



Confidential Maternal Death Enquiry in Ireland

Report for 2009 - 2012

February 2015



MDE

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Maternal Death Enquiry
Ireland

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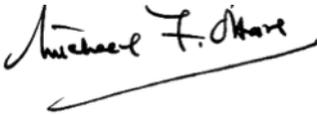
Contents

Foreword	4
Acknowledgements	5
Executive Summary	6
Recommendations	8
Confidential Maternal Death Enquiry UK and Ireland 2009-2012	9
Reasons for Ireland Joining the UK-based Enquiry	10
Establishment of the Confidential Maternal Death Enquiry in Ireland.....	10
The Confidential Enquiry into Maternal Deaths: Definitions and Methodology	11
Identifying Maternal Deaths in Ireland	12
Expert review.....	14
Maternal Mortality in Ireland 2009-2012: Main findings	15
Comparison of Maternal Mortality Rates: Ireland and the UK 2009–2012	17
Causes of Maternal Deaths in Ireland 2009-2012.....	18
Causes of Coincidental Maternal Deaths: Ireland 2009-2012	18
Characteristics of women who died from direct and indirect causes:Ireland 2009-2012	19
Specific lessons learned in the Irish context 2009-2012	23
Direct Maternal Deaths	23
Indirect Maternal Deaths	23
Appendix 1: Irish assessors for the confidential maternal death enquiry in Ireland and the UK.....	26
Appendix 2: Membership of the Working Group on Maternal Mortality in Ireland	27
Appendix 3: Members of the Oxford based MBRRACE-UK team	28

Foreword

This second Maternal Death Enquiry (MDE) Ireland report appears in the wake of publication in December 2014 of the first report incorporating Irish data in the long-established UK Confidential Enquiry into Maternal Deaths. It covers the same timeframe as the latter, and provides further detail on Irish data included in the first MDE Ireland report published in August 2012. A formal working relationship developed with CEMACH, subsequently CMACE, in 2009 has been consolidated by a new agreement with colleagues based at MBRRACE-UK in Oxford, and has come to fruition with *Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12*. It is another and important landmark in the longstanding relationship between professional colleagues involved in maternity services in Ireland and the UK. For the future, the revised reporting and assessment procedures will result in annual reports, resulting in earlier 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

This report represents a culmination of commitment and hard work of a great many people both within Ireland and the UK.

MDE Ireland extends sincere thanks and appreciation 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 like 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.

Within the UK, MDE Ireland would like to 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.

Finally, we would like to thank Ms Edel Manning, Coordinator for MDE Ireland and Dr Paul Corcoran, Epidemiologist in the National Perinatal Epidemiology Centre, Cork, for statistical advice and input into this report.

Executive summary

This is the second Maternal Death Enquiry (MDE) Ireland report. The first MDE Ireland report focused on implementation issues of a Confidential Enquiry into Maternal Deaths (CEMD) in Ireland with preliminary results for the years 2009-2011. This report provides further detail in respect of two triennia - 2009-2011 and 2010-2012. A further section outlines the characteristics of women who died during the four year period 2009-2012. In common with the UK, it is anticipated that future reports will be produced annually and will similarly 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 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.

In December 2014, the latest report of the UK-based CEMD, *'Saving Lives, Improving Mother's Care: Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Death and Morbidity 2009 – 2012'*¹ was published. This was the first report in its sixty year history of the UK CEMD to include maternal deaths occurring in Ireland.

For the years 2009 – 2012, a total number of 38 maternal deaths, occurring during or within 42 days of pregnancy end, were reported to MDE Ireland. Of these 38 deaths,

10 were classified as direct maternal deaths (due to obstetric causes), 21 as indirect maternal deaths (due to pre-existing medical or mental disorders which were exacerbated by pregnancy), and the remaining 7 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 annual maternal mortality rates (MMR) is inevitable and must be interpreted with caution. To improve the power of analysis and to facilitate direct comparisons with UK triennial reports, rates for maternal deaths (MMR) occurring in Ireland are presented in this report over three year periods.

For the triennium 2009 – 2011, the maternal mortality rate (MMR) was 8.6 per 100,000 maternities (95% CI = 4.7-12.4). For the years 2010 – 2012 the MMR rate was 10.5 per 100,000 maternities (95% CI 6.2-14.9). The apparent increase in MMR between the years 2010 - 2012 is not statistically significant and is similar to the UK MMR of 10.1 per 100,000 maternities.

For the years 2009-2012 case ascertainment by MDE Ireland (direct, indirect and coincidental) was four times that of the civil death registration system. This issue is not unique to Ireland as 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 were from indirect causes, i.e. from pre-existing disorders exacerbated by pregnancy. For the years 2010

1 Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. *Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12*. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.

– 2012, the proportion of maternal deaths due to direct obstetric causes and indirect causes was 30% and 70% respectively. This reflects findings in the UK and underscores the importance of preconception counselling for all women of childbearing years with preexisting medical and mental health disorders. It also emphasises the importance of a comprehensive history being documented at the first booking visit to a maternity unit.

Similar to the UK, cardiac disease was the single commonest cause in Ireland of indirect maternal death. Thromboembolic disease continues to feature prominently among direct obstetric causes. This serves as a reminder of the importance of adherence to national guidelines for prevention and management of this complication.

Over one third (35.5%) of women who died were still pregnant at the time of death. The majority of women had accessed antenatal care in maternity units. Of the women who had not accessed antenatal care, all deaths occurred in early pregnancy and all but two women had attended their GP.

