influenza-related mortality

Table 5: Cause of direct and indirect maternal deaths using ICD-MM classification, per 100,000 maternities: Ireland 2009-2018

Cause of Maternal Death	2009-11	2012-14	2013-15	2014-16	2015-17	2016-18	2009-18
Direct Maternal Deaths	8	10	4	4	3	4	23
Group 1: Pregnancy with abortive outcome	0	0	0	2	2	1	2
Group 2: Hypertensive disorders	1	1	1	0	0	0	2
Group 3: Obstetric haemorrhage	1	1	0	0	0	0	2
Group 4: Pregnancy-related infection	0	1	0	0	0	1	2
Group 5: Other obstetric complication	0	0	0	2	1	2	15
Group 6: Unanticipated complication of pregnancy	0	0	0	0	0	0	0
Indirect Maternal Deaths	11	10	9	8	7	6	31
Group 7: Non obstetric complications	11	10	9	8	7	6	31
Group 8: Unknown/undetermined	0	0	0	0	0	0	0
Coincidental Maternal Deaths	6	2	2	3	3	3	12

Characteristics of women who died from direct and indirect causes: Ireland 2009-2018

Mothers and babies

One third (n=18; 33 per cent) of the 54 women who died from direct and indirect causes in Ireland 2009-2018 were still pregnant at the time of death (Table 6). This is similar to the rate of 32 per cent reported in the UK for the triennium 2016-2018.

Of the remaining 36 women, 30 women gave birth to 32 babies. Of these 32 babies, there were 2 stillbirths and 30 livebirths, two of which resulted in early neonatal death. The remaining six women died before fetal viability, 4 associated with early pregnancy loss and 2 associated with ruptured ectopic pregnancy.¹⁰

Table 6: Timing of direct and indirect maternal deaths in relation to pregnancy 2009-2018

Timing of maternal death in relation to pregnancy	Direct Maternal Deaths (n=23)	Indirect Maternal Deaths (n=31)	Total Maternal Deaths (n=54)
Antenatal period < 20 weeks	4	6	10
Antenatal period ≥ 20 weeks	2	6	8
Postnatal on day of delivery	10	6	16
Postnatal day1 to 42 days	7	13	20

The majority of these 30 women were delivered by caesarean section (n=22; 73%), and 7 were reported as perimortem caesarean sections. Five perimortem caesarean sections were performed at ≥37 weeks gestation, delivering 1 stillbirth and 4 live births, 1 of which

resulted in early neonatal death. A further 2 perimortem caesarean sections were carried out at ≤32 weeks gestation. The outcome of these deliveries was one early neonatal death and one intrauterine death diagnosed prior to delivery.

Location of death in women who died from direct and indirect causes: Ireland 2009-2018

Approximately half of women (n=11; 48 per cent) whose causes of death were classified as direct died in an Intensive Care Unit (ICU). A further five direct maternal deaths, of which

four were attributed to suicide, occurred outside the hospital setting. The indirect maternal deaths followed a similar pattern (see Table 7).

Table 7: Location of direct and indirect maternal deaths 2009 – 2018

Location of death	Direct Maternal Deaths (n=23)	Indirect Maternal Deaths (n=31)	Total Maternal Deaths (n=54)
Home / outwith hospital setting	5*	6	11
Hospital (except A&E and ICU)	5	3	8
A&E	2	8	10
ICU	11	14	25

*4 of 5 cases were classified as direct due to suicide

10 Knight M, Bunch K, Tuffnell D, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2016-18. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2020.

Ethnicity/ Nationality

Of the 54 deaths of women from direct and indirect causes in 2009-2018, 30 per cent occurred in women born outside of Ireland. Non Irish women accounted for 23.4 per cent of all maternities in Ireland for that time period.¹¹ While such a finding suggests over-representation in Irish maternal deaths, it was not statistically significant (Rate ratio 1.42, CI 0.79-2.55, p=0.235), most likely due to small cohort size.

