Confidential Maternal Death Enquiry in Ireland

Report for 2019–2021

October 2023

MDE
Confidential
Maternal Death Enquiry
Ireland

Contents

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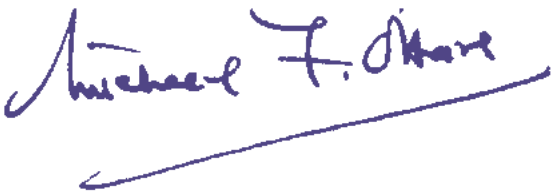
Foreword

Publication of this fifth Maternal Death Enquiry (MDE) Ireland report coincides with release of the 2023 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 2012, 2015, 2017 and 2020, i.e. data collected during the first thirteen 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A formal working relationship initially developed with CEMACH (subsequently CMACE) in 2009 has been superseded by an agreement with colleagues based at NPEU/MBRRACE-UK at the University of Oxford.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.



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Executive Summary

This is the fifth Maternal Death Enquiry (MDE) Ireland report, and follows on from previous reports covering the period 2009–2018. In common with the UK, reports or data briefs 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.

This publication coincides with the latest report from MBRRACE-UK, 'Saving Lives, Improving Mother's Care: Lessons learned to inform maternity care from the UK and Ireland. Confidential Enquiries into Maternal Death and Morbidity 2019–2021'.[1] During the same triennium, a total of 12 maternal deaths, occurring during or within 42 days of pregnancy end, were reported to MDE Ireland. Of these 12 deaths, 6 were classified as direct maternal deaths (due to obstetric causes), 5 as indirect maternal deaths (due to pre-existing disease aggravated by pregnancy), and the remaining 1 was attributed to a coincidental cause (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 2019–2021, the MMR was 6.3 per 100,000 maternities (95% CI 3.2–11.3). This rate does not differ statistically from previous reported years, but is statistically significantly lower than the currently reported UK MMR of 11.66 per 100,000 maternities (95% CI 10.23-13.23) (RR 0.54, CI 0.30-0.99, p=0.047). It does not, however, differ statistically significantly from the UK rate of 10.06 per 100,000 maternities (95% CI 8.74-11.53) following correction for COVID-19 attributed deaths (RR 0.63, 95% CI 0.34-1.15, p=0.132).

A notable finding for the 2019–2021 triennium was that, of the 24 maternal deaths investigated during pregnancy and up to 1 year postnatally, 8 were due to suicide - 3 during the antenatal period and 5 late deaths. In a declining number of maternities per annum, this is in contrast with a total of 5 deaths due to suicide up to six weeks postpartum and 4 late deaths during the preceding decade 2009–2018. Of particular concern is the occurrence of 7 (1 in 2020, 6 in 2021) of these 8 deaths during the COVID-19 pandemic and that 5 of these 7 deaths were late. Comparison of the rate of suicide deaths in 2019–2021 with the previous decade 2009-2018 confirmed a statistically significant increase (RR 3.46, 95% CI 1.34-8.97, p=0.011).

[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 2019-21. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2023.

There were no maternal deaths in Ireland attributed to COVID-19 in the 2019–2021 triennium.

For the years 2019–2021 case ascertainment by MDE Ireland (direct, indirect and coincidental) was again somewhat greater than that by the civil death registration system.[2] As discussed in previous reports, 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).

In the years 2019–2021, the proportion of maternal deaths due to direct and indirect causes was 54 and 46 per cent respectively.

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, but not with obesity. Parity of 2 or more, however, conferred a statistically significant increased risk compared with first or second pregnancies.

Specific learning points in an Irish context are:

- Cardiac disease was the largest single cause of all maternal deaths for the years 2009–2021, accounting for 25 per cent of all maternal deaths up to 6 weeks postpartum.
- Suicide was the leading direct cause of maternal death (12.3 per cent), and the leading cause of late deaths in Ireland (n=9 of 33; 27 per cent) for the years 2009–2021.
- There have been no reported maternal deaths attributable to COVID-19 in Ireland to end of 2021.
- Thromboembolism remains a leading direct cause of maternal death in Ireland.
- It is noteworthy that, in the 13 years 2009–2021, there were no maternal deaths in Ireland attributable to anaesthesia.

A number of learning points are 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 2019–2021 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.

[2] Central Statistics Office. (2022) Vital Statistic Annual Report 2020. Cork. Available at: https://www.cso.ie/en/releasesandpublications/ep/p-vsar/vitalstatisticsannualreport2020/infantmortalitystillbirthsandmaternalmortality2020/

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.

Confidential Maternal Death Enquiry UK and Ireland 2009–2021

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 thus 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.

Since 2013, the UK CEMD has been conducted by 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. Following revision and updating of the process for data collection and analysis on maternal deaths including 'late' maternal deaths, reports or data briefs are now published annually rather than triennially. Topic-specific chapters on individual causes of death 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. This current report incorporates data collected during the first thirteen years of the existence of MDE Ireland.