Delivery of live or stillbirths in women who died of direct and indirect causes most frequently occurred in obstetric led units.

The majority (60%) of direct maternal deaths occurred in an Intensive Care Unit (ICU), with no direct deaths occurring outside the hospital setting. This highlights the importance of good communication between ICU in adult hospitals and stand-alone maternity units and also adherence to national guidelines for care of critically ill women in obstetrics. In contrast, indirect maternal deaths occurred in a variety of settings.

Women born outside of Ireland were over-represented in reported deaths, reflecting findings from successive UK CEMD reports which found an increased risk of maternal death among migrant ethnic minorities.

While the numbers of maternal deaths in specific age groups were small, there was a suggestion of an increasing MMR among older women.

In summary, the findings of this report in conjunction with the *'Saving Lives, Improving Mother's Care: Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Death and Morbidity 2009 – 2012'* highlight the need for ongoing enquiries into maternal deaths in order to identify key factors impacting on adverse maternal outcomes. It is imperative that lessons are learned from such deaths to ensure continuing improvements in maternity services.

Recommendations

Based on the CEMD findings in Ireland 2009 – 2012, MDE Ireland makes the following recommendations within the context of Ireland. Some recommendations from the last report are restated as improvements are still applicable.

- All health care professionals within the Irish maternity services should be aware of recommendations and lessons contained within the recent MBRRACE-UK *'Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12'* report.²
- Irrespective of cause, all maternal deaths occurring during or within in one year of giving birth, ectopic pregnancy, miscarriage or termination of pregnancy should be notified to MDE Ireland in order to support the enquiry process.
- A question on pregnancy status at time of death, (similar to that on the medical death certificate), should be added to the Coroner's death certificate.
- Interpretative services should be used to ensure that the care of any patient is not compromised by lack of communication and misunderstanding.
- In the absence of co-location, establishment of a more effective communication system between general hospitals and maternity units in the event of a maternal death is necessary.
- Women with medical disorders should receive preconception advice and ideally have their medical conditions optimised prior to pregnancy. This will need to be provided by their GP's and specialist physicians in conjunction with the obstetric services.
- Pregnant patients with pre-existing medical and mental health disorders should undergo risk assessment at booking and should be afforded high priority by colleagues in other medical disciplines when referred for assessment.
- Maternity medical staff should review and audit current practice concerning the prevention and treatment of thromboembolic disease, giving consideration to the national guideline.³
- Consideration should be given to provision of a perinatal psychiatry mother and baby unit in Ireland.

² Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. *Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12*. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.

³ Clinical Practice Guideline No 20 (2013). *Venous Thromboprophylaxis in Pregnancy* : Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

Confidential Maternal Death Enquiry UK and Ireland 2009-2012

The Confidential Maternal Death Enquiry (CEMD) was initiated in England and Wales in 1952 and became UK - wide in the 1980's. From 1992 until 2011 the UK CEMD was led by Professor Gwyneth Lewis, latterly under the auspices of the Centre for Maternal and Child Enquiries (CMACE). Ireland became a participant in 2009. Although much has changed since its inception in 1952, the lessons to be learned from the Enquiry remain as valid now as in the past.

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 ensure that women with pre-existing disorders have had their treatment optimised prior to conception. The overwhelming strength of successive CEMD reports has been the impact their findings have had on improving standards of care and clinical governance in the UK maternity services, and further afield.

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 Enquiry.

MBRRACE-UK has revised and updated the process for data collection and analysis on maternal deaths including 'late' maternal deaths. This will result, in future, in UK CEMD reports being published annually rather than triennially. Topic-specific chapters on individual causes of death, which appeared in previous triennial CEMD reports, will appear once every three years on a cyclical basis, alongside a surveillance chapter reporting three years of statistical data for the UK. The focus is not in attributing blame, but on improving future mothers' care.

The first MBRRACE-UK report, covering the years from 2009 to 2012 was published in December 2014.⁴ 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 the Republic of Ireland. For consistency and comparability with previous CEMD reports, UK surveillance data on maternal mortality rates and trends does not include Irish data. MDE Ireland continues to analyse and publish surveillance data on maternal mortality occurring in Ireland independently. The themed review topics in the recent report included sepsis, haemorrhage, amniotic fluid embolism (AFE), anaesthesia, neurological, respiratory, endocrine and other indirect causes. A chapter on severe maternal morbidity resulting from sepsis is also included. MDE Ireland recommends that all health care professionals within the Irish maternity services should be aware of recommendations and lessons contained within this report, available at: <http://www.ucc.ie/en/mde/publications/>

4 Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.

Reasons for Ireland Joining the UK-based Enquiry

Taking account of the number of maternities reported annually in Ireland (74,318 maternities in 2010⁵) it was imperative to join a larger cohort in order to protect confidentiality and maintain anonymity. Further, a larger cohort would allow for more meaningful analysis and recommendations for care. The UK CEMD has a respected and validated research methodology, internationally recognised as the gold standard for Confidential Enquiries.⁶

Historically, recommendations from previous MDE UK reports have informed Irish health care professionals in ensuring continued improvement in Irish maternity services. International evidence has also shown that, in the absence of active case ascertainment, under-reporting and misclassification of maternal deaths occur, even in developed countries with advanced civil registration systems.^{7,8,9}

Establishment of the Confidential Maternal Death Enquiry in Ireland

In July 2007, a Maternal Mortality in Ireland Working Group was established with the stated objective of linking Ireland with the UK based Confidential Enquiries into Maternal Deaths (CEMD). This Working Group was a joint Institute of Obstetricians and Gynaecologists / Health Service Executive (HSE) collaboration.