It should be noted that, in the UK, there remains a more than four-fold difference in maternal mortality rates amongst women from Black ethnic backgrounds and an almost two-fold difference amongst women from Asian ethnic backgrounds compared to white women (Knight et al, 2020).¹²

Maternal Age

The mortality rate increased with advancing maternal age, apparently doubled for the age range 35-39 years. However, this was not

statistically significant (Rate ratio 1.16, 95% CI 1.13-2.30, p = 0.008).

Table 8: Age distribution of women who died from direct and indirect causes in Ireland 2009-2018

Maternal Age	Direct (n=23)	Indirect (n=31)	Total Maternal Deaths (n=54)	Total Maternities*	Mortality Rate** (95%CI)	Relative risk (95%CI)	P-value
<20	0	0	0	14,471	-	-	
20-24	2	2	4	64,339	6.2 (1.7-15.9)	1.00 (Ref.)	
25-29	3	5	8	138,653	5.8 (2.5-11.4)	0.93 (0.28-3.08)	0.903
30-34	11	8	19	239,813	7.9 (4.8-12.4)	1.27 (0.43-3.75)	0.659
35-39	7	15	22	177,565	12.4 (7.8-18.8)	1.99 (0.69-5.78)	0.205
40+	0	1	1	39,352	2.5 (0.1-14.2)	0.41 (0.05-3.66)	0.424

*Maternities by maternal age groups

**Maternal Mortality Rate per 100,000 maternities.

11 Healthcare Pricing Office. *Perinatal Statistics Report 2017*. Dublin: Health Service Executive

12 Knight M, Bunch K, Tuffnell D, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. *Saving Lives, Improving Mothers' Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2016-18*. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2020.

Parity

Table 9 details the distribution of maternal deaths by parity. There was a statistically significant increased risk in multiparous women, especially Para 2 (Rate ratio 2.34, CI 1.27-4.30, p=0.006).

Table 9: Distribution of maternal deaths by parity: Ireland 2009-2018

Parity	Direct (n=23)	Indirect (n=31)	Total Maternal Deaths (n=54)	Total Maternities*	Mortality Rate (95%CI)	Relative risk (95%CI)	P-value
0	9	5	14	381,931	3.7 (2.0-6.2)	1.00 (Ref.)	
1	7	10	17	238,102	7.1 (4.2-11.4)	1.95 (0.96-3.95)	0.065
2	4	12	16	149,553	10.7 (6.1-17.4)	2.92 (1.42-5.98)	0.003
3+	3	4	7	78,495	8.9 (3.6-18.4)	2.43 (0.98-6.03)	0.055

Body mass index (BMI)

There is evidence that increased maternal BMI is associated with higher risk of maternal death due to specific pregnancy complications. National guidelines recommend the recording of BMI in the maternity notes. While this may be common practice, there are no national data on the BMI of the pregnant population available in Ireland.¹³ Table 10 demonstrates the distribution of BMI among women who died.

Overall, the weight distribution of mothers who died in Ireland is similar to that found in the population (Healthy Ireland Survey, 2015), and does not suggest increasing risk of maternal death with increased BMI. However, this observation may simply reflect small cohort size.

Table 10: Body Mass Index of women who died: Ireland 2009 – 2018

BMI Category (Kg.m ⁻²)	Direct (n=23)	Indirect (n=31)	Total Maternal Deaths n=54 (%)*	Healthy Ireland Survey 2015 (%)
Underweight (<18.5)	1	1	2	3%
Healthy (18.5-24.9)	10	11	21 (47%)	44%
Overweight (25.0-29.9)	3	10	13 (29%)	31%
Obese (≥ 30.0)	3	6	9 (20%)	22%
Data Missing	6	3	9	-

*Percentages based on the 45 maternal death cases where data on BMI was known.