The themed review topics in the 2023 MBRRACE-UK report include information on women who died from obstetric haemorrhage, amniotic fluid embolism and anaesthetic causes between 2019 and 2021.[3] The recommendations and lessons contained within this report are available at: **www.npeu.ox.ac.uk/mbrrace-uk/reports**

[3]Knight M, Bunch K, Patel R, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care Core Report - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2019-21. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2023.

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 puerperium.[5]

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	Non-obstetric conditions • 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 or late maternal deaths. 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 ≥ 500g.[6] These data are 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 per cent.[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]

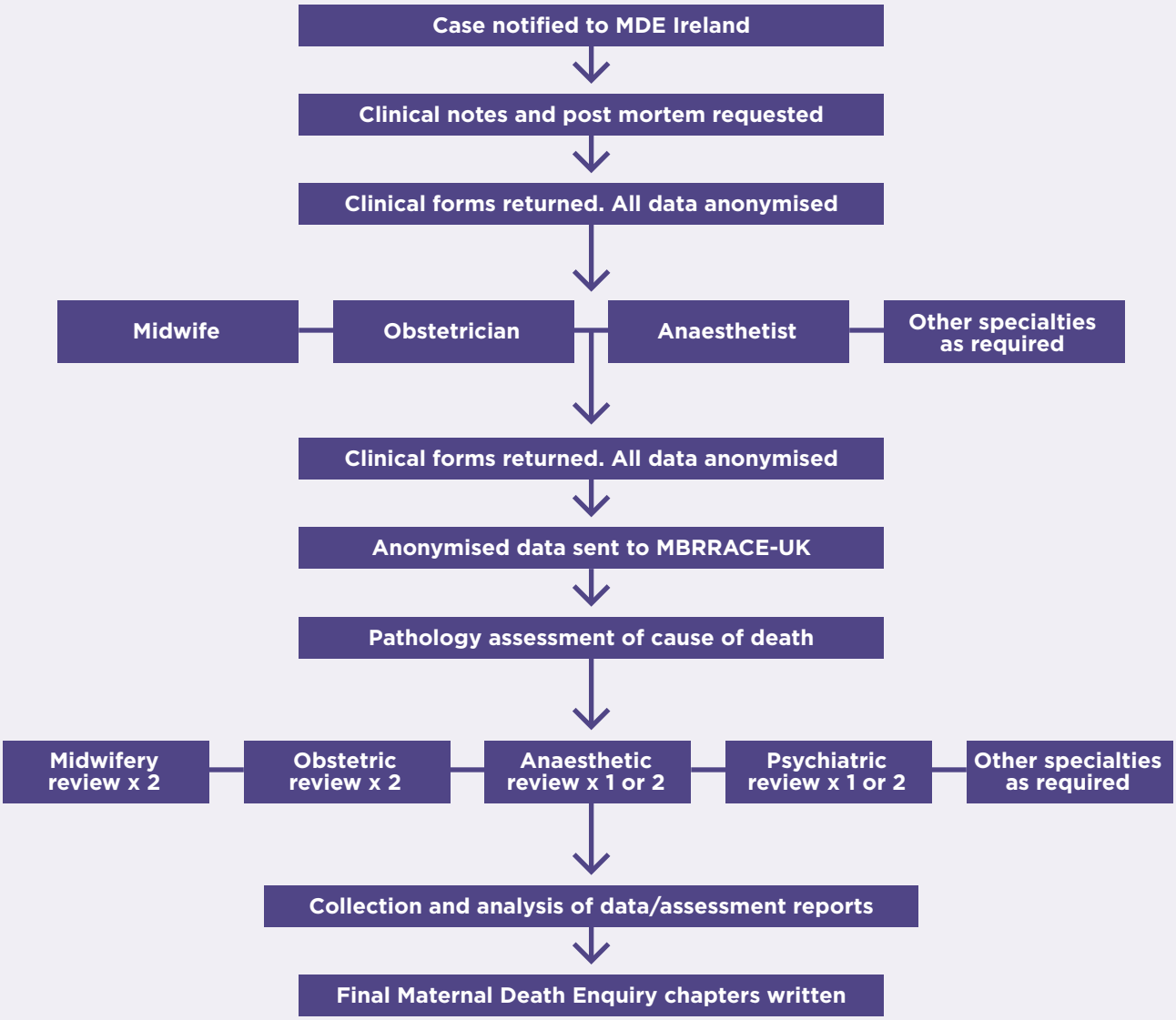
[6] Healthcare Pricing Office. Perinatal Statistics Report 2021. Dublin: Health Service Executive. [in press]

[7] Central Statistics Office. (2022) Vital Statistics Annual Report 2020. Cork. Available at: https://www.cso.ie/en/releasesandpublications/ep/p-vsar/vitalstatisticsannualreport2020/infantmortalitystillbirthsandmaternalmortality2020/

[8] Euro-Peristat Project. European Perinatal Health Report. Core indicators of the health and care of pregnant women and babies in Europe in 2015. November 2018. Available at www.europeristat.com

[9] WHO, UNICEF, UNFPA, et al. Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division: WHO, 2015.