Current members of the group are identified in Appendix 2. Following consultation with the relevant advisory authorities,¹⁰ funding for MDE Ireland was secured from the HSE. In April 2009, MDE Ireland was established with the support of the Department of Health and Children and the State Claims Agency.

5 Economic and Social Research Institute (2012) Perinatal Statistics Report 2010. National Perinatal Reporting System. Dublin: ESRI.

6 World Health Organisation. (2004) "Beyond the numbers: reviewing maternal deaths and complications to make pregnancy safer." Available at: http://www.who.int/maternal_child_adolescent/documents/9241591838/en/.

7 Murphy C and O'Herlihy C (2007). Maternal Mortality Statistics in Ireland: Should They Carry a Health Warning? *Irish Medical Journal*. 2007; Vol 100 (8) p 574

8 WHO, UNICEF, UNFPA and The World Bank. Trends in Maternal Mortality: 1990 to 2008. WHO 2010, Geneva

9 Deneux-Tharaux C, Berg C, Bouvier-Colle MH, et al (2005). Under-reporting of pregnancy-related mortality in the United States and Europe. *Obstet Gynecol*. 2005;106:684–692.

10 Relevant advisory authorities included the Data Protection Commissioner and the Director of the General Register Office

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. Of note, the Enquiry classifies deaths from suicide as indirect maternal deaths. In future, such deaths will be classified as direct deaths.

Table 1: Definitions of Maternal Deaths: (World Health Organisation 2010)

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)

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.¹¹ 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 live or stillbirth with birth weight of $\geq 500\text{g}$.¹² These data were also used to calculate age and parity specific mortality rates.

11 Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.
 12 Economic and Social Research Institute (2013) Perinatal Statistics Report 2012. National Perinatal Reporting System. Dublin: ESRI

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,

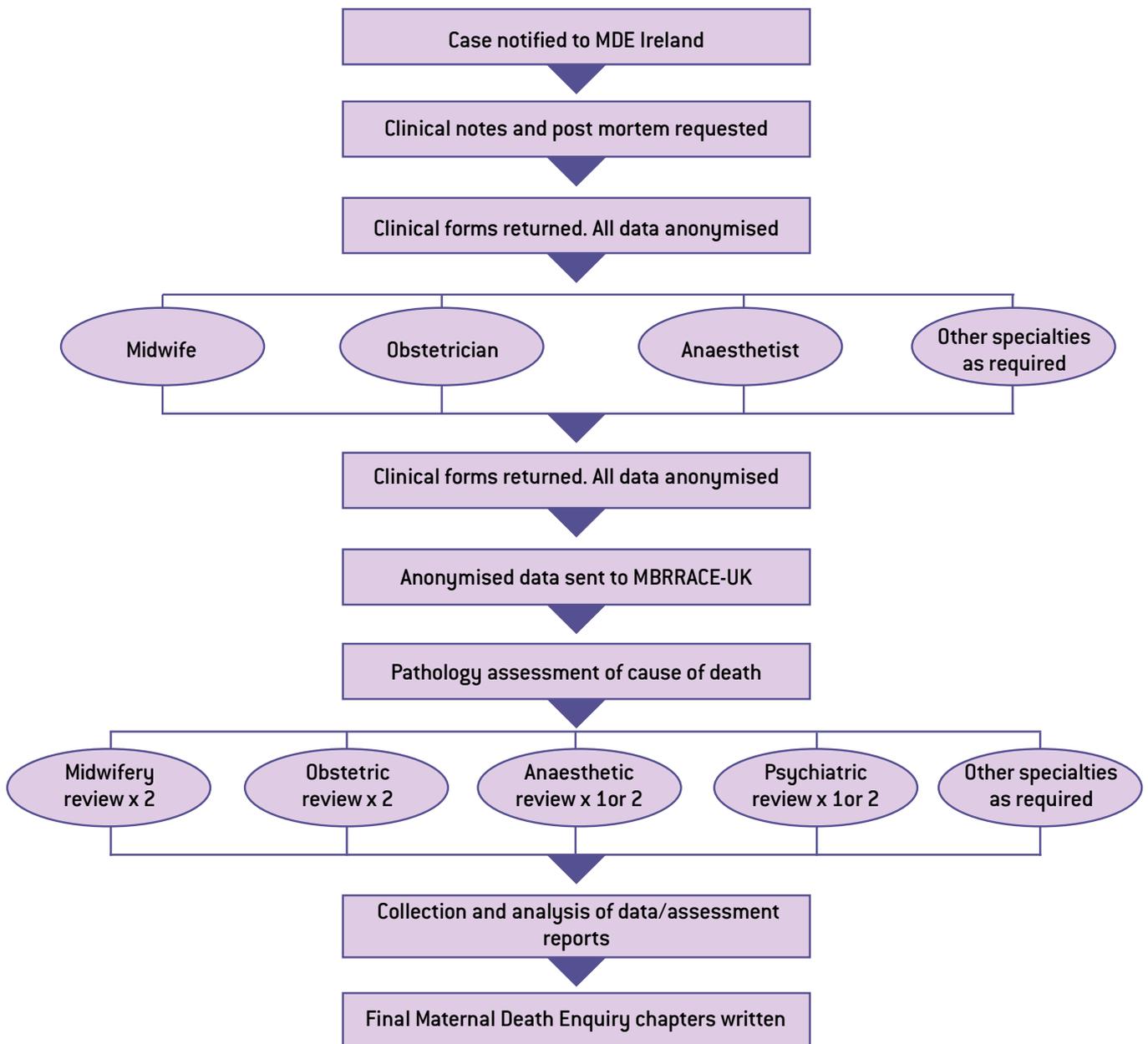
the Central Statistics Office (CSO) collates statistics on deaths from death registration data gathered by the General Register Office (GRO). Since the inception of the Enquiry in 2009, the number of maternal deaths identified by MDE Ireland (direct, indirect and coincidental) has been four times the number identified by death registration alone. 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%.¹³ 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 1.5.¹⁴

¹³ 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

¹⁴ 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 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 1.¹⁵ 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.

