NATIONAL PERINATAL EPIDEMIOLOGY CENTRE

Major Obstetric Haemorrhage Clinical Audit in Ireland

2021 and 2022 Report

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Acknowledgements

It is with sincere thanks and appreciation that the National Perinatal Epidemiology Centre (NPEC) would like to acknowledge the many healthcare professionals who contributed to this NPEC clinical audit on major obstetric haemorrhage (MOH). In particular, we extend our thanks to the unit co-ordinators who continued to co-ordinate the collection of data on Severe Maternal Morbidity (SMM) with the additional challenge of collating data for this detailed clinical audit of MOH data tool in 2021 and 2022. This report would not have been possible without their dedicated support and co-operation (Appendix A). Collation of audit data at unit level was particularly challenging in 2021 following the HSE Cyber-attack and subsequent impact on IT systems.

The NPEC would like to acknowledge, with thanks, members of the NPEC Severe Maternal Morbidity Group for their guidance in the continual optimisation of the NPEC national clinical audit of severe maternal morbidity (Appendix B). We also thank the NPEC Governance Committee, which represents a diverse range of key stakeholders from maternity centres and universities throughout the country, for their support and guidance as the Centre continues to evolve (Appendix C).

Introduction

Major Obstetric Haemorrhage (MOH) is a leading cause of maternal morbidity and mortality worldwide with the vast proportion of deaths occurring in resource-poor countries.[1] In resource rich countries, MOH is a frequent event on labour wards including in the United Kingdom (UK) and in Ireland, but mortality is rare in contrast to the situation in many other parts of the world.[2]

Within the Irish context, MOH continues to be a significant challenge for service providers and is a critical indicator of the quality and responsiveness of maternity care. MOH has been recorded as the most commonly occurring severe maternal morbidity (SMM) in Ireland, accounting for over half (54%) of reported SMM events in 2022. Further, increasing rates of MOH have been identified with a 47% rate increase between the reporting years 2011 and 2022 which was statistically significant (p value = <0.001).[3,4] Encouragingly, despite increasing rates of MOH in Ireland, there is a relatively low fatality ratio currently associated with obstetric haemorrhage.[5, 6]

In response to recommendations from previous NPEC reports on SMM in Ireland, the National Perinatal Epidemiology Centre (NPEC) conducted a comprehensive clinical audit on MOH events occurring in Ireland for the reporting years 2021 and 2022. The clinical audit aims to systematically capture, analyse, and reflect on the incidence, management, and outcomes of MOH cases, with a view to informing clinical practice, identifying areas for improvement, and ultimately enhancing maternal safety and care.

Furthermore, by comparing findings from the MOH audit 2021-2022 to findings of a similar audit conducted by the NPEC for the years 2011–2013[7], the NPEC sought to enhance clinical education by identifying potential modifications in clinical practice, risk factors, or changes in the demographic profile of pregnant, or recently pregnant, women experiencing MOH.

This MOH Clinical Audit Report 2021-2022 is divided into three sections (Figure 1) with additional information provided in the Appendices.

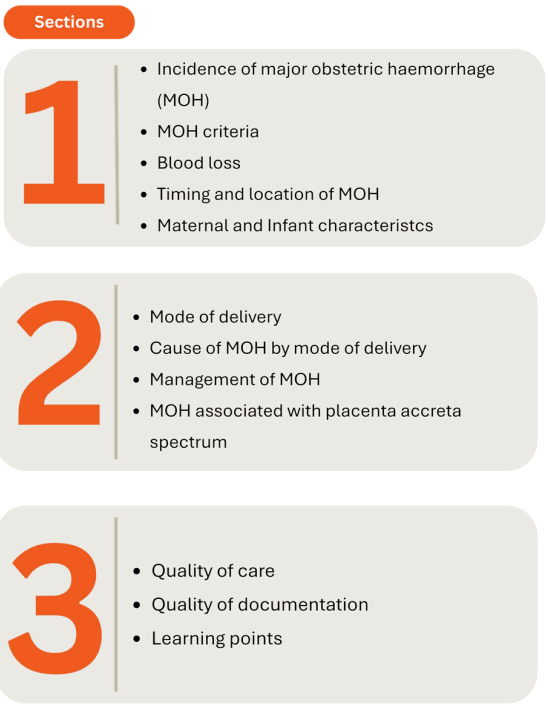


Figure 1. Outline of the MOH report sections.

[1]GBD 2015 Maternal Mortality Collaborators Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388:1775–1812. doi: 10.1016/S0140-6736(16)31470-2.

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

[3]Greene RA, McKernan J, Manning E, Corcoran P, Byrne B, Cooley S, et al. Major obstetric haemorrhage: Incidence, management and quality of care in Irish maternity units. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2021; 257:114-20.

[4]Leitao S, Manning E, Corcoran P, Keane J, McKernan J, Greene RA, on behalf of the Severe Maternal Morbidity Group. Severe Maternal Morbidity in Ireland Annual Report 2022. Cork: National Perinatal Epidemiology Centre, 2024.

[5]Leitao, S, E Manning, RA Greene, P Corcoran, Bridgette Byrne, Sharon Cooley, Deirdre Daly, et al. 2021. "Maternal Morbidity and Mortality: An Iceberg Phenomenon." BJOG: An International Journal of Obstetrics & Gynaecology 129 (3): 402–11. https://doi. org/10.1111/1471-0528.16880.

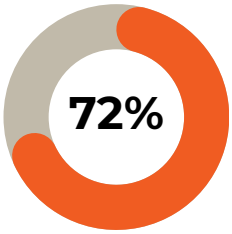
[6]O'Hare MF, Manning E, Corcoran P, Greene RA on behalf of MDE Ireland. Confidential Maternal Death Enquiry in Ireland, Data Brief No 7. Cork: MDE Ireland, October 2024 https://www.ucc.ie/en/media/research/nationalperinatalepidemiologycentre/documents/ MaternalDeathEnquiryReport2019-2021.pdf.

[7]Greene RA, McKernan J, Manning E, Corcoran P, Byrne B, Cooley S, et al. Major obstetric haemorrhage: Incidence, management and quality of care in Irish maternity units. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2021; 257:114-20.

Key Findings

The incidence of MOH was **3.56** and **3.38** per 1,000 maternities in **2021** and **2022** respectively, **a 47% increase since 2011.**

Almost three quarters **(72%) of MOH events** occurred in the **post-partum period.**



The mean reported blood loss was **3,000mls.**

BMI

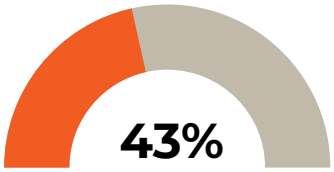
Women with a **high BMI** and women with **multiple pregnancy** had a higher risk of MOH.

- **27%** of women required **≥5 units of blood transfusion**
- **62%** were treated for **coagulopathy**
- **95%** received a **prophylactic uterotonic agent** at birth.

Quantitative measurement of blood loss was reported in **almost all MOH cases** (98% in theatre and 96% in the labour ward).

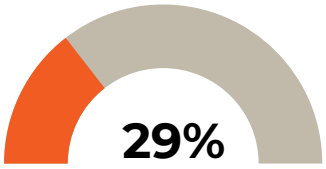
Causes and care of Major Obstetric Haemorrhage

Associated with vaginal delivery



The most common cause of MOH was **retained placenta/membranes (43%)** followed by **uterine atony (32%).**

Associated with caesarean section



The most common causes of MOH were **uterine atony (29%), placenta praevia (15%) and bleeding from uterine incision (14%).**

Emergency C-section at full dilation occurred in **16%** of MOH cases, 77% with an obstetric consultant present.

Multidisciplinary senior staff were present at **98%** of MOH events, with fewer consultants available out of hours (79%) vs. daytime (91%).

Almost half **(49%)** of women experiencing an MOH were **admitted to a high dependency unit** and **28%** were cared for in an **ICU.**

A maternity early warning system **(IMEWS)** was used in **89% of cases.**

Invasive monitoring: central venous pressure line 14% & arterial line 49%.

An **MOH protocol was available in 96%** of cases and an **obstetric heamorrhage proforma** was used in **63%** of MOH cases. In most cases where a proforma was not used, the woman was managed in theatre.

Pharmaceutical arrest of bleeding

At **least one uterotonic agent** was administered to arrest bleeding in 97% of MOH cases.