Smoking

Data on smoking status was unknown in nine cases of direct and indirect maternal deaths over the decade 2009 – 2018. Of the 45 women whose smoking status was recorded, one in four smoked (n=12, 27%). There are no

national data on the prevalence of smoking during pregnancy in Ireland but rates of 12%, 15%, 16% and 19% have been reported in England, Northern Ireland, Wales and Scotland respectively.¹⁴

13 Clinical Practice Guideline No 2 (2011). Obesity and pregnancy : Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland / HSE

14 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

Specific lessons learned in the Irish context 2009-2018

- Cardiac disease remains the largest single cause of all maternal deaths for the years 2009 – 2018. However, it is gratifying that, in the triennium 2016-2018, there were no maternal deaths (up to 42 days postpartum) attributable to cardiac disease in Ireland.
- Thromboembolism remains a leading cause of direct maternal death in Ireland.
- The higher rate of indirect maternal deaths compared with direct deaths highlights on-going challenges for maternity services in caring for women with pre-existing medical and mental health disorders.
- Suicide is now classified as a direct cause of maternal death, of which it is a leading cause.
- It is noteworthy that, in the decade 2009 -2018, there were no maternal deaths directly attributable to anaesthesia.

Learning Points from ‘Saving Lives, Improving Mother’s Care: Lessons learned to inform maternity care from the UK and Ireland. Confidential Enquiries into Maternal Death and Morbidity 2016 – 2018’¹⁵

For ease of access, the following learning points are reproduced from the report for UK and Ireland (2020):

Causes and Trends

- Thrombosis and thromboembolism remains the leading cause of direct maternal death during or up to six weeks after the end of pregnancy.
- Maternal suicide remains the leading cause of direct deaths occurring within a year after the end of pregnancy.
- Cardiac disease remains the largest single cause of indirect maternal deaths.
- Neurological causes (epilepsy and stroke) are the second most common indirect cause of maternal death, and the third commonest cause of death overall.
- There has been a statistically significant increase in maternal mortality due to Sudden Unexpected Death in Epilepsy (SUDEP).
- Maternal deaths from direct causes are unchanged with no significant change in the rates between 2013-15 and 2016-18.

¹⁵ Knight M, Bunch K, Tuffnell D, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers’ Care - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2016-18. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2020.

New recommendations to improve care

For professional organisations:

1. Develop guidance to ensure SUDEP awareness, risk assessment and risk minimisation is standard care for women with epilepsy before, during and after pregnancy and ensure this is embedded in pathways of care.
2. Develop guidance to indicate the need for definitive radiological diagnosis in women who have an inconclusive VQ scan.
3. Produce guidance on which bedside tests should be used for assessment of coagulation and the required training to perform and interpret those tests.
4. Establish a mechanism to disseminate the learning from this report, not only to maternity staff, but more widely to GPs, emergency department practitioners, physicians and surgeons

For policy makers, service planners/ commissioners and service managers:

5. Develop clear standards of care for joint maternity and neurology services, which allow for: early referral in pregnancy, particularly if pregnancy is unplanned, to optimise anti-epileptic drug regimens; rapid referral for neurology review if women have worsening epilepsy symptoms; pathways for immediate advice for junior staff out of hours; postnatal review to ensure anti-epileptic drug doses are appropriately adjusted.
6. Ensure each regional maternal medicine network has a pathway to enable women to access their designated epilepsy care team within a maximum of two weeks.
7. Ensure all maternity units have access to an epilepsy team.
8. Establish pathways to facilitate rapid specialist stroke care for women with stroke diagnosed in inpatient maternity settings.

9. Provide specialist multidisciplinary care for pregnant women who have had bariatric surgery by a team who have expertise in bariatric disorders.
10. Use the scenarios identified from review of the care of women who died for 'skills and drills' training.
11. Ensure early senior involvement in the care of women with extremely preterm prelabour rupture of membranes and a full explanation of the risks and benefits of continuing the pregnancy. This should include discussion of termination of pregnancy.

For health professionals:

12. Regard nocturnal seizures as a 'red flag' indicating women with epilepsy need urgent referral to an epilepsy service or obstetric physician.
13. Ensure that women on prophylactic and treatment dose anticoagulation have a structured management plan to guide practitioners during the antenatal, intrapartum and postpartum period.
14. Ensure at least one senior clinician takes a 'helicopter view' of the management of a woman with major obstetric haemorrhage to coordinate all aspects of care.
15. Ensure that the response to obstetric haemorrhage is tailored to the proportionate blood loss as a percentage of circulating blood volume based on a woman's body weight.
16. Do not perform controlled cord traction if there are no signs of placental separation (blood loss and lengthening of the cord) and take steps to manage the placenta as retained.
17. Be aware that signs of uterine inversion include pain when attempting to deliver the placenta, a rapid deterioration of maternal condition and a loss of fundal height without delivery of the placenta.