15 Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.

Maternal Mortality in Ireland 2009-2012:

Main findings

For the years 2009 – 2012, a total number of 38 maternal deaths, occurring during or within 42 days of the pregnancy end, were identified by MDE Ireland. Of these 38 deaths, 10 were classified as direct maternal deaths, 21 as indirect maternal deaths, and the remaining 7 were attributed to coincidental causes.

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

Taking account of the relatively small number of maternal deaths in Ireland, wide fluctuation in annual maternal mortality rate (MMR) is inevitable and must be interpreted with caution. To improve the power of analysis and to facilitate direct comparison with UK CEMD reports, all rates for maternal deaths occurring in Ireland are presented in this report over three year periods: 2009 – 2011

and 2010 – 2012. It is anticipated that MMR data in future annual UK and Ireland reports will be presented on a rolling 3 year basis.

For the years 2009 – 2011 there were 19 direct or indirect maternal deaths among 222,136 maternities. This gave a MMR of 8.6 per 100,000 maternities [95% CI 4.7-12.4].

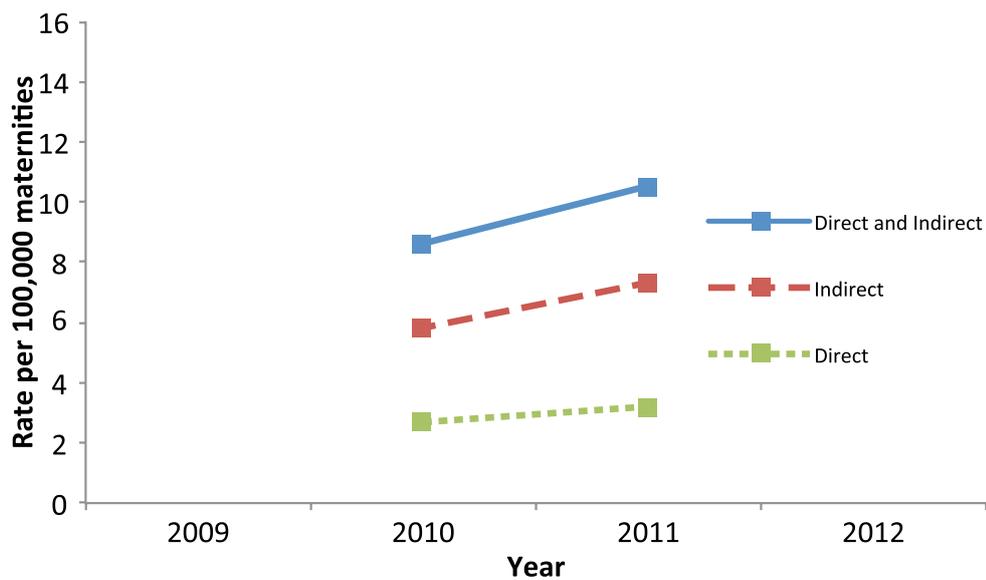
For the years 2010 – 2012 there were 23 direct or indirect maternal deaths among 218,035 maternities, giving an MMR rate of 10.5 per 100,000 maternities [95% CI 6.2-14.9].

The apparent increase in MMR for 2010-2012 does not represent a statistically significant increase. Table 2 demonstrates a rolling three-yearly average MMR. These rates are plotted in the middle year of the triennium in Figures 2 and 3.

Table 2: Direct and Indirect Maternal Mortality rates per 100,000 maternities in Ireland: rolling three year average 2009 – 2012

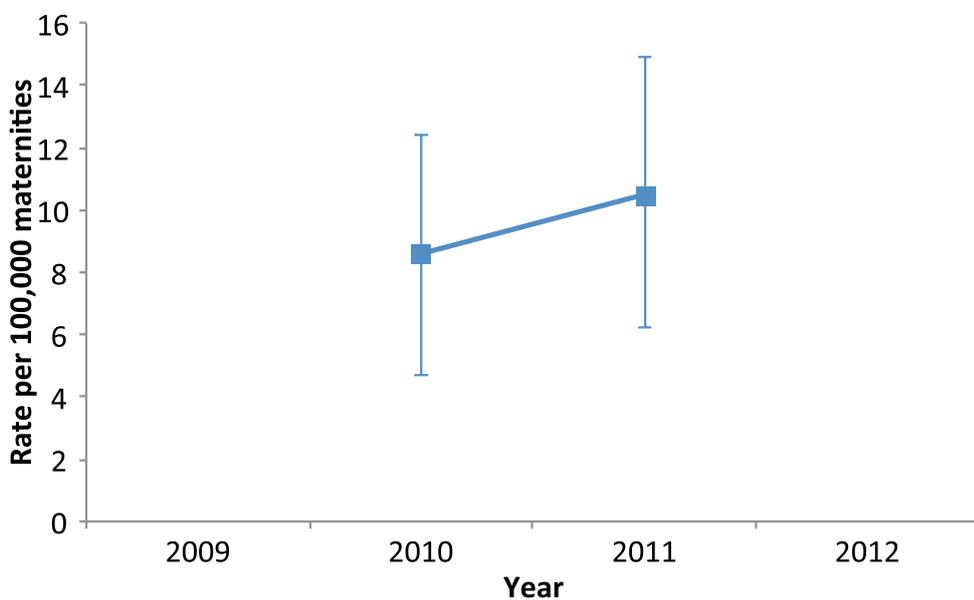
3 Year Period	Total Irish Maternities	Direct Maternal Deaths			Indirect Maternal Deaths			Total Maternal Deaths*		
		n	Rate	95%CI	n	Rate	95%CI	n	Rate	95%CI
2009-2011	222,136	6	2.7	0.5-4.9	13	5.8	2.7-9.0	19	8.6	4.7-12.4
2010-2012	218,035	7	3.2	0.8-5.6	16	7.3	3.7-10.9	23	10.5	6.2-14.9