Syntocinon was used more often in vaginal births than C-sections, either by injection or infusion.

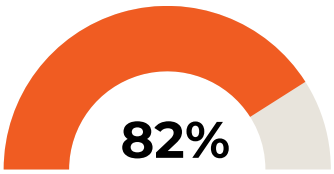
Tranexamic acid

Significant **increase** in its use in 2021-2022 (85%) compared to the 11% in 2011-2013.

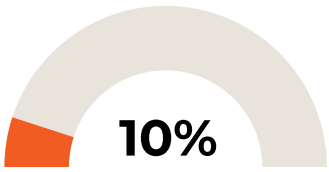
Misoprostal

There was a **reduction** in its use in 2021-2022 (44%) compared to the 55% in 2011-2013.

Haemostatic surgical procedures



82% of women experiencing MOH had **1 or more haemostatic surgical procedure.**



Ten percent of women required a **peripartum hysterectomy. Intra-uterine balloon tamponade** was the most common haemostatic surgical procedure (33%).

Quality of Care

- Appropriate, **well managed care** was reported in **87% of cases**.
- **Formal debriefing** was provided for **89% women** experiencing MOH.
- **Lack of debriefing for staff** following an MOH event is a lost learning opportunity.

Quality of Documentation

- Documentation of timing and blood loss at time of pharmaceutical and surgical interventions in the management of MOH is **suboptimal.**

Methods

Since 2011, the NPEC has conducted a national clinical audit of women experiencing severe maternal morbidity (SMM) in Ireland. To allow for international comparison, the NPEC adapted the validated methodology and audit tools of the Scottish Confidential Audit of Severe Maternal Morbidity (SCASMM) to evaluate SMM and major obstetric haemorrhage (MOH). This SMM methodology utilises fourteen morbidities based on organ dysfunction criteria described by Mantel et al.[8,9] including MOH, which has informed this clinical audit for the reporting years 2021-2022.

Definitions

In this 2021-2022 audit, MOH was defined as women experiencing one or both of the following criteria during pregnancy or up to 42 days following pregnancy end:

1. An estimated blood loss (EBL) of at least 2,500ml

2. and or receiving a blood transfusion of five or more units of blood

The definition of MOH used in this 2021-2022 audit differs from a similar audit on MOH conducted by the NPEC between the years 2011 to 2013 which included the criterion of receiving treatment for coagulopathy. This should be noted when comparisons are made between detailed MOH audit findings across the years.

The rationale for a difference in definition of MOH in 2011-2013 can be explained by the SCASMM methodology adopted by the NPEC in 2011, which defined MOH as occurring if one of the following criteria were met: estimated blood loss (EBL) of at least 2,500ml; transfusion of five or more units of blood; and/or receiving treatment for coagulopathy. However, it was observed in subsequent years, an increase in the number of MOH cases in Ireland reported solely based on the criterion of treatment received for coagulopathy without meeting the criteria of EBL or blood transfusion. This reflected changes in practice based on national guidelines on the management of post-partum haemorrhage (PPH). In order to adjust for this change in practice, the NPEC definition of MOH in the national SMM clinical audit changed for the reporting year 2019 and adjustments were made in the trend MOH data to allow for comparison of MOH rates across the years.

[8] Mantel GD, Buchmann E, Rees H, Pattinson RC. Severe Acute maternal morbidity: a pilot study of a definition for a near-miss. BJOG 1998; 105: 985-90

[9]Scottish Confidential Audit of Severe Maternal Morbidity: 10th Annual Report (2014). Available from: http://www.healthcareimprovementscotland.org/our_work/ reproductive,_maternal__child/programme_resources/ scasmm.aspx

Data recording

In 2021 and 2022, there were 19 maternity units in Ireland. All 19 Irish maternity units contributed data to the detailed clinical audit on women experiencing MOH in 2021, and all but one large tertiary referral maternity unit in 2022.

Data on women experiencing MOH events occurring between 1 January 2021 and 31 December 2022 were identified from the ongoing SMM clinical audit. Maternity units submitted data on women experiencing MOH using a standardised SMM notification dataset electronically, via the secure online NPEC database. In the event of an MOH, an additional detailed audit data set was presented automatically on the SMM IT platform for the unit contributor to complete. Both the SMM notification form and MOH clinical audit form are available HERE.

Maternal and fetal characteristics associated with the MOH case (n=390) were captured on the SMM notification dataset. The MOH dataset captured management and treatment details of the MOH event recorded in clinical records. The data were subsequently processed by NPEC in a pseudonymised format, which means that they cannot be attributed to a specific individual without the use of additional information, and only the submitting unit has access to this information.

Rate calculations: In keeping with the international published literature in this area, the incidence rate of MOH is calculated per 1,000 maternities resulting in the live birth or stillbirth with a birthweight ≥500g.

Rate ratios: Analysis involved using Poisson regression which calculates a rate ratio. Rate ratios have the advantage of being easy to interpret. They are interpreted against the rate to which they are being compared (the reference group/reference rate). Further information on the interpretation of rate ratios is available in the methods section in the Severe Maternal Morbidity in Ireland report 2022 available here.

Use of language:
In this MOH audit report, we use the term women to reflect the language commonly used in perinatal care. We acknowledge that not everyone who becomes pregnant or gives birth identifies as a woman, and our findings and recommendations are intended to be inclusive of all people who access the Irish maternity services.

Major obstetric haemorrhage (MOH), main findings

Section 1

The incidence of major obstetric haemorrhage

The incidence of major obstetric haemorrhage (MOH), criteria for MOH, timing and location of MOH event and maternal and infant characteristics of women experiencing MOH in 2021-2022 are detailed in this section of the report based on data submitted to the ongoing severe maternal morbidity (SMM) clinical audit for the reporting years 2021 and 2022 **(n=390)**.

The overall incidence of MOH in 2021 and 2022 was similar in Ireland: 3.56 (3.1-4.08) per 1,000 maternities in 2021 and 3.38 (2.90-3.91) in 2022 respectively.

Of the 390 women experiencing MOH for the combined years 2021 and 2022, the majority (n=380, 97.4%) had a blood loss ≥2,500mls and over a quarter (n=105, 26.9%) required a blood transfusion of five or more units. This is lower than the rate of women (45%) requiring five or more units of blood in a similar MOH clinical audit in 2011-2013.[10]

Table 1 below and Table A, Appendix D details the case criteria met for the MOH clinical audit 2021-2022 as defined in the ongoing SMM clinical audit conducted by the National Perinatal Epidemiology Centre (NPEC). Almost two thirds (n=285, 73.1%) involved an estimated blood loss ≥2,500ml without a transfusion of ≥5 units of blood, 2.6% (n=10) involved a transfusion of ≥5 units of blood without an estimated blood loss of ≥2,500ml. One quarter (n=95, 24.4%) of MOH cases met both criteria.

Over half (243 of 390, 62.3%) of women who experienced MOH received treatment for coagulopathy (Table A, Appendix D).

Table 1: Case criteria met for major obstetric haemorrhage in 2021 and 2022.

	2021-2022 (N=390)
Met one criterion	
Estimated blood loss ≥ 2500ml	285 (73.1%)
Transfused ≥ 5 units of blood	10 (2.6%)
Met two criteria	
Blood loss ≥ 2500ml and transfused ≥ 5 units of blood	95 (24.4%)
Total	390 (100%)

[10]Greene RA, McKernan J, Manning E, Corcoran P, Byrne B, Cooley S, et al. Major obstetric haemorrhage: Incidence, management and quality of care in Irish maternity units. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2021; 257:114-20.

Blood loss

The volume of blood loss was known for all but 3 MOH cases (n=387) and ranged from 1,500 mls to 11,000 mls with the median reported loss of 3,000 mls (standard deviation (SD) = 1302.7). In almost two thirds of MOH cases (n=286 of 387, 73.9%), the reported volume of blood loss was between 2,500 mls and 3,500 mls and in less than a quarter, (n=90, 23.3%), the volume of blood loss was greater than 3,500 mls (Table 2).

Table 2: Volume of blood loss in women experiencing major obstetric haemorrhage in 2021 and 2022.

Volume of blood loss	n (%)
<2500 mls	11 (2.8%)
2500 mls -3500 mls	286 (73.9%)
>3500 mls	90 (23.3%)
Total	387 (100%)

Note: volume of blood loss missing for 3 cases.