Appendix 1: Irish assessors for the confidential maternal death enquiry in Ireland and the UK

Obstetric Assessor:

Peter McParland, Consultant Obstetrician and Gynaecologist, National Maternity Hospital, Dublin (from 2016)

Pathology Assessor:

Peter Kelehan, Consultant Perinatal and Gynaecological Pathologist

Paul Downey, Consultant Pathologist, National Maternity Hospital (from 2019)

Anaesthetic Assessor:

Conan McCaul, Consultant Anaesthetist, Rotunda Hospital and Mater Misericordiae University Hospital, and Clinical Professor, School of Medicine, University College, Dublin

Psychiatric Assessors:

Anthony McCarthy, Consultant Perinatal Psychiatrist, National Maternity Hospital and St Vincent's University Hospital, Dublin

Joanne Fenton, Consultant Perinatal Psychiatrist, Coombe Women and Infants University Hospital, Dublin (from 2015)

Midwifery Assessors:

Siobhan Canny, Group Director of Midwifery, Saolta University Healthcare Group, Galway

Mary Doyle, Assistant Director of Midwifery, Midwifery Practice Development Coordinator, University Maternity Hospital, Limerick

Fiona Hanrahan, Director of Midwifery and Nursing, Rotunda Hospital, Dublin

Appendix 2: Membership of the Working Group on Maternal Mortality in Ireland

Michael F O'Hare, Consultant Obstetrician & Gynaecologist (Chairman)

Colm O'Herlihy, Consultant Obstetrician, Professor of Obstetrics and Gynaecology in the UCD School of Medicine and Medical Science (until 2016)

Richard Greene, Consultant Obstetrician, Professor of Clinical Obstetrics in UCC and Director of the National Perinatal Epidemiology Centre, Cork

John Loughrey, Consultant Anesthetist, Rotunda Hospital, Dublin

Karen Robinson, Clinical Risk Advisor, States Claims Agency, Dublin

Deirdre Daly, Assistant Professor in Midwifery, Trinity College, Dublin

Ursula Byrne, Acting Director of Regulation, Nursing and Midwifery Board of Ireland

Fionnuala Cooney, Specialist in Public Health Medicine, Health Service Executive (HSE) East

Jennifer Martin, National Lead for Information and Analysis, Quality and Patient Safety Directorate, HSE

Sheila Sugrue, National Lead Midwife, Office of Nursing and Midwifery Services Directorate (until 2019)

Edel Manning, Coordinator, Maternal Death Enquiry, Ireland

Appendix 3: Members of the Oxford based MBRRACE-UK team:

Jenny Kurinczuk, Professor of Perinatal Epidemiology, Director, National Perinatal Epidemiology Unit, Lead MBRRACE-UK, University of Oxford

Marian Knight, Professor of Maternal and Child Population Health, NIHR Research Professor and Honorary Consultant in Public Health, Maternal Programme Lead for MBRRACE-UK, University of Oxford

Rachel Smith, Programme Manager

Thomas Bobby, Senior Programmer

Kate De Blanger, Events Coordinator

Jane Forrester-Barker, Data Coordinator

Hatty Goddard, Programme Assistant

Miguel Neves, Programmer

Scott Redpath, C# Developer and Data Manager

Jemima Roberts, Data Coordinator

Shalimar Sahota, Data Assistant

Oliver Shaw, Administrative Assistant

Peter Smith, Programmer

Events Coordination Support: **Dagmar Hutt, Dianne Ward**

NPEU Senior Epidemiologist: **Kathryn Bunch**

Other support staff who assisted on a temporary basis: **Catalina Salas Saez**

Maternal Death Enquiry Ireland,
5th Floor Cork University Maternity Hospital,
Wilton, Cork, Ireland, T12 YE02
Tel: +353 (0)21 4205042
Email: mdeireland@ucc.ie
Web: <http://www.ucc.ie/en/mde/>