*Includes direct and indirect maternal deaths but not deaths due to coincidental causes.



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: rolling three year average 2009 – 2012.



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

Figure 3: Maternal Mortality rates per 100,000 maternities (95% CI), rolling three year average 2009 – 2012.

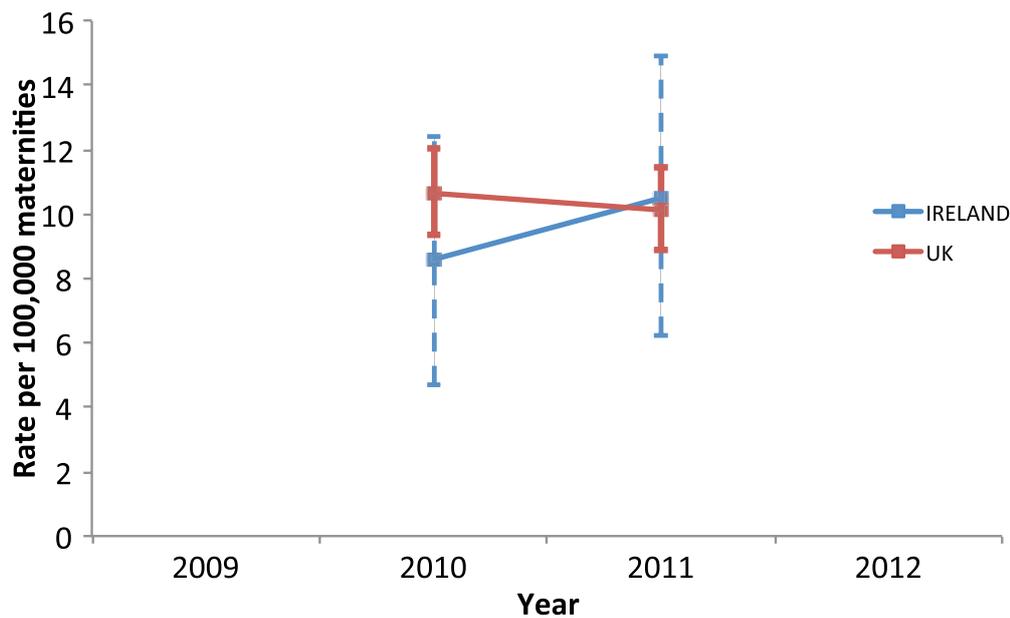
Comparison of Maternal Mortality Rates: Ireland and the UK 2009–2012

For the triennium 2009 – 2011, the Irish MMR was 8.6 per 100,000 maternities (95% CI 4.7 - 12.4) and the UK MMR was 10.6 per 100,000 maternities (95% CI 9.4-12.0). This does not represent a statistically significant difference in MMR between countries (Risk ratio 0.8, $p = 0.360$).

For the triennium 2010 – 2012, the Irish MMR was 10.5 per 100,000 maternities (95% CI 6.2

-14.9) and the UK MMR was 10.1 per 100,000 maternities (95% CI 8.9-11.5). This does not represent a statistically significant difference in MMR between countries (Risk ratio 1.04, $p = 0.848$).

Figure 4 illustrates rolling three-yearly average MMR for Ireland and the UK 2009 – 2011 and 2010-2012.



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

Figure 4: Maternal Mortality rates per 100,000 maternities, 95% CI: Ireland and the UK 2009 – 2012

Causes of Maternal Deaths in Ireland 2009-2012

The proportion of direct and indirect maternal deaths was 30% and 70% respectively for 2010 – 2012. This reflects recent findings in the UK.

Direct and Indirect maternal deaths by cause are detailed in Table 3. To create standardisation and facilitate comparisons

with UK CEMD reports, causes of maternal deaths are categorised and presented using the UK convention. 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.