Timing and location of major obstetric haemorrhage

Data on timing and location of MOH was available for 360 women experiencing MOH. Analyses excludes cases from one maternity unit in 2022 (n=30) for which further information was not available. The time of onset of haemorrhage was postpartum in almost two-thirds (n=258, 72%) and intrapartum in 18% (n=65) of MOH cases (Figure 2). A small number of cases (n=25, 7%) occurred in the antenatal period and a further 3% (n=12) occurred < 20 weeks gestation.

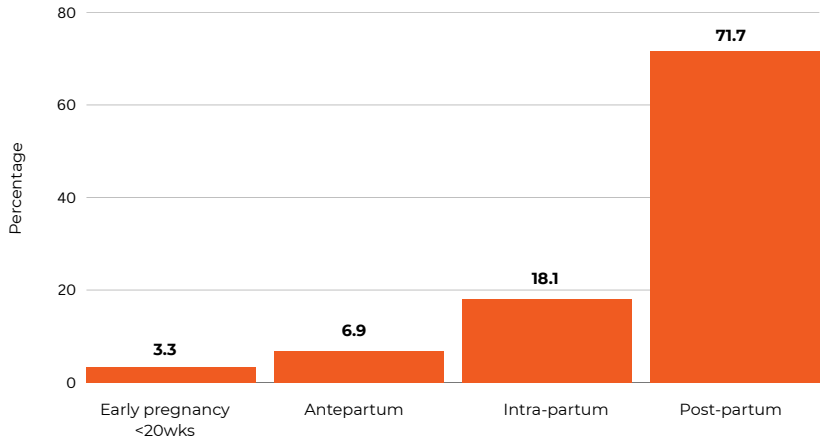


Figure 2. Timing of major obstetric haemorrhage 2021-2022.

Note: Analyses exclude MOH cases from one hospital in 2022 (n=30) for which further information was not available.

Location at the onset of haemorrhage was known for all but one MOH case in 2021-2022 (n=389). In the majority (93%) of MOH cases, the location at onset of haemorrhage was in an obstetric-led unit, a further 3% occurred at home and 2% occurred in a midwifery-led unit.

Pathway of maternity care

The booking status of women who experienced MOH in 2021-2022 was known for all but two cases (n=388) in 2021-2022 (Table 3). The majority (83%) of women availed of maternity care in the public scheme. This is similar to general booking status of women in the Irish pregnant population in Ireland.

Table 3: Pathway of maternity care in women experiencing major obstetric haemorrhage in 2021 and 2022.

Maternity care	Maternities	MOH cases (N=388)
Public	92,027	322 (83%)
Private	20,254	66 (17%)

Note: Data on pathway of maternity care missing for two cases

Maternal characteristics

Data on maternal characteristics were recorded for all 390 women experiencing MOH in 2021-2022. The age of women experiencing MOH ranged from 17 years to 48 years (mean= 35 years SD= 5.2 years). Similar to the MOH clinical audit conducted in 2011-2013, most women (n=253, 65%) were multiparous (Table B, Appendix D).
In terms of ethnicity, two-thirds (n=295, 76%) were white Irish and 10.6% were described as Black, Asian or Irish Traveller. There are no national data available on ethnicity for the pregnant population in Ireland which impedes the calculation of MOH risk per ethnic group.

BMI
An association between high BMI and women experiencing MOH in Ireland has been identified in recent years (2019-2022).[11] Women with high BMI had a 44% higher risk of MOH. In this 2021-2022 MOH clinical audit slightly more women were in the overweight and obese BMI category (28.7% and 29% respectively) compared to findings in the 2011-2013 MOH clinical audit (overweight, 23.1% and obese, 18.2%) (Table B, Appendix D).

[11]Leitao S, Manning E, Corcoran P, Keane J, McKernan J, Greene RA, on behalf of the Severe Maternal Morbidity Group. Severe Maternal Morbidity in Ireland Annual Report 2022. Cork: National Perinatal Epidemiology Centre, 2024.

Obstetric factors associated with MOH

The prevalence of a previous caesarean section in women experiencing MOH in 2021 and 2022 who gave birth was 30.3% (n=118 of 390).

Gestation at pregnancy end was recorded for all but one (n=389) women experiencing MOH in 2021-2022 and ranged from 4 weeks to 42 weeks (mean= 36.7 weeks, SD= 6.0). For almost two thirds (74.3%, n=289 of 389) of the women affected by MOH in 2021-2022, their pregnancy went full term, i.e. 37-41 weeks gestation (Table 4). For a further 15.4% (n=60) of women, their pregnancy ended at moderate-to-late pre-term gestation (32-36 weeks), whereas for 3.6% (n=14), the end of pregnancy occurred before 22 weeks of gestation.

Table 4: Gestation at pregnancy-end for women who experienced major obstetric haemorrhage, 2021-2022.

Gestation at pregnancy end*	2011-2013 N=304	2021-2022 N=389
Pre-viable (<22wks)	13 (4.3)	14 (3.6)
Extremely pre-term (22-27wks)	7 (2.3)	10 (2.6)
Very pre-term (28-31wks)	12 (4.0)	14 (3.6)
Moderate/late pre-term (32-36wks)	52 (17.1)	60 (15.4)
Term	217 (71.4)	289 (74.3)
Post-term	3 (1)	2 (0.5)

Note: Values are shown as n (%) unless otherwise stated; * Gestation at pregnancy-end was not known for 151 women in 2011-2013 and in 1 case in 2021-2022.

Multiple pregnancy

Twenty six of the 390 MOH cases (6.7%) were associated with a multiple pregnancy. This rate is slightly lower than the rate of 8.5% reported in the 2011-2013 MOH clinical audit. However, this rate is higher than the prevalence of multiple pregnancy among all women who gave birth in 2021-2022.

Fetal and neonatal outcome

Of the 390 MOH cases, there were two (0.5%) ectopic pregnancies, one (0.3%) termination of pregnancy, 13 (3.3%) miscarriages and 13 (3.3%) perinatal deaths (12 stillbirths and one neonatal death).

Section 2

Section 2 details the mode of delivery, cause of MOH by mode of delivery, management of MOH events and management of MOH cases associated with placenta accreta spectrum (PAS). Findings are based on the data submitted to the supplementary detailed MOH clinical audit on the care of **360** women experiencing MOH (missing data from one tertiary referral unit with 30 MOH cases in 2022).

Mode of delivery

Of the 360 MOH cases in 2021-2022, 16 cases were associated with early pregnancy loss (two ectopic pregnancies, one termination of pregnancy and thirteen miscarriages <24 weeks). Excluding these 16 early pregnancy losses, the mode of delivery for 344 women experiencing MOH is detailed in Table 5. Caesarean section (CS) was the most common mode of delivery (n=183 of 344, 53.2%) of the women who experienced MOH in 2021 and 2022, of which over half (n=108 of 183, 59.0%) were reported as an emergency CS (Table 5).

Of the 161 of 344 (46.8%) women who had a vaginal delivery, the majority (n=105 of 161, 65.2%) had a spontaneous vaginal delivery and 34.8% (n=56 of 161) underwent an operative vaginal delivery.

Table 5: Mode of delivery for women who experienced major obstetric haemorrhage, 2021-2022.

Mode of delivery	N=344	%
Vaginal delivery	161	46.80%
Spontaneous vaginal delivery	105	30.50%
Operative vaginal delivery	56	16.30%
LSCS	183	53.20%
Elective LSCS	75	21.80%
Emergency LSCS	108	31.40%

Note: analysis excludes detailed MOH data from one unit (n=30) and 16 cases of MOH associated with early pregnancy loss. LSCS = Lower Segment Caesarean Section.

Mode of labour

Considering the 344 women experiencing an MOH who gave birth (excludes 16 MOH cases associated with early pregnancy loss), the majority of women laboured (n=229, 66.6%) and 33.4% (n= 115) were never in labour. Of the 229 women who laboured, 48% (n=110) had spontaneous onset of labour and just over half of the women (n=119, 52%) had their labour induced.

Emergency caesarean section delivery at full cervical dilatation

An increased risk of maternal morbidity has been associated with caesarean section performed at full cervical dilatation compared to caesarean section at less than full dilatation.[12] In this 2021-2022 clinical audit, an emergency caesarean section delivery at full cervical dilatation was reported for 17 women experiencing an MOH who laboured. This equates to 15.7% of the 108 MOH cases delivered by emergency caesarean section.