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 2019–2021: Main Findings

For the years 2019–2021, a total of 12 maternal deaths, occurring during or within 42 days of the pregnancy end, were identified by MDE Ireland. Of these 12 deaths, 6 were classified as direct and 5 as indirect. The proportion of direct and indirect maternal deaths was 54 per cent and 46 per cent respectively. There was, in addition, 1 maternal death attributable to a coincidental cause. There were a further 12 late maternal deaths, i.e. deaths occurring between 42 days and one year following pregnancy. There was no evidence of clustering in any one maternity hospital.

Causes of Maternal Deaths in Ireland 2019-2021

Direct

The six maternal deaths in 2019–2021 due to direct causes were attributed to:

- Suicide (3)
- Thromboembolism (1)
- Ruptured Ectopic Pregnancy (1)
- Hypertension / Eclampsia (1)

Indirect

The five maternal deaths in 2019–2021 due to indirect causes were attributed to:

- Cardiac Disease (2)
  - Dissection of aorta, cardiac tamponade (1)
  - Sudden Arrythmic Death Syndrome (SADS) (1)
- Indirect Neurological Condition (1)
  - Epilepsy, upper cervical cord injury secondary to fall (1)
- Other Indirect Causes (2)
  - Spontaneous intraperitoneal haemorrhage, extensive extrauterine decidualisation of pelvis, thrombocytopenia (1)
  - Thrombotic Microangiopathy (1)

Coincidental

- Road Traffic Accident (1)

Late

Twelve late maternal deaths were reported in 2019-2021. These were attributed to:

- Suicide (5)
- Malignancy (4)
  - Pancreatic carcinoma (2)
  - Ovarian carcinoma (1)
  - Grade IV Astrocytoma (1)
- Thromboembolism (1)
- Cerebral Haemorrhage (1)
- Road traffic accident (1)

A notable finding for the 2019–2021 triennium was that, of the 24 maternal deaths investigated during pregnancy and up to 1 year postnatally, 8 were due to suicide - 3 during the antenatal period and 5 late deaths. In a declining number of maternities per annum, this is in contrast with a total of 5 deaths due to suicide up to six weeks postpartum and 4 late deaths during the preceding decade 2009-2018 (Table 3). Of particular concern is the occurrence of 7 (1 in 2020, 6 in 2021) of these 8 deaths during the COVID-19 pandemic and that 5 of these 7 deaths were late. Comparison of the rate of suicide deaths in 2019–2021 with the previous decade 2009-2018 confirmed a statistically significant increase (RR 3.46, 95% CI 1.34-8.97, p=0.011). This experience is consistent with clear evidence internationally of (i) a decline in the mental health of women more than men; and (ii) a significant decline in maternal mental health, during the COVID-19 pandemic (Otu and Yaya, 2022; Jia et al, 2020; Lancet, 2021).[10, 11, 12]

Table 3: Maternal deaths attributed to suicide since commencement of Confidential Enquiry in Ireland in 2009.

Analysis Years	Maternities	Suicide Deaths up to 42 days postpartum	Late Suicide Deaths	All Suicide Deaths	All Suicide Death Rate* (95% CI)
2009 - 2012 (4 yrs)	292,845	5	0	5	1.7 (0.6-4.0)
2013 - 2015 (3 yrs)	198,914	0	4	4	2.0 (0.5-5.2)
2016 - 2018 (3 yrs)	183,797	0	0	0	0 (0-2.0)
2009 - 2018 (10 yrs)	675,556	5	4	9	1.3 (0.6-2.5)
2019 - 2021 (3 yrs)	174,251	3	5	8	4.6 (2.0-9.1)

*Rate per 100,000 maternities.

COVID-19 Pandemic

In relation to the COVID-19 pandemic, ICU admission related to infection in pregnant or recently pregnant women was reported in 4 cases in Ireland in the 2020 NPEC Severe Maternal Morbidity (SMM) audit, and 34 cases in the 2021 SMM audit.[13] It is noteworthy, however, that there were no reported maternal deaths attributable to COVID-19 infection in Ireland in the triennium 2019-2021.

Maternal Mortality Rate in Ireland 2019-2021

For the triennium 2019–2021 there were 11 direct or indirect maternal deaths among 174,251 maternities in Ireland. This gave an MMR of 6.3 per 100,000 maternities (95% CI 3.2-11.3). 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 thirteen years from 2009 does not reach statistical significance.

Comparison of Maternal Mortality Rates: Ireland and the UK 2019–2021

For the triennium 2019–2021, the Irish MMR was 6.3 per 100,000 maternities (95% CI 3.2-11.3) and the UK MMR was 11.66 per 100,000 maternities (95% CI 10.23-13.23). Thus, Ireland's MMR was 46% lower and this is a statistically significant difference in MMR between the countries (RR 0.54, CI 0.30-0.99, p=0.047).