Table 3: Cause of direct and indirect maternal deaths: Ireland 2009-2012

Cause of Death	2009-2011 (n)	2010-2012 (n)	2009-2012 (n)
Direct Maternal Deaths	6	7	10
Thrombosis and thromboembolism	3	2	4
Pre-eclampsia and eclampsia	1	1	1
Amniotic fluid embolism	1	1	2
Genital tract sepsis*	-	1	1
Haemorrhage	1	2	2
Anaesthesia	-	-	-
Indirect Maternal Deaths	13	16	21
Cardiac disease	4	6	8
Other indirect causes [†]	4 [†]	3	5
Indirect neurological conditions [‡]	3	3	3
Psychiatric causes ^{**}	2	4	5

*Genital tract sepsis deaths only, including early pregnancy deaths as the result of genital tract sepsis. Other deaths from infectious causes are classified under other indirect causes

[†]Includes 2 deaths attributed to H1N1 influenza

[‡]Includes 2 cases of Epilepsy related mortality

** In all cases the cause of death was classified as suicide

Confidential enquiry findings into the care of women who died from sepsis, haemorrhage, amniotic fluid embolism, anaesthetic-related causes, neurological and other

indirect causes in the UK and the Ireland are described in detail in the MBRRACE UK 2014 report.¹⁶

Causes of Coincidental Maternal Deaths: Ireland 2009-2012

There were 7 deaths between 2009 and 2012 attributed to coincidental causes. Causes of death were categorised as: metastatic cancer

(2); road traffic accident (2); CNS lymphoma (1) and substance abuse (2).

16 Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.

Characteristics of women who died from direct and indirect causes: Ireland 2009-2012

Mothers and babies

Over one third (n=11:35.5%) of the 31 women who died from direct and indirect causes were still pregnant at time of death (Table 4). This is similar to the UK rate of 30%.

Of the remaining 20 women, 18 gave birth to 20 babies. There were 2 stillbirths and 18 livebirths, one of which resulted in early neonatal death. A further two women died before fetal viability.

The majority of these women were delivered by caesarean section (n=15:83%) of which 6 were reported as perimortem caesarean sections. Four perimortem caesarean sections were carried out at greater than 37 weeks gestation, delivering three live births and 1 stillbirth. A further two perimortem caesarean sections were carried out at ≤ 32 weeks gestation. The outcome of these deliveries included one livebirth resulting in early neonatal death and one intrauterine death diagnosed prior to delivery.

Table 4: Timing of direct and indirect maternal deaths in relation to pregnancy 2009-2012

Timing of maternal death in relation to pregnancy	Direct Maternal Deaths (n=10)	Indirect Maternal Deaths (n=21)	Total Maternal Deaths (n=31)
Antenatal period < 20 weeks	2	4	6
Antenatal period ≥ 20 weeks	0	5	5
Peripartum or on day of delivery	5*	6**	11
Postnatal day 1 to 42 days	3	6	9

*Delivery mode was classified as perimortem caesarean section in 2 direct maternal deaths.

** Delivery mode was classified as perimortem caesarean section in 4 indirect maternal deaths.

Location of delivery in women who died from direct and indirect causes: Ireland 2009- 2012

Table 5 illustrates the location of delivery of the 18 women who died on day of delivery or postpartum.

Table 5: Place of delivery among women who died from Direct and Indirect causes including live and stillbirths: Ireland 2009 – 2012

Location of delivery	Direct Maternal Deaths (n=7)	Indirect Maternal Deaths (n=11)	Total Maternal Deaths (n=18)
Obstetric led unit	7	7	14*
A&E	-	2	2
Hospital (except A&E or obstetric unit)	-	2**	2

*6 deliveries occurred in obstetric units in co-located sites with a general hospital

** Occurred within a co-located obstetric/general hospital site.

Location of death in women who died from direct and indirect causes: Ireland 2009-2012

The majority of women (n=6: 60%) who were classified as direct maternal deaths died in an Intensive Care Unit (ICU) with no direct deaths occurring outside the hospital setting. In contrast, indirect maternal deaths occurred in a variety of settings (see Table 6). With regard to pregnant and recently pregnant women, this

highlights the importance of communication between health professionals across a range of healthcare services and the importance of awareness of Irish national guidelines for critically ill women in obstetrics published in 2014.¹⁷

Table 6: Location of direct and indirect maternal death 2009 – 2012

Location of death	Direct Maternal Deaths (n=10)	Indirect Maternal Deaths (n=21)	Total Maternal Deaths (n=31)
Home / outwith hospital setting	0	6*	6
Hospital (except A&E and ICU)	3	3	6
A&E	1	5	6
ICU	6	7	13

*Includes 4 cases classified as indirect due to suicide at a location outwith a hospital setting.

Ethnicity/ Nationality

Significantly, 38.7 % of maternal deaths 2009-2012 (includes direct and indirect causes) occurred in women born outside Ireland, who represented 24.2% of all maternities in Ireland for that time period.¹⁸

Thus, such women were over-represented in Irish maternal deaths, reflecting findings from successive UK CEMD reports which found an increased risk of maternal death among migrant ethnic minorities.

Maternal Age

While the number of maternal deaths is small in specific age groups there was a suggestion of an increasing MMR in women 30 years of

age and above compared with younger women. (Table 7). This reflects findings reported in the recent MBRRACE-UK report.

Table 7: Age distribution of women who died: Ireland 2009 – 2012

Maternal Age	Direct (n=10)%	Indirect (n=21)%	Total Maternal Deaths (n=31)	Total Maternities*	Mortality Rate** (95% CI)	Relative risk (95% CI)
< 20	-	-	-			
20 – 24	-	2	2 (6.5%)	31,219	6.4 (1.6-25.6)	1.00 (Ref.)
25 – 29	3	2	5 (16.1%)	67,690	7.4 (3.1-17.8)	1.15 (0.22-5.94)
30 – 34	7	7	14 (45.2%)	103,384	13.5 (8.0-22.9)	2.11 (0.48-9.30)
35 – 39	-	10	10 (32.3%)	69,450	14.4 (7.8-26.8)	2.25 (0.49-10.26)
≥ 40	-	-	-			

*Maternities by maternal age groups

**Maternal Mortality Rate per 100,000 maternities MR

¹⁷ Clinical Practice Guideline No 30 (2014). Guideline for the Critically ill Woman in Obstetrics : Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

¹⁸ Economic and Social Research Institute (2012) Perinatal Statistics Report 2010. National Perinatal Reporting System. Dublin: ESRI.