In over two-thirds (n=13 of 17, 76.5%) of cases of emergency CS performed at full cervical dilatation a consultant obstetrician was present, and in seven cases the consultant obstetrician performed the CS. This reflects a high level of compliance for senior staff involvement as advised in such cases. The indication for half of these operative deliveries in 2021/2022 was failed instrumental delivery. The indication in the other cases related failure to progress in the second stage of labour or fetal bradycardia.

Cause of major obstetric haemorrhage

The primary cause of MOH in 2021-2022 is presented by mode of delivery in Table 6 which excludes mode of delivery for 16 cases associated with early pregnancy loss (n=344 of 360 MOH cases with available data). For women experiencing an MOH who had a vaginal delivery (n=161), the most common primary cause of MOH was retained placenta/membranes (n=69, 42.9%) followed by uterine atony (n=52, 32.3%).

Conversely, for women experiencing an MOH who had a caesarean section (CS; n=183), the most common primary cause of an MOH reported was uterine atony (n=53, 29%) followed by placenta praevia (n=27, 14.8%), bleeding from uterine incision (n=26, 14.2%), and placenta accreta spectrum (PAS) (n=22, 12%). MOH due to bleeding from a uterine incision was reported more frequently following an emergency CS, occurring in one in five cases (n=22 of 108, 20.4%) compared to an elective CS (n=4 of 75, 5.3%).

[12]Allen VM, O'Connell CM, Baskett TF. Maternal and Perinatal morbidity of caesarean delivery at full cervical dilatation compared with caesarean delivery in the first stage of labour. BJOG. 2005; 112:986-90

Table 6: Primary cause of major obstetric haemorrhage by mode of delivery for women who gave birth in 2021 and 2022.

	Vaginal Delivery (N=161)	CS* (N=183)	Total (N=344)
Uterine atony	52 (32.3%)	53 (29.0%)	105 (30.5%)
Retained placenta/membranes	69 (42.9%)	6 (3.3%)	75 (22.4%)
Placenta praevia	0 (0%)	27 (14.8%)	27 (7.8%)
Bleeding from uterine incision	0 (0%)	26 (14.2%)	26 (7.6%)
Vaginal laceration/haematoma	24 (14.9%)	1 (0.5%)	25 (7.3%)
Placenta Accreta Spectrum	0 (0%)	22 (12.0%)	22 (6.4%)
Abruption	5 (3.1%)	12 (6.6%)	17 (4.9%)
Broad ligament haematoma	0 (0%)	4 (2.2%)	4 (1.1%)
Cervical laceration	3 (1.9%)	0 (0%)	3 (0.9%)
Uterine rupture	0 (0%)	2 (1.1%)	2 (0.6%)
Uterine inversion	2 (1.2%)	0 (0%)	2 (0.6%)
Other	6 (3.7%)	30 (16.4%)	36 (10.5%)
Total	161 (100%)	183 (100%)	344 (100%)

Note: analysis data excludes mode of delivery associated with 16 early pregnancy loss. *CS= Caesarean Section.

Management of major obstetric haemorrhage

Location of care

National guidelines[13] recommend continuous close monitoring of women in appropriate settings following major postpartum haemorrhage (PPH) and findings from this audit identifies good adherence to this advice. Considering the 360 women where data was available on location of care who experienced an MOH in 2021 and 2022, over one quarter were admitted to an ICU (n=100, 27.8%), and nearly a half of the women (n=176 of 360, 48.9%) were managed in a high dependency unit. It must be noted that a woman may be cared for in several locations during an MOH event. In this clinical audit most women (n=280, 77.8%) received all or partial care in theatre and over half (n=192, 53.3%) received care in the delivery ward (Table C, Appendix D).

[13] Clinical Practice Guideline No 17 (2012). Guideline for the Prevention and Management of Primary Postpartum Haemorrhage: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

Healthcare professionals

It is widely acknowledged that the management of an MOH requires a multidisciplinary care approach with early recognition and senior decision making, being key to the effective management of patients with an MOH.[14] Figure 3 illustrates the reported presence of health professionals during the management and care of MOH in each of the MOH clinical audits; 2011-2013 and 2021-2022. An obstetric registrar, an anaesthetic registrar and a senior midwife were present for 98%, 97% and 98% of MOH cases respectively for the years 2021-2022. This is similar to findings in the 2011-2013 MOH clinical audit. However, an increase in the percentage of the laboratory technician on call being informed increased from 69% in the reporting years 2011-2013 to 90% in the 2021-2022 MOH clinical audit.

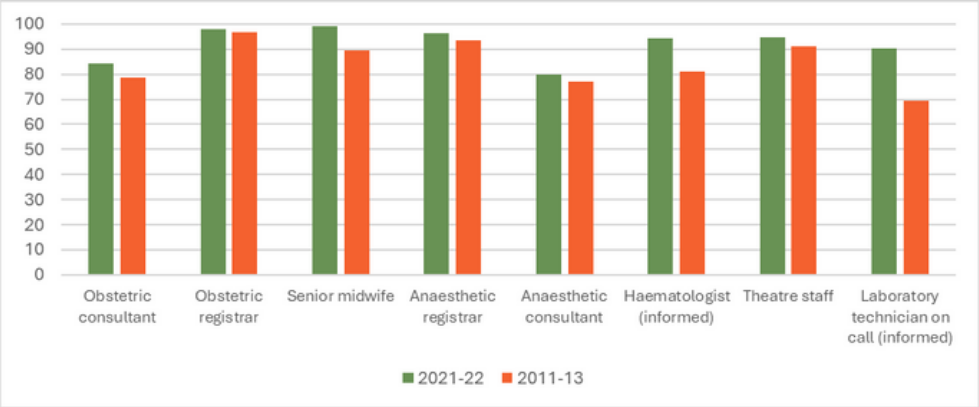


Figure 3. Presence of healthcare professionals during management and care of major obstetric haemorrhage clinical audits, 2021-2022 and 2011-2013.

Note: Percentages illustrated above were calculated after excluding cases where the presence of the healthcare professional was not known.

The presence of healthcare professionals present during the management of an MOH outside standard clinical clinic times (5pm-8am) was also examined. The presence of obstetric registrars, anaesthetic registrars and theatre staff, did not differ according to the time of event. Senior midwives were present at the vast majority of MOHs (98.4% at standard clinical hours; 99.4% out of hours). However, fewer obstetric consultants (79%) and anaesthetic consultants (69%) were present when the MOH event occurred out of hours compared to when the MOH event occurred between 8am and 5pm (91% and 92%) respectively.

Monitoring

Use of an obstetric haemorrhage proforma: Accurate documentation of a delivery with MOH is essential and use of a structured obstetric proforma is recommended.[15]

[14] Drew T, Carvalho JCA. Major obstetric haemorrhage. BJA Educ. 2022 Jun;22(6):238-244. doi: 10.1016/j.bjae.2022.01.002. Epub 2022 Mar 30. PMID: 35614908; PMCID: PMC9125414

[15] Clinical Practice Guideline No 17 (2012). Guideline for the Prevention and Management of Primary Postpartum Haemorrhage: Instituteof Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive

An obstetric haemorrhage proforma was used in over half MOH cases in 2021-2022 (n=222, 63.4%, data missing for 10 cases). Of the 128 (36.6%) of MOH cases where a proforma was not used, it was reported that the woman was managed in theatre (OT), where obstetric proformas were not in use. However, in a small number of cases (n=29) when the woman was not managed in OT and no proforma was used, no reason was documented in 17 cases, an obstetric proforma was not available in 9 cases and in 3 cases various reasons reported included: staffing issue, consultant decision, and MOH not declared.

The value of a scribe in documenting care provided and supporting the overview of management in obstetric haemorrhage events is recommended.[16] A scribe was present in over half of MOH cases (n=221 of 350, 63.1%) during the MOH event (unknown for 10 cases).

A maternity early warning system (MEWS) was used for monitoring 88.9% (n=320) of cases in this 2021-2022 MOH clinical audit. This is higher than the rate of 65.8% identified in the 2011-2013 MOH clinical audit. The increase in use of a MEWS in this more recent MOH audit may be explained by the national implementation of the Irish maternity early warning system (IMEWS) in April 2013.[17]

For almost all MOH patients in 2021-2022 it was reported that regular monitoring of blood pressure, pulse, use of a pulse oximeter, urinary output and use of a Foley urinary catheter was performed (Appendix D, Table C).