However, the MMR in the UK 2019–2021 adjusted to exclude deaths attributed to COVID-19 was 10.06 per 100,000 maternities (95% CI 8.74-11.53). In the same triennium there were no deaths attributed to COVID-19 in Ireland. Thus, the Irish MMR in 2019–2021 was 37% lower than the adjusted MMR for the UK, which was not a statistically significant difference (RR 0.63, 95% CI 0.34-1.15; p=0.132).

[10] Otu, A., Yaya, S. Uncovering the collateral impacts of COVID-19 on maternal mental health. Reprod Health 19, 115 (2022). https://doi.org/10.1186/s12978-022-01427-5.

[11] Jia R, Ayling K, Chalder T, et al. Mental health in the UK during the COVID-19 pandemic: cross-sectional analyses from a community cohort study. BMJ Open. 2020;10: e040620

[12] Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet 2021; 398 (10312):1700–1712.

[13] Leitao S, Manning E, Corcoran P, Keane J, McKernan J, Escanuela Sanchez T, Greene RA, on behalf of the Severe Maternal Morbidity Group. Severe Maternal Morbidity in Ireland Annual Report 2021. Cork: National Perinatal Epidemiology Centre, 2023.

Maternal Mortality in Ireland 2009–2021

For the 13 years 2009–2021, a total of 79 maternal deaths occurring during or within 42 days of the pregnancy end were identified by MDE Ireland. There were 849,807 maternities in Ireland during these reporting years. Of these 79 deaths, 29 were classified as direct maternal deaths, 36 as indirect maternal deaths, and the remaining 14 were attributed to coincidental causes.

Table 4 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.

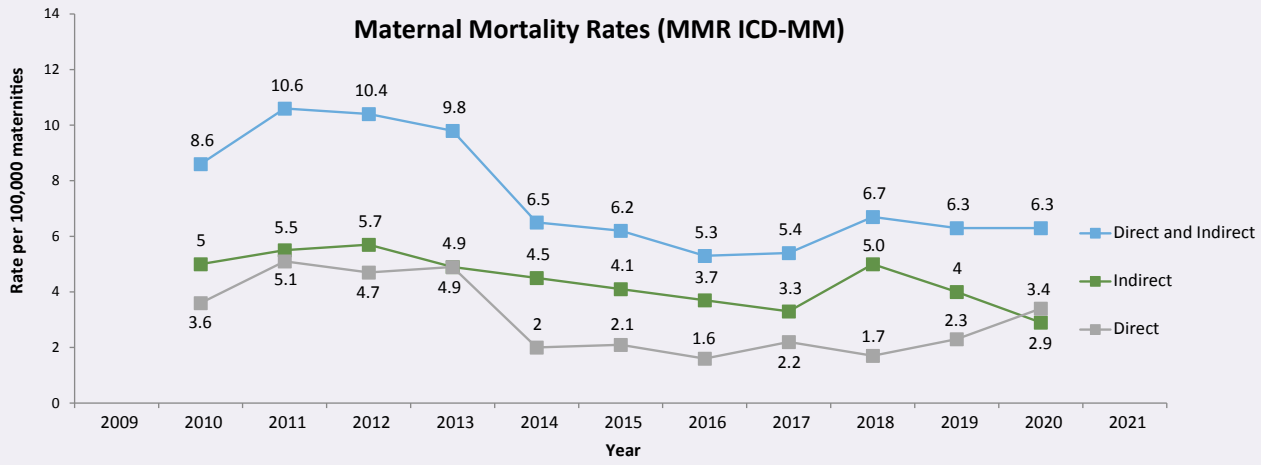
Observed changes in the MMR over the thirteen-year period 2009-2021 suggest a declining rate, but did not achieve statistical significance (RR 0.95, CI 0.89-1.02, p=0.171).

Table 4: Direct and Indirect Maternal Mortality rates per 100,000 maternities in Ireland using ICD-MM classification on cause of death: rolling three-year data 2009–2021.

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	4.0 (2.2-5.6)	6	3.3 (1.2-7.1)	10	5.4 (2.6-10.0)
2017-2019	179,376	3	1.7 (0.3-4.9)	9	5.0 (2.3-9.5)	12	6.7 (3.5-11.7)
2018-2020	174,505	4	2.3 (0.6-5.9)	7	4.0 (1.6-8.3)	11	6.3 (3.2-11.3)
2019-2021	174,251	6	3.4 (1.3-7.5)	5	2.9 (0.9 – 6.7)	11	6.3 (3.2-11.3)

• Source: Healthcare Pricing Office. Perinatal Statistics Reports 2009–2021.

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 2009–2021.

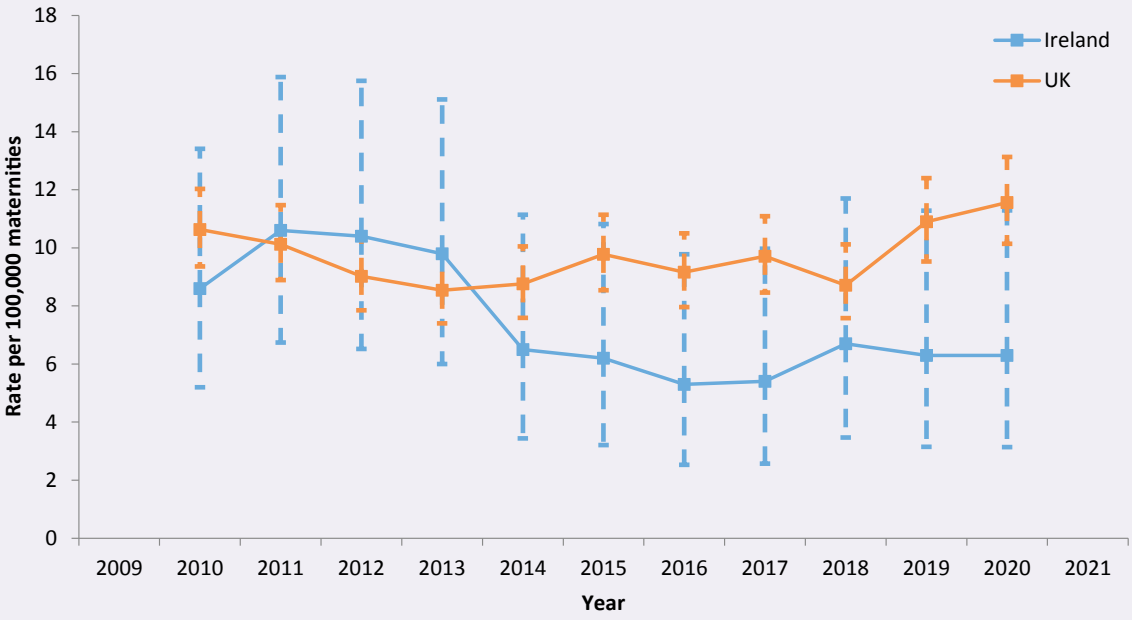


Note: Three-year moving average rates are plotted in middle year of triennium

Comparison of Maternal Mortality Rates: Ireland and the UK 2009–2021

Figure 3 illustrates rolling three-yearly average MMR for Ireland and the UK over the thirteen years 2009–2021.

Figure 3: Maternal Mortality rates per 100,000 maternities: Ireland and the UK 2009–2021.



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

Causes of Maternal Deaths in Ireland 2009-2021

Based on the ICD-MM (WHO, 2012) classification, the proportion of direct and indirect maternal deaths was 45 per cent and 55 per cent respectively for the reporting years 2009-2021. This reflects recent findings in the UK.[14]

Direct and Indirect maternal deaths by cause are detailed in Tables 5 and 6. To facilitate international comparisons and comparison with UK CEMD reports, causes of maternal deaths are categorised and presented using the UK convention in Table 5 and the ICD-MM classification in Table 6. 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 13 years 2009-2021. The 16 cardiac deaths in Ireland accounted for 25 per cent of all direct and indirect deaths reported, and were attributed to:

- Sudden Arrythmic Death Syndrome (SADS) (5)
- Coronary artery dissection (4)
- Dissection of aorta (3)
- Myocardial infarction (1)
- Peripartum cardiomyopathy (1)
- Hyperkalaemia (1)
- Aortic thrombus with multiple infarcts (1)

Venous thromboembolism and psychiatric causes (including suicide), continue to feature prominently as leading causes of direct maternal death.

Table 5: Causes of direct and indirect maternal deaths: Ireland 2009–2021.

Cause of Maternal Death	2009-2012	2013-2015	2016-2018	2019-2021	2009-2021
Direct Maternal Deaths	**15**	**4**	**4**	**6**	**29**
Thrombosis and thromboembolism	4	1	1	1	7
Pre-eclampsia and eclampsia	1	1	0	1	3
Genital tract sepsis*	1	0	1	0	2
Amniotic fluid embolism	2	1	1	0	4
Early pregnancy deaths	0	1	1	1	3
Haemorrhage	2	0	0	0	2
Anaesthesia	0	0	0	0	0
Deaths due to psychiatric causes	5	0	0	3	8
Indirect Maternal Deaths	**16**	**9**	**6**	**5**	**36**
Cardiac disease	8	6	0	2	16
Other Indirect causes	5†	0	4	2	11
Indirect neurological conditions	3**	3	2	1	9
Indirect malignancies	0	0	0	0	0
Indirect psychiatric and alcohol related	0	0	0	0	0
Coincidental Maternal Deaths	**8**	**2**	**3**	**1**	**14**

*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 HINI influenza related mortality

[14] Knight M, Bunch K, Patel R, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care Core Report - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2019-21. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2023.

Table 6: Causes of direct and indirect maternal deaths using ICD-MM classification, per 100,000 maternities: Ireland 2009–2021.

Cause of Maternal Death	2009-2012	2013-2015	2016-2018	2019-2021	2009-2021
Direct Maternal Deaths	**15**	**4**	**4**	**6**	**29**
Group 1: Pregnancy with abortive outcome	0	1	1	1	3
Group 2: Hypertensive disorders	1	1	0	1	3
Group 3: Obstetric haemorrhage	2	0	0	0	2
Group 4: Pregnancy-related infection	1	0	1	0	2
Group 5: Other obstetric complication*	11	2	2	4	19
Group 6: Unanticipated complication of pregnancy	0	0	0	0	0
Indirect Maternal Deaths	**16**	**9**	**6**	**5**	**36**
Group 7: Non obstetric complications	16	9	6	5	36
Group 8: Unknown/undetermined	0	0	0	0	0
Coincidental Maternal Deaths	**8**	**2**	**3**	**1**	**14**

Table 7: Causes of late maternal deaths: Ireland 2009–2021.

Cause of Maternal Death	2009-2012	2013-2015	2016-2018	2019-2021	2009-2021
Direct Maternal Deaths	**0**	**5**	**0**	**6**	**11**
Thrombosis and thromboembolism	0	1	0	1	2
Deaths due to psychiatric causes	0	4	0	5	9
Indirect Maternal Deaths	**4**	**2**	**6**	**1**	**13**
Cardiac disease	2	0	3	0	5
Other Indirect causes	0	0	1	0	1
Indirect neurological conditions	1	1	0	1	3
Indirect psychiatric and alcohol related	1	1	2	0	4
Coincidental Late Maternal Deaths	**0**	**2**	**2**	**5**	**9**
Malignancy	0	2	2	4	8
Road Traffic Accidents	0	0	0	1	1

Characteristics of women who died from direct and indirect causes: Ireland 2009-2021

Mothers and babies

Over one third (n=25; 38.5 per cent) of the 65 women who died from direct and indirect causes in Ireland 2009-2021 were still pregnant at the time of death (Table 6).

Of the remaining 40 women, 34 women gave birth to 36 babies. Of these 36 babies, there were 3 stillbirths and 33 livebirths, three 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.

Table 8: Timing of direct and indirect maternal deaths in relation to pregnancy 2009–2021.

Timing of maternal death in relation to pregnancy	Direct Maternal Deaths	Indirect Maternal Deaths	Total Maternal Deaths
	(n=29)	(n=36)	(n=65)
Antenatal period < 20 weeks	7	7	14
Antenatal period ≥ 20 weeks	4	7	11
Postnatal, on day of delivery	10	7	17
Postnatal, Day 1 to 42 days	8	15	23

The majority of these 40 women were delivered by caesarean section (n=24; 60 per cent), 7 of which 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 2009-2021

Over one third of women (n=12 of 29; 41 per cent) whose causes of death were classified as direct died in an Intensive Care Unit (ICU). A further eight direct maternal deaths, of which seven were attributed to suicide, occurred outside the hospital setting. The indirect maternal deaths followed a similar pattern (Table 9).

Table 9: Location of direct and indirect maternal deaths 2009–2021.

Location of death	Direct Maternal Deaths	Indirect Maternal Deaths	Total Maternal Deaths
	(n=29)	(n=36)	(n=65)
Home / outwith hospital setting	8*	6	14
Hospital (except A&E and ICU)	5	6	11
A&E	4	9	13
ICU	12	15	27

*7 of 8 cases were classified as direct due to suicide.

Ethnicity/ Nationality

Of the 65 deaths of women from direct and indirect causes in 2009-2021, 31 per cent occurred in women born outside of Ireland. Non-Irish women accounted for 23.7 per cent of all maternities in Ireland for that time period.[15]

Such a finding suggests an over-representation of non-Irish women among maternal deaths in Ireland. The MMR for Irish women was 6.9 per 100,000 compared to 9.9 per 100,000 maternities for non-Irish women. While this was a 43% difference, it was not statistically significant (RR 1.43, CI 0.84-2.42, p=0.186).

It should be noted that, in the UK, there remains a nearly 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, 2023).[16]

Maternal Age

Women aged 35-39 years had a mortality rate of 11.1 per 100,000. This was 70% higher than the rate among the reference group, 25-29 years, but did not reach statistical significance (RR 1.70, 95% CI 0.84-3.44, p=0.140) (Table 10).

Table 10: Age distribution of women who died from direct and indirect causes in Ireland 2009–2021.

Maternal Age	Direct	Indirect	Total Maternal Deaths	Total Maternities*	Mortality Rate**	Relative risk	P-value
	(n=29)	(n=36)	(n=65)	(n=849,909)	(95%CI)	(95%CI)	
<20	0	0	0	16,934			
20-24	2	3	5	77,491	6.5 (2.1-15.1)	0.98 (0.34-2.83)	0.977
25-29	5	6	11	167,900	6.6 (3.3-11.7)	1.00 (ref. group)	
30-34	14	8	22	300,361	7.3 (4.6-11.1)	1.12 (0.54-2.31)	0.763
35-39	8	18	26	233,483	11.1 (7.3-16.3)	1.70 (0.84-3.44)	0.140
40+	0	1	1	53,676	1.9 (0-10.4)	0.28 (0.04-2.20)	0.229
Not stated	0	0	0	64			

*Healthcare Pricing Office. Perinatal Statistics Report 2021 (in press).
**Maternal Mortality Rate per 100,000 maternities.

Parity

Table 11 details the distribution of maternal deaths by parity. The mortality rate was similar for nulliparous women (6.0 per 100,000) and those who had one previous delivery (6.9 per 100,000). Women who had at least two previous deliveries had a 75 per cent higher mortality rate compared with women who had never given birth or who had one previous delivery. This was a statistically significant difference (RR 1.74, 95% CI 1.06-2.87, p=0.029).

[15] Healthcare Pricing Office. Perinatal Statistics Report 2021 (in press)

[16] Knight M, Bunch K, Patel R, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care Core Report - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2019-21. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2023.

Table 11: Distribution of maternal deaths by parity: Ireland 2009–2021.

Parity	Direct	Indirect	Total Maternal Deaths	Total Maternities	Mortality Rate	Relative risk	P-value
	(n=29)	(n=36)	(n=65)	(n=849,909)	(95%CI)	(95%CI)	
0	12	8	20	333,788	6.4 (4.6-8.7)	1.00 (ref. group)	
1	8	12	20	291,717			
2	5	12	17	147,085	11.1 (7.2-16.5)	1.74 (1.06-2.87)	0.029
3 or >	4	4	8	77,167			
Not stated	0	0	0	152			

Body Mass Index

There is evidence internationally that increased maternal BMI is associated with higher risk of maternal death due to specific pregnancy complications. Irish national guidelines recommend the recording of BMI in the maternity notes.[17] While this may be common practice, there are no national data on the BMI of the pregnant population available in Ireland.

Table 12 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 pregnant population in 2021 (Leitao et al, 2023) and does not suggest increasing risk of maternal death with increased BMI. However, this observation may simply reflect small cohort size and comparison with BMI data from the year 2021 only.

Table 12: Body Mass Index of women who died: Ireland 2009–2021.

BMI Category ($kg.m^{-2}$)	Direct	Indirect	Total Maternal Deaths	Irish pregnant population 2021**
	(n=29)	(n=36)	(n=65)(%)*	(%)
Lean (<25.0)	12	15	27 (50.0%)	28,682 (48.7%)
Overweight (25.0-29.9)	5	11	16 (29.6%)	17,960 (30.5%)
Obese (≥ 30.0)	5	6	11 (20.4%)	12,310 (20.9%)
Data missing	7	4	11 cases	

Note: Percentages based on the 54 maternal death cases where data on BMI was known
**Severe Maternal Morbidity in Ireland Annual Report 2021[18]

Smoking

Data on smoking status was unknown in ten cases of direct and indirect maternal deaths over the years 2009–2021. Of the 55 women whose smoking status was recorded, almost one third (n=17, 31 per cent) smoked. 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.[19]

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

[18] Leitao S, Manning E, Corcoran P, Keane J, McKernan J, Escañuela Sánchez T, Greene RA, on behalf of the Severe Maternal Morbidity Group. Severe Maternal Morbidity in Ireland Annual Report 2021. Cork: National Perinatal Epidemiology Centre, 2023.

[19] 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 2009–2021

- Cardiac disease was the largest single cause of all maternal deaths for the years 2009–2021, accounting for 25 per cent of all maternal deaths up to 6 weeks postpartum.
- Suicide was the leading direct cause of maternal death (n=8 of 65; 12.3 per cent), and the leading cause of late deaths in Ireland (n=9 of 33; 27.3 per cent) for the years 2009–2021. In addition, there was a statistically significant increase in deaths due to suicide during pregnancy and up to one year postnatally in 2019–2021 compared with the previous decade.
- There have been no reported maternal deaths attributable to COVID-19 in Ireland to end of 2021.
- Thromboembolism remains a leading direct cause of maternal death in Ireland.
- It is noteworthy that, in the 13 years 2009–2021, there were no maternal deaths in Ireland 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 2019 – 2021'[20]

Overall, 261 women died in 2019-21 during or within 42 days of the end of pregnancy in the UK. The deaths of 241 of these women were from direct and indirect causes, and 20 were classified as coincidental.

For ease of access, the following learning points are reproduced from the report for UK and Ireland (2023):

Causes and Trends

There was a statistically non-significant increase in the overall maternal death rate in the UK between 2016-18 and 2019-21. When deaths due to COVID-19 in 2020 and 2021 were excluded, maternal death rates were very similar for the two periods, which suggests that an even greater focus on implementation of the recommendations of these reports is needed to achieve a reduction in maternal deaths.

There remains a nearly 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. Twelve percent of the women who died during or up to a year after pregnancy in the UK in 2019-21 were at severe and multiple disadvantage. The main elements of multiple disadvantage were a mental health diagnosis, substance use and domestic abuse. Women living in the most deprived areas continue to have the highest maternal mortality rates, emphasising the need for a continued focus on action to address these disparities.

Cardiovascular disorders and thrombosis and thromboembolism are now responsible for the same number of maternal deaths in the UK, followed by psychiatric disorders; together, these three causes represent 38% of maternal deaths. During 2020 and 2021, maternal mortality in the UK directly attributable to COVID-19 was at a rate well in excess of that due to any other single cause.

There was a significant 33 per cent increase in maternal death rates from direct causes between 2016-18 and 2019-21 (95% CI 0%-45%, p=0.043). Thrombosis and thromboembolism remains the leading cause of direct maternal death during or up to six weeks after the end of pregnancy.

Deaths from mental health-related causes as a whole account for nearly 40% of deaths occurring between six weeks and a year after the end of pregnancy, with maternal suicide remaining the leading cause of direct deaths in this period.

New recommendations to improve care

Key messages to improve care

The majority of recommendations which MBRRACE-UK assessors have identified to improve care are drawn directly from existing guidance or reports and denote areas where implementation of existing guidance needs strengthening. All recommendations based on existing guidance are presented in full chapters. Actions needed for which national guidelines are not available are presented below.

[20] Knight M, Bunch K, Patel R, Shakespeare J, Kotnis R, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care Core Report - Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2019-21. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2023.

New recommendations to improve care

For professional organisations:

1. Update guidance to make certain that category 4 caesarean section lists are managed separately from more urgent caesarean sections to ensure these operations are not delayed to late in the day.

2. Update guidance on the use of coagulation tests in the context of obstetric haemorrhage including the timelines for availability and how to interpret these, noting that women should not be inappropriately denied clotting products based on a single measure of coagulation in the face of ongoing haemorrhage.

3. Review guidance on when to use balloon tamponade to control haemorrhage, how to insert the balloon and inflate it. Resources such as postpartum haemorrhage checklists should include when not to use balloon tamponade and when to abandon it and move on to a different haemostatic technique.

4. Update guidance on ECMO for severe acute respiratory failure in adults to include specific information on referral and admission of pregnant and recently pregnant women with respiratory failure to ECMO services.

5. Ensure that guidance on care for pregnant women with complex social factors is updated to include a role for networked maternal medical care and postnatal follow-up to ensure that it is tailored to women's individual needs and that resources in particular target vulnerable women with medical and mental health comorbidities and social complexity.

6. Develop training resources concerning shared decision making and counselling regarding medication use in pregnancy and breastfeeding, including specific information on the benefits and risks of different medications and non-adherence.

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

1. Review and revise the service specification for centres providing specialist services for managing abnormally invasive placentation to ensure that all specialist units can provide appropriate equipment, facilities and appropriately skilled personnel in an emergency situation occurring at any time of day or night.

2. Clarify that review of the care of women who return to theatre may provide important safety learning but should not be perceived as a performance metric after caesarean birth, as re-operation may be the appropriate response to control internal haemorrhage.

3. Ensure that pregnant and breastfeeding women are not excluded inappropriately from research, including new vaccine and treatment research, and ensure that messaging about benefits and risks of medication and vaccine use is clear and well informed with involvement of key opinion leaders and representatives of communities at risk from an early stage. Prepare a route to enable rapid dissemination of updated advice and data concerning new vaccines and treatments to both women and their clinicians in the future.

4. Ensure that staff working within maternal medicine networks are equipped with the skills to care for the complex and multiple medical, surgical, mental health and social care needs of the current maternity population.

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.

Pathology Assessor:
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 (Until 2021).

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.

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 (Until 2021).

Karen Robinson, Clinical Risk Advisor, Clinical Indemnity Scheme, States Claims Agency.

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

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 (Until 2020).

Margaret Quigley, National Lead for Midwifery, Office of the Nursing & Midwifery Services Director (From 2021).

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 MBBRACE-UK, University of Oxford.

Rachel Smith, Maternal Programme Manager.

Kate De Blanger, Events Coordinator.

Peter Smith, Senior Programmer.

Scott Redpath, C# Developer and Data Manager.

Jemima Roberts, Admin and Data Coordinator.

Oliver Shaw, Admin and Data Assistant.

Rosie Butler, Admin and Data Assistant.

Sheena Fleming, Admin and Data Assistant.

Shalimar Sahota, Data Assistant.

Events Coordination Support: **Dagmar Hutt**, **Lisa Shelton**.

Communications Officer: **Lulu Phillips**.

NPEU Senior Epidemiologist: **Kathryn Bunch**.

MBRRACE-UK Senior Researcher: **Allison Felker**.

Other support staff who assisted on a temporary basis: **Nick Symons**, **Victor Diaconu**.

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Ireland