Parity

Table 8 details the distribution of maternal deaths by parity. There was a suggestion of increasing MMR with increasing parity.

Table 8 Distribution of maternal deaths by parity: Ireland 2009-2012

Parity	Direct (n=10)%	Indirect (n=21)%	Total Maternal Deaths (n=31)	Total Maternities*	Mortality Rate** (95% CI)	Relative risk (95% CI)
0	5	3	8 (25.8%)	118,997	6.7 (3.4-13.4)	1.00 (Ref.)
1	4	7	11 (35.5%)	97,812	11.2 (6.2-20.3)	1.67 (0.67-4.16)
2	1	7	8 (25.8%)	49,195	16.3 (8.1-32.5)	2.42 (0.91-6.44)
≥3	-	4	4 (12.9%)	26,817	14.9 (5.6-39.7)	2.22 (0.67-7.37)

*Maternities by maternal age groups

**Maternal Mortality Rate per 100,000 maternities MR

Body mass index (BMI)

There is evidence that increased maternal BMI is associated with higher odds of maternal death due to specific pregnancy complications. National guidelines recommend the recording of BMI in the maternity notes.¹⁹ While this may be common practice, there are no national data on the BMI of the pregnant population available in Ireland. Table 9 demonstrates the

distribution of BMI among women who died. Overall, the distribution of maternal deaths in Ireland does not suggest an association with increased BMI. However, of the maternal deaths attributed to cardiac disease 2009-2012 (n=8), half of the women were either overweight or obese.

Table 9: Body mass index of women who died: Ireland 2009 – 2012

BMI Category (Kg.m ⁻²)	Direct (n=10)	Indirect (n=21)	Total Maternal Deaths (n=31)%
Underweight (<18.0)	-	-	-
Healthy (18.0-24.9)	5	12	17 (55%)
Overweight (25.0-29.9)	2	2	4 (13%)
Obese (>30.0)	1	4	5 (16%)
Missing	2	3	5 (16%)

Smoking

Data on smoking status was unknown in three cases of direct and indirect maternal deaths 2009 – 2012. Of the 28 women whose smoking status was recorded, one in five smoked (n=6:21.4%). Cause of death was classified as indirect in all but one

of the women who 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.²⁰

19 Clinical Practice Guideline No 2 (2011). Obesity and pregnancy : Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive
20 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

Accessing antenatal care

Successive UK CEMD reports have highlighted the issue of suboptimal attendance for antenatal care among women who died. The standard for optimal care was based on NICE antenatal care guidelines.²¹

Of the 31 women who died from direct or indirect causes in Ireland 2009-2012, all but 5 women accessed antenatal care in maternity units. Of these 5 women, all deaths occurred

in early pregnancy (3 before 12 weeks and 2 between 12 and 16 weeks gestation). All but 2 women had attended a GP.

Of the women who attended for antenatal care in a maternity unit (n=26), 42% (n =11) had their first antenatal visit at less than 12 weeks, 50% (n=13) between 13-19 weeks and 8% (n=2) at 20 or more weeks gestation.

²¹ National Institute for Health and Care Excellence [2008]. "CG62: Antenatal care." Available at: <http://www.nice.org.uk/guidance/cg62>.

Specific lessons learned in the Irish context 2009-2012

The number of maternal death cases in Ireland is small, and conclusions must incorporate the limitations of cohort size. As such it is imperative that this report is read

in conjunction with the MBRRACE-UK report published in December 2014, available at: <http://www.ucc.ie/en/mde/publications/>²²

Ethnicity/ Nationality

Maternal mortality was proportionally higher among minority ethnic groups of women who were not born in Ireland. This raises issues as to how these women engage with Irish maternity services and the importance of the availability of interpretative services. A particular concern

was the issue of engagement with the services by non-national patients in receipt of alternative medical advice from outside the country. These challenges need ongoing review.

Direct Maternal Deaths

It was gratifying to note the absence of any deaths in Ireland 2009-2012 attributable to anesthetic complications, historically among one of the commonest causes of maternal deaths for generations. However,

thromboembolic disease continues to feature prominently, and serves as a reminder of the importance of adherence to national guidelines for prevention and management of this complication.²³

Indirect Maternal Deaths

As with the UK, the significantly higher rate of indirect maternal deaths compared with direct deaths highlights ongoing challenges for maternity services in caring for women with pre-existing medical and mental health disorders.

Cardiac disease was the largest single cause of indirect maternal deaths for the years 2009 – 2011 and 2010-2012. This is similar to current and previous CEMD reports.

Pre-Conception Counselling

The importance of pre-conception counselling and patient compliance was evident in cases of pre-existing disease. Ideally women should have management of their medical conditions optimised prior to becoming pregnant.

Prospectively, there may be opportunities for improvement in relation to anti-epileptic and anti-depressant medication compliance in the peri-conceptual period.

22 Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons learned to inform future maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2014.

23 Clinical Practice Guideline No 20 (2013). Venous Thromboprophylaxis in Pregnancy : Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

First Hospital Booking Appointment

The number of indirect deaths underlines the importance of a comprehensive booking interview. There is a particular importance in ascertaining any

history of previous medical or mental disorders, and substance abuse. Previous involvement with social services requires follow up.