Invasive monitoring: The use of a central venous pressure line (n=50, 13.9%) and arterial line (n=178, 49.4%) for monitoring was less frequent in this 2021-2022 clinical audit compared to the 2011-2013 clinical audit where rate of use was 23% and 56% respectively (Appendix D, Table C).

Method for blood loss measurement

Data on the method of blood measurement in 344 of the 360 women experiencing MOH, (excludes 16 cases associated with early pregnancy loss), was available for all but two cases. The method of blood loss measurement, including both visual estimation and direct quantitative measurement, varied according to location of care and are detailed in Appendix D, Table D. Direct quantitative measurement of blood loss was reported in the majority of cases managed in both theatre and in the labour ward (n=281, 97.6% in theatre and n=144, 96.0% in the labour ward).

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

[17]The Irish Maternity Early Warning System 2014. Available at: https://www.hse.ie/eng/services/publications/clinical-strategy-and-programmes/imews-guidelines.pdf

Various aides were used in the quantitative measurement of blood loss (MBL) including the weighing of incontinence sheet, sanitary pads, gauze swabs and under-buttock sheets. Table D in Appendix D provides a detailed breakdown of the frequency with which various methods of quantitative measures were used by location of care and by mode of delivery. The weight assessment of sanitary pads was the most common (60.7%) quantitative method used in the labour ward compared with the weight measurement of gauze swabs being the most common (70.5%) quantitative method used in theatre.

Visual estimation of blood loss (EBL) was reported in just over one quarter (n=40, 26.7%) of MOH cases occurring in the labour ward compared to 18.4 % (n=53) of cases managed in theatre. It was reported that visual aid memoires were available in the labour ward for all MOH cases that involved blood loss measurement by EBL.

Prophylactic use of uterotonic agents

National clinical guidelines at the time of this audit recommended the routine use of prophylactic oxytocin in the management of the third stage of labour.[18] A prophylactic uterotonic agent was administered to 327 (95.1%) of the women who gave birth and experienced MOH in 2021-2022 (Table 7). This is similar to the rate of 94% administered in the 2011-2013 MOH audit (Appendix D, Table E). There was a difference in the specific prophylactic uterotonic agents administered by mode of delivery (Table 7). Over two thirds of the women who gave birth (n=269, 78.2%) received a syntocinon injection with a slightly higher rate being administered following CS versus a vaginal delivery (n=150, 82.0% versus n=119, 73.9% respectively).

A syntocinon infusion was administered twice as often in women delivered by CS (n=86, 47.0%) compared to women delivering vaginally (n=40, 24.8%). Conversely, syntometrine was administered three times more often to women who gave birth vaginally (n=43, 26.7%) compared to women who delivered by CS (n=16, 8.7%). These findings are similar to findings in the 2011-2013 MOH clinical audit.[19]

[18] Clinical Practice Guideline No 17 (2012). Guideline for the Prevention and Management of Primary Postpartum Haemorrhage: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

[19]Greene RA, McKernan J, Manning E, Corcoran P, Byrne B, Cooley S, et al. Major obstetric haemorrhage: Incidence, management and quality of care in Irish maternity units. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2021; 257:114-20.

Table 7: Use of prophylactic uterotonic agents by mode of delivery for women who experienced major obstetric haemorrhage in 2021 and 2022.

	Total Vaginal delivery (N=161)	Total CS (N=183)	Total (N=344)
Oxytocin/Syntocin (5-10 units IM/IV injection)	119 (73.9%)	150 (82.0%)	269 (78.2%)
Syntocinon infusion (40 units)	40 (24.8%)	86 (47.0%)	126 (36.6%)
Syntometrine (5mg)	43 (26.7%)	16 (8.7%)	59 (17.2%)
Tranexamic acid 1g	5 (3.1%)	13 (7.1%)	18 (5.2%)
Prostaglandin F2-alpha (Carboprost/Haemabate)	2 (1.2%)	5 (2.7%)	7 (2.0%)
Misoprostol	1 (0.6%)	5 (2.7%)	6 (1.7%)
Ergometrine (0.5mg IM/IV injection)	0 (0%)	3 (1.6%)	3 (0.9%)
Other type of drug	0 (0%)	2 (1.1%)	2 (0.6%)
No drugs given	2 (1.2%)	15 (8.2%)	17 (4.9%)

Note: More than one prophylactic agent can apply. Data on the use of a prophylactic uterotonic agent excludes 16 cases associated with pregnancy loss in 2021-2022.

Uterotonic agents in treatment of major obstetric haemorrhage

In addition to the prophylactic use of a uterotonic agent, at least one uterotonic agent was used to arrest bleeding in the majority (96.8%) of women experiencing MOH who gave birth in 2021-2022. Table 8 details the use of utertonic agent by mode of delivery and for women whose MOH was associated with uterine atony (data excludes 16 cases associated with early pregnancy loss and data missing for one case). Syntocinon was administered by injection and infusion more commonly in women delivering vaginally (n=52, 32.3% and n=127, 79.0% respectively) compared to women who gave birth by CS (n=52, 28.6% versus n=88, 48.4% respectively). The use of syntocinon, both by injection and infusion, has decreased compared to 2011-2013 MOH clinical audit (Appendix D, Table F).

There was a far higher use of Tranexamic acid in Ireland in 2021-2022 compared to the audit years 2011-2013. Tranexamic acid was administered to 89% of women who had a vaginal delivery compared to just 8% in 2011-2013 (Appendix D, Table F). Similarly, increased use of Tranexamic acid was reported in women who gave birth by CS in 2021-2022 compared to 2011-2013 (81% versus 12% respectively). Conversely there was a reduction in the use of misoprostal in 2021-2022 compared to 2011-2013 for both modes of delivery and in the case of MOH associated with uterine atony, a decrease in use of misoprostal from 76% to 60%.

Table 8: Use of uterotonic agents to arrest the bleeding by mode of delivery and for cases associated with uterine atony in 2021 and 2022.

	Vaginal delivery (N=161)	CS (n=182)*	Uterine Atony (N=150)**
Tranexamic acid 1g	143 (88.8%)	148 (81.3%)	130 (86.7%)
Syntocinon infusion (40 units)	127 (78.9%)	88 (48.4%)	104 (69.3%)
Prostaglandin F2-alpha (Carboprost/Haemabate)	86 (53.4%)	95 (51.1%)	101 (67.3%)
Misoprostol	87 (54.0%)	63 (34.6%)	90 (60.0%)
Oxytocin/Syntocin (5-10 units IM/IV injection)	53 (32.3%)	52 (28.6%)	58 (38.7%)
Ergometrine (0.5mg IM/IV injection)	43 (26.7%)	50 (27.5%)	47 (31.3%)
Syntometrine (5mg)	40 (24.8%)	38 (20.9%)	41 (27.3%)
Other type of drug	4 (2.5%)	6 (3.3%)	7 (4.7%)
No drugs given	3 (1.9%)	8 (4.4%)	3 (2.0%)

Note: More than one uterotonic agent can apply. Analysis data excludes mode of delivery associated with 16 early pregnancy loss. *Use of uterotonic agents not recorded for one case. **Uterine atony was the primary cause of 105 and the secondary cause of 45 MOH cases.

Haemostatic procedures undertaken in women experiencing MOH

Data on manual procedures performed to arrest bleeding was available for 249 of 344 MOH cases that gave birth (excludes 16 cases associated with early pregnancy loss). Considering these 249 cases, the manual procedure of rubbing up the uterus to produce a contraction was performed in two thirds (74.7%) of the women experiencing an MOH and in just under a half (n=109, 43.8%) of the cases a bimanual uterine compression was performed (Table 9).

The incidence of haemostatic surgical procedures performed to arrest bleeding was assessed for 342 of 344 women experiencing MOH who gave birth by mode of delivery (data excludes 16 cases associated with early pregnancy loss). None of the listed procedures were undertaken for 17.8% (n=61) of the women who experienced MOH in Ireland in 2021-2022. There was a difference in the haemostatic surgical procedure by mode of delivery as detailed in Table 9 for 2021-2022 and comparative data with the MOH clinical audit 2011-2013 in Appendix D, Table G.

Table 9: Incidence of manual and surgical haemostatic procedures to arrest the bleeding in 2021 and 2022.

	2021-22		
	Vaginal delivery	CS	Total
Manual procedures	**(N=134)**	**(N=115)**	**(N=249)****
Rubbing up of the Uterus to produce a contraction	111 (82.8%)	75 (65.2%)	186 (74.7%)
Bimanual uterine Compression	61 (45.5%)	48 (41.7%)	109 (43.8%)
Other manual procedures	12 (9.0%)	16 (13.9%)	28 (11.2%)
Surgical Procedures	**(N=161)**	**(N=181)**	**(N=342)*****
Intra-uterine Balloon Tamponade	64 (39.8%)	50 (27.6%)	114 (33.3%)
Manual Evacuation of Placenta	67 (41.6%)	22 (12.2%)	89 (26.0%)
Suturing lacerations (cervical/vaginal)	49 (30.4%)	6 (3.3%)	55 (16.1%)
Laparotomy	3 (1.9%)	35 (19.3%)	38 (11.1%)
Hysterectomy	0 (0%)	33 (18.2%)	33 (9.6%)
Re-suturing of C section uterine incision and/or suturing of lateral extension	0 (0%)	25 (13.8%)	25 (7.3%)
Intra-myometrial carboprost	1 (0.6%)	16 (8.8%)	17 (5.0%)
Haemostatic brace uterine suturing	1 (0.6%)	16 (8.8%)	17 (5.0%)
Bilateral ligation of uterine arteries	0 (0%)	5 (2.8%)	5 (1.5%)
Other type of surgical procedure	13 (8.1%)	29 (16.0%)	42 (12.3%)
No surgical procedures undertaken	29 (18.0%)	32 (17.7%)	61 (17.8%)

Note: more than one procedure might apply therefore values are not mutually exclusive. ** Data not available for 95 of the 344 women who gave birth (excludes 16 MOH cases associated with early pregnancy loss). ***Data not available for two of the 344 women who gave birth.

Overall intra-uterine balloon tamponade was the most common haemostatic surgical procedure undertaken for approximately one third (n=114, 33.3%) of women experiencing MOH (n=64, 39.8% following vaginal delivery and n=50, 27.6% in women who gave birth by CS). This is similar to findings in the 2011-2013 MOH clinical audit (Appendix D, Table G).

Other common haemostatic surgical procedures performed in women following a vaginal delivery included manual removal of placenta/retained tissue (n=67, 41.6%), suturing of vaginal/cervical lacerations (n=49, 30.4%).

In contrast, common haemostatic surgical procedures performed in women who gave birth by CS included laparotomy (n=35, 19.3%) and peripartum hysterectomy (n=33, 18.2%) (Table 9). Further, some haemostatic procedures performed on women who gave birth by CS were associated with the CS surgery, 13.8% (n=25) of the women had re-suturing of the CS uterine incision and/or suturing of lateral extension.

Contributors across units were asked to report the timing and estimated blood loss at time of haemostatic procedures in order to assess the efficacy of specific treatment approaches. However, many units reported that the timing of treatment approaches (specifically the use of uterotonic agents and haemostatic procedures) were not documented in the clinical records during the MOH event in a significant number of cases. This reflects the quality of documentation on interventions that could inform quality of care and efficacy of therapeutic and medical procedures in the management of MOH at local and national level.

The measured blood loss for women experiencing MOH involving the intra-uterine balloon tamponade as the first haemostatic intervention ranged from 1,500 mls to 5,500 mls (M=2524.9, SD=706.6, data on blood loss at time of procedure was not recorded for 22 cases). Ultimately, six women who gave birth by CS and had an intrauterine balloon inserted underwent a hysterectomy (Table 10).

Seventeen (5%) women experiencing MOH underwent haemostatic brace uterine suturing (e.g. B-Lynch) of which six subsequently had a hysterectomy (Table 10). Six of the 17 women who had haemostatic brace uterine suturing, underwent it as a first procedure to manage MOH. The measured blood loss at time of procedure was recorded for only three of these six cases and ranged from 2,000 mls to 2,922 mls.

Peripartum hysterectomy

Thirty-three (9.6%) of the 342 women who gave birth and experienced an MOH (data missing for two cases) in 2021-2022 required a peripartum hysterectomy (PH). All 33 women were delivered by CS (Table 9).

In over half (n=20, 60.6%) of these 33 cases, PH was carried out as the first haemostatic procedure to manage MOH of which placenta praevia or PAS was the most reported cause of MOH (15% and 70% respectively). Information on the measured blood loss at procedure was available for 12 of these 20 cases; the blood loss ranged from 2,000mls to 9,000mls (M=3978.8, SD=2244.8).

Table 10 details the incidence of haemostatic surgical procedures to arrest bleeding in women experiencing MOH that ultimately required a PH.

Table 10: Incidence of haemostatic surgical procedures to arrest bleeding in MOH cases that ultimately required a peripartum hysterectomy (PH), 2021-2022.

Haemostatic procedure performed prior to PH	Required a PH N=33
None	20
Intrauterine balloon tamponade	6
Intra-myometrial carboprost	4
Haemostatic brace uterine suturing	6
Bilateral ligation of uterine arteries	1
Manual evacuation of placenta	1
Laparotomy	8
Other	2

Note: More than one procedure can apply.

Resuscitation, blood tests and blood transfusion

Actions undertaken related to the resuscitation of the MOH patients in 2021-2022 are detailed in Table C in Appendix D. For the vast majority (n=330, 91.7%) venous access was obtained prior to the MOH event, two large venous cannulae were sited in 75.3% (n=271) of cases and oxygen given in 61.4% (n=221) of cases. This is in keeping with recommended clinical practice.

A full blood count was taken during the MOH event in almost all (339 of 357, 95.0%) of MOH cases (missing data n=3). In the majority (92.4%) of MOH cases a clotting screen (e.g PT, PTTT, thrombin time) was taken prior to transfusion (or during the MOH event if no transfusion was given).

The vast majority (n=326 of 358, 91.1%) of women experiencing an MOH received a blood transfusion (missing data n=2), and the number of units transfused ranged from one to 20 units. Types of blood transfusions and the range of units transfused are detailed in Table 11. It was most common for Cross-matched blood (n=300, 83.8%) to be transfused and the number of units transfused ranged between one and 20. No women were reported to have refused a blood transfusion.

Data on the transfusion of 'Other Blood Products' with coagulation factor in 2021-2022 is also detailed in Table 11. Fibrinogen Concentrate was more commonly transfused in MOH cases (n=196, 54.7%) followed by Fresh Frozen Plasma (FFP; n=96, 26.8%).

Blood salvage was only attempted in a small number (n=15, 4.2%) of the 358 MOH cases with available data in the 2021-2022 MOH clinical audit. Notably, blood cell salvage is not available in all Irish units and as such cannot be considered a comparable management option for MOH across all Irish maternity units.

Table 11: Type of transfusion and units transfused in cases of major obstetric haemorrhage in 2021 and 2022.

	N=358* N(%)	Range of units transferred
Blood Transfusion	326 (91.1%)	
Emergency O neg	50 (14.0%)	1-10
Group specific uncross-matched blood	23 (6.4%)	1-11
Cross-matched blood	300 (83.8%)	1-20
Other Blood Products		
Fibrinogen Concentrate	196 (54.7 %)	1 - 23, 68**
Fresh Frozen Plasma (FFP)	96 (26.8%)	1-15
Platelets	57 (15.9 %)	1-6
Octoplas	57 (15.9 %)	1-16
Activated Factor VII	1 (0.3%)	8

Note: % of blood transfusions and blood products transfused are not mutually exclusive. *Data on blood transfusion not recorded for two of the 360 cases; **One case with severe coagulopathy received 68 units of fibrinogen concentrate

Haemoglobin levels

Of the 360 MOH cases, 98.3% (n=354) had a haemoglobin (Hb) level reported prior to or during the event. The mean level was 11.9 g/l (SD= 1.4, range 6.9 g/l to 16.5 g/l) and 11.9% (n=42) of women were found to be anaemic (Hb <10.5 g/l).
The Hb level after management of the event was reported for 357 (99.2%) of the women experiencing MOH. The mean Hb after management of MOH was 9.1 g/l (SD = 1.5, range 6.1 g/l to 14.2 g/l) and 80.1% (n=286) were anaemic Hb <10.5 g/l

Major obstetric haemorrhage associated with placenta praevia and accreta

It has been identified that women with placenta praevia/accreta are at very high risk of major post-partum haemorrhage. In total, one or both risk factors were known or suspected for 53 (15.4%) of 344 women who gave birth experiencing MOH (excludes 16 cases associated with early pregnancy loss). Management details of these cases are detailed in Table 12. An action plan was recorded in the clinical records for most of these high-risk pregnancies (n=41, 80.4%) which was adhered to in 87.8% (n=36) cases.

Elective caesarean section was planned for the majority (n=47, 88.7%) of suspected placenta praevia /accreta cases and an obstetric consultant was present at the delivery in 92.3% (n=48) of cases. Interventional Radiology (IR) was used in just 9.4% (n=5) of these 53 high risk cases.

Overall, of the 344 MOH cases, IR was performed in nine (2.6%) cases. For most cases where IR was not used, it was reported that IR was not available in the maternity unit. Notably, IR is not available in all Irish units and as such cannot be considered a comparable treatment/management of MOH across all Irish maternity units.

Table 12: Management of major obstetric haemorrhage cases with known placenta praevia and/or suspected placenta accreta

	2021 and 2022 (N=53)
Action plan recorded (N=51)	41 (80.4%)
Action plan adhered to (N=41)	36 (87.8%)
Elective caesarean section planned (N=53)	47 (88.7%)
Obstetric consultant present at delivery (N=52)	48 (92.3%)
Interventional radiology undertaken	5 (9.4 %)

Section 3

Section 3 describes quality of care during the MOH event, formal debriefing following the event, quality of documentation and learning points reported by maternity units. Findings are based on the data submitted to the supplementary detailed MOH clinical audit on the care of **360** women experiencing MOH (missing detailed data from one tertiary referral unit with 30 MOH cases).

Quality of care

The detailed MOH questionnaire requests each maternity unit to self-assess lessons to be learnt from the care given in each case of MOH. Data on the classification of management was available for 347 of 360 (96.4%) cases Appendix D, Table H. For the majority of MOH cases (n=300 of 347, 86.5%) it was reported that the case was well managed and clinical care was appropriate. In 10.4% (n=36) of cases, incidental suboptimal care was reported which did not affect the outcome but where lessons could be learned. There were nine cases (2.6%) where the management of the case was described as suboptimal impacting on the outcome and in two cases (0.6%) major suboptimal care and management was reported which contributed significantly to morbidity. These viewpoints were either based on consensus at a risk management meeting (n=140, 40.3%), clinical case presentation (n=65, 18.7%), informal clinical discussion (n=40, 11.5%) or the audit contributor's own opinion (n=104, 30%).

It was encouraging to notice that regardless of the time of the event, the occurrence of MOH cases recording delay in accessing theatre was rare (1 case occurring within standard clinical hours and 2 cases out of hours).

National clinical guidelines recommend that all maternity units have a protocol for the management of PPH.[20] For almost all MOH cases (n=330 of 344, 95.9%, data missing for 16 cases), it was stated that the maternity unit had a protocol for the management of MOH. In the majority of cases with available data (n=308 of 327, 94.2%), it was reported that the management of the MOH case adhered to the unit's protocol.

Formal debriefing following an MOH event

A MOH event can be traumatic for the woman experiencing an MOH, her partner and for staff caring for the woman. For most women experiencing an MOH (n=321, 90.2%, missing data for 4 cases) in this 2021-2022 MOH clinical audit a formal debriefing was offered.

Data on whether staff were offered formal debriefing/counselling support following an MOH event was not recorded in the clinical records for almost half (n=176 of 354, 49.7%) of the cases in this 2021-2022 MOH clinical audit. Of the available documented data (n=354, missing data for six cases), only one in five (n=77, 21.8%) of staff members were

[20]Clinical Practice Guideline No 17 (2012). Guideline for the Prevention and Management of Primary Postpartum Haemorrhage: Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and Directorate of Strategy and Clinical Programmes, Health Service Executive.

offered formal debriefing/counselling support following the MOH event. This is perhaps a missed educational opportunity for members of the multidisciplinary team, particularly for junior staff who may not have the opportunity to attend risk management or senior case review meetings.

Quality of documentation

Accurate documentation of an MOH event is essential for local and external MOH case review, audit of serious incidences and debriefing of women experiencing MOH. As mentioned earlier, a specific obstetric proforma was used in 63.4% of MOH cases in this 2021-2022 national clinical audit. Units were specifically asked to assess the quality of documentation in the clinical records of reported MOH cases. In under half (n=155, 44.4%, missing data n=11) of the MOH cases, documentation was reported as excellent, easy to follow, entries signed and timed. In 45.3% (n=158) of cases documentation was reported as good, clear though some gaps. However, in 9.7% cases (n=34) it was reported that documentation was only fair with some entries not timed or signed and in just two cases (0.6%) documentation was poor with major omissions (Table I, Appendix D).

Notably, many maternity units reported that the timing of treatment approaches (specifically the use of uterotonic agents and or haemostatic procedures) were not documented and similarly the estimation of blood loss at these interventions in many of the clinical records were not documented. This could be addressed by using a structured obstetric proforma which would improve the learning from MOH events and inform clinical audit, at local and national level, on the efficacy of pharmaceutical and operative interventions. Again, a lost opportunity for learning from the management of MOH events.

Summary of learning points described by units

Many reporting maternity units described examples of both good practice and learning points gleaned in the assessment of individual MOH cases in this clinical audit. Recurrent reported themes, varied across units, and are summarised in Table 13.

Most maternity units highlighted the critical need for ongoing multidisciplinary team (MDT) skills and drills educational programs in their action plans following MOH case review. The importance of regular MDT training sessions was reported by units as not only necessary to enhance individual competencies but also to foster effective communication and teamwork to ensure continuous improvement in patient care.

Table 13: Recurrent themes identifying positive practice and learning points.

Positive practice	Learning point
Early identification of MOH and appropriate escalation of care	Resource issues (out of hours)
Multidisciplinary approach with good interdisciplinary communication	Suboptimal interdisciplinary communication
Senior presence during MOH event	Poor documentation in relation to timing of drugs and estimated blood loss at time at time of proceedure
Adherence to local protocols/guidelines	No availability of scribe to document interventions during the MOH event
Clear management plans recorded in the clinical notes	

Appendix A: Hospital co-ordinators and contributors 2021/2022

Hospital	Co-ordinators	Additional contributors
Cavan General Hospital	Dr Tabassum Aman	Ms Karen Malocca
Coombe Hospital	Ms Julie Sloan	Dr Bridgette Byrne
Cork University Maternity Hospital	Ms Clare Buckley Ms Ciara Archer Ms Doireann Cuddihy	Prof Richard Greene Dr Aoife Morris
University Hospital Kerry	Ms Mary Stack Courtney	Ms Sandra O'Connor
University Maternity Hospital Limerick	Dr Consol Plans Dr Clare Crowley Dr Mendinaro Imcha Dr Nyan Chin Liew	Ms Fiona Sampson
Letterkenny University Hospital	Ms Mary Lynch	Ms Evelyn Smith Ms Marion Doogan Ms Alison Johnston Ms Lorna Sweeney
Mayo University Hospital, Castlebar	Ms Mary Devers Ms Jacinta Byrne	Dr Hilary Ikele Ms Andrea McGrail
Regional Hospital, Mullingar	Ms Marie Corbett Ms Kathryn Woods Ms Karen Wilson	Ms Maureen Revilles
Midland Regional Hospital, Portlaoise	Ms Emma Mullins Ms Melanie Adams Ms Yvonne Young	Ms Ita Kinsella
National Maternity Hospital	Prof Mary Higgins Ms Samantha Vega Figueroa Ms Cassandra Herron	Ms Eve Blake Mr Philip Mulvey Ms Fionnuala Byrne
Our Lady of Lourdes Hospital, Drogheda	Ms Laura Muckian	
Portiuncula University Hospital, Ballinasloe	Ms Sheila Melvin	Ms Melinda O'Rourke
Rotunda Hospital, Dublin	Dr Maria Kennelly Dr Enya Fullston Ms Ruth Richie	
Sligo University Hospital	Ms Geraldine O Brien	Ms Juliana Henry
Tipperary University Hospital	Ms Mary O' Donnell Ms Maggie Dowling	
St Luke's Hospital, Kilkenny	Ms Kayla Thornton Ms Anne Margaret Hogan Ms Cathriona Dooley	
University Hospital Galway	Ms Louise Fitzpatrick Ms Sadhlog Ni Chuala	
University Hospital Waterford	Ms Janet Murphy	
Wexford General Hospital	Ms Emily Moffatt Ms Norma Doyle	Ms Helen McLoughlin

Appendix B: Severe Maternal Morbidity group membership

- **Prof. Richard Greene,** Consultant Obstetrician/Gynaecologist, Cork University Maternity Hospital Chair, Director of the National Perinatal Epidemiology Centre.
- **Dr. Miriam Brennan,** Lecturer in Midwifery, School of Nursing and Midwifery, University of Galway.
- **Dr. Bridgette Byrne,** Consultant Obstetrician & Gynaecologist, Coombe Women & Infants University Hospital, Dublin. Nominated by the Institute of Obstetricians & Gynaecologists, RCPI.
- **Ms. Siobhan Canny**, Group Director of Midwifery, Saolta Group. Nominated by Lead Midwife NWIHP.
- **Ms. Catriona Carr,** Advocacy Team Lead, Patient Advocacy Service.
- **Ms. Alexandria Collins,** Advocacy Team Lead, Patient Advocacy Service.
- **Dr. Paul Corcoran** PhD, Epidemiologist, National Perinatal Epidemiology Centre.
- **Ms. Georgina Crowe,** Director of Midwifery, Cavan General Hospital Nominated by Lead Midwife NWIHP.
- **Dr. Deirdre Daly** PhD, Associate Professor in Midwifery, Trinity College Dublin. Nominated by Deputy Nursing Services Director, HSE.
- **Prof. Mary Higgins,** Consultant Obstetrician & Gynaecologist, National Maternity Hospital, Holles Street, Dublin 2 Nominated by the Institute of Obstetricians & Gynaecologists, RCPI.
- **Ms. Claire Jones,** Patient Representative.
- **Dr. Maria Kennelly**, Consultant Obstetrician & Gynaecologist, Rotunda Hospital.
- **Ms. Janet Murphy**, Advanced Midwife Practitioner, Waterford Regional Maternity Hospital. Nominated by Deputy Nursing Services Director, HSE.
- **Ms. Edel Manning**, Research Midwife, National Perinatal Epidemiology Centre, Severe Maternal Morbidity Audit Project Manager.
- **Dr. Cliona Murphy,** Consultant Obstetrician & Gynaecologist, Coombe Women & Infants University Hospital, Dolphins Barn, Dublin 8 Nominated by the Institute of Obstetricians & Gynaecologists, RCPI.
- **Dr. Terry Tan,** Consultant Anaesthetist, Coombe Women & Infants University Hospital, Nominated by The College of Anaesthesiologists.

Appendix C: NPEC Governance committee members

- **Chair: Dr. Michael Robson**, Consultant Obstetrician and Gynaecologist, National Maternity Hospital.
- **Dr. Linda Biesty,** Senior lecturer in Midwifery at the School of Nursing & Midwifery, University of Galway.
- **Ms. Marie Cregan,** Patient Representative, University College Cork Georgina Cruise, Patient Representative, Patient Advocacy Service.
- **Ms. Marina Cronin,** NOCA Head of Quality & Development, National Office of Clinical Audit.
- **Professor Sean Daly,** Master, The Rotunda Hospital Angela Dunne, National Lead Midwife, National and Infants Health Programme (NWIHP).
- **Ms. Faye Ferris**, Student Midwifery Representative.
- **Dr. Geraldine Gaffney**, Senior Lecturer, National University of Ireland, Galway.
- **Professor Richard Greene,** Consultant Obstetrician & Gynaecologist, Cork University Maternity Hospital, Director of the National Perinatal Epidemiology Centre.
- **Professor Shane Higgins**, Master, The National Maternity Hospital.
- **Dr. Heather Langan**, Consultant Obstetrician and Gynaecologist, Sligo General Hospital.
- **Professor Eleanor Molloy,** Professor of Paediatrics & Child Health, TCD, Faculty of Paediatrics Representative.
- **Dr. Cliona Murphy,** Clinical Director, National and Infants Health Programme (NWIHP).
- **Ms. Denise Malone/ Ms. Jo Delaney** co-chairs of the national Designated Midwifery Officer Group - Home Births.
- **Ms. Lilian Mudoti,** Post Grad Student, Midwifery Representative.
- **Dr. Oladayo Oduola,** JOGS Committee Member Dr Michael O'Connell, Master, Coombe Women & Infants University Hospital.
- **Dr. Mary O'Mahony,** Specialist in Public Health Medicine, HSE Margaret Quigley, National Lead for Midwifery ONMSD, HSE.

Appendix D

Table A: Case criteria met for major obstetric haemorrhage and women receiving treatment for coagulopathy in 2021 and 2022.

Case criteria met	N	%
Estimated blood loss ≥ 2500ml	141	36.15
Estimated blood loss ≥ 2500ml and transfused ≥ 5 units of blood	5	1.28
Estimated blood loss ≥ 2500ml and received treatment for coagulopathy	144	36.92
Estimated blood loss ≥ 2500ml and transfused ≥ 5 units of blood and received treatment for coagulopathy	90	23.08
Transfused ≥ 5 units of blood	1	0.26
Transfused ≥ 5 units of blood received treatment for coagulopathy	9	2.31
Total	390	100

Table B: Maternal and obstetric characteristics of women who experienced a Major Obstetric Haemorrhage, 2021-2022 and 2011-13.

	2011-13 (N=455)	2021-22 (N=390)
Characteristic	**M (SD)**	**M (SD)**
Maternal age	33.2 (5.5)	34.6 (5.2)
BMI	26.2 (5.4)	27.6 (26.6)
Characteristic[a]	**n (%)**	**n (%)**
Previous pregnancies (>=24weeks)		
0	161 (35.5)	137 (35.1)
1	125 (27.6)	126 (32.3)
2	87 (19.2)	80 (20.5)
>=3	80 (17.7)	47 (12.2)
Maternal age[b]		
<25	-	16 (4.1)
25-29yrs	-	45 (11.5)
30-34yrs	-	118 (30.3)
35-39yrs	-	149 (38.2)
>40yrs	-	62 (15.9)
Ethnicity		
White Irish	297 (65.3)	295 (76.8)
Other White background	47 (10.3)	48 (12.5)
Other (Black, Asian, Traveller, mixed ethnicities)	60 (14.9)	41 (10.6)
Smoking status		
Yes	42 (9.2)	27 (6.9)
No	244 (53.6)	349 (89.7)
BMI (categories)		
Underweight (<18.5)	6 (1.3)	7 (1.8)
Healthy (18.5-24.9)	156 (34.3)	147 (38.8)
Overweight (25.0-29.9)	105 (23.1)	112 (29.6)
Obese (>30.0)	83 (18.2)	113 (29.8)
Multiplicity		
Singleton pregnancy	280 (91.5)	364 (93.3)
Multiples	26 (8.5)	26 (6.7)
Gestation at pregnancy end		
Pre-viable (<22wks)	13 (4.3)	14 (3.6)
Extremely pre-term (22-27wks)	7 (2.3)	10 (2.6)
Very pre-term (28-31wks)	12 (4.0)	14 (3.6)
Moderate/late pre-term (32-36wks)	52 (17.1)	60 (15.4)
Term	217 (71.4)	289 (74.3)
Post-term	3 (1)	2 (0.5)

Notes: [a]missing data 2011-2013: Previous pregnancy (n=2), ethnicity (n=51), smoking status (n=169), BMI (n=105), multiplicity (n=149), gestation at pregnancy end (n=151). Missing data 2021-2022: ethnicity (n=6), smoking status (n=14), BMI (n=11), gestation at pregnancy end (n=1). [b]Data on maternal age not available for 2011-2013.

Table C: Management of major obstetric haemorrhage cases, 2011-13 and 2021-22.

Location of care	2011-2013 N (%)	2021-2022 N (%)
Ward	200 (44%)	109 (30.3%)
Delivery Suite [a]	-	192 (53.3%)
Theatre[a]	-	280 (77.8%)
HDU	65 (15%)	176 (48.9%)
ICU/CCU	162 (35.6%)	100 (27.8%)
Resuscitation		
Venous access prior to the event	419 (93.5%)	330 (91.7%)
Venous access during the event	359 (88.9%)	237 (65.8%)
Two large venous cannulae sited	412 (90.7%)	271 (75.3%)
Oxygen given	397 (87.4%)	221 (61.4%)
Other	-	30 (8.3%)
No resuscitation	-	3 (0.8%)
Monitoring		
A maternity early warning system*	291 (65.8%)	320 (88.9%)
BP monitored (