Appropriate Referral to Specialist Services

In cases of pre-existing medical and mental health disorders, appropriate referral was apparent. Timeliness of access to colleagues providing other specialist services remains a challenge in some areas.

The recent UK report recommends multi-agency evidence-based guidelines for the care of pregnant and postpartum women with epilepsy. Within Ireland implementation of a national epilepsy register has been an important development.

Immunisation programmes: Influenza

The recent MBBRACE-UK report describes maternal deaths due to a novel strain of influenza A virus subtype A/H1N1/09 (commonly referred to as H1N1 or 'swine flu') occurring during a global pandemic declared by WHO in 2009. Two such cases occurred in Ireland. The importance of immunisation

against seasonal and pandemic influenza for pregnant women is a key recommendation both in the recent MBRRACE-UK report and Immunisation Guidelines issued by the National Immunisation Advisory Committee (NIAC) of the Royal College of Physicians of Ireland.²⁴

Maternity Early Warning Systems (MEWS)

The potential value of MEWS to identify maternal compromise was again identified. This was noted both in cases considered to have exemplary care and in cases where the use of a MEWS chart might have identified impending

maternal collapse. The implementation of a national iMEWS guideline has been an important development in ensuring quality of clinical care in the maternity services.²⁵

Substance Abuse

Indirect and coincidental maternal deaths related to substance abuse identified a maternal profile similar to that identified in successive UK CEMD reports.²⁶ These women

are more likely to attend late for booking, and be poorly compliant with maternity and social services.

Mental Illness

Women who had a documented history of mental illness were engaged with the mental health services, and good communication between maternity services and mental health services was apparent.

The absence of a mother and baby unit is a continuing and regrettable deficiency in the Irish health services. Stand-alone psychiatric units are poorly equipped to look after women with medical and obstetrical complications.

²⁴ <http://www.hse.ie/eng/health/immunisation/hcpinfo/fluinfo/>

²⁵ Clinical Practice Guideline No 25 (2014). The Irish Maternity Early Warning System (IMEWS) : Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive

²⁶ Lewis, G. (Ed), R. Cantwell, T. Clutton-Brock, G. Cooper, A. Dawson, et al. (2011). "Saving Mothers' Lives: Reviewing maternal deaths to make motherhood safer: 2006-2008. The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom." BJOG 118 Suppl 1: 1-203. Lim, W. S., S. V. Baudouin, R.

Location of Maternal Deaths

When deaths occurred in general hospitals, there was some evidence of lack of communication with the maternity unit and/or GP. This serves to highlight the recommendation in the UK *Saving Mothers' Lives* report 2006-2008 of a policy of follow-up for non-attenders in maternity units. The role of Intensive Care Units in

the management of direct maternal deaths underscores the value of co-located hospitals as recommended elsewhere,²⁷ the importance of transfer where necessary to a general hospital with ICU facilities, and adherence to national Guidelines for the Critically ill Woman in Obstetrics.²⁸

Ascertainment of maternal deaths, MMR, using the routine civil death registration system

WHO recommends inclusion of a question on pregnancy status at certification of female death. This contributes particularly to the identification of indirect maternal deaths.²⁹ In Ireland, the Medical Death Notification Form completed by a medical practitioner contains the question "*If the deceased was female, was she known to have been pregnant at the time of death, or within the previous 42 days?*" (Answer "yes" or "no" in all cases). The Coroner's certificate does not contain this question. In a review of death certificates relating to maternal death cases identified by

MDE Ireland, the question on pregnancy status was incorrectly answered in some cases registered on receipt of a medical certificate. Review of death certificates issued by the General Registry Office (GRO) office, following receipt of a Coroner's certificate, information on current or recent pregnancy was absent in some cases of indirect maternal deaths. These issues clearly impact on ascertainment of reliable maternal mortality data through the civil death registration system.

27 KPMG: Independent Review of Maternity and Gynaecology Services in the Greater Dublin Area 2008. Health Service Executive: ISBN 978-1-906218-20-1

28 Clinical Practice Guideline No 30 (2014). Guideline for the Critically ill Woman in Obstetrics : Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

29 WHO, UNICEF, UNFPA and The World Bank. Trends in Maternal Mortality: 1990 to 2008. WHO 2010 Geneva.

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

Obstetric Assessor:

Colm O’Herlihy, Consultant Obstetrician, Professor of Obstetrics and Gynaecology in UCD School of Medicine and Medical Science

Pathology Assessor:

Peter Kelehan, Consultant Perinatal and Gynaecological Pathologist

Anaesthetic Assessor:

John Loughrey, Consultant Anaesthetist, Rotunda Hospital, 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

Midwifery Assessors:

Siobhan Canny, Clinical Midwife Manager 3, Galway University Hospital, Galway

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

Fiona Hanrahan, Assistant 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

Karen Robinson, Doctor, Clinical Risk Advisor, Clinical Indemnity Scheme, 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

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

Charlotte McClymont, Programme Manager

Marketa Laube, Deputy Programme Manager

Sarah Lawson, Head of IT and Security

Peter Smith, Programmer

Carl Marshall, Programmer

Lucila Canas Bottos, Programmer

Scott Redpath, Project Assistant

Joanna Oakley, Administrator

Oliver Hewer, Project Advisor (until August 2014)

Sally Arlidge, Midwifery Advisor (until July 2014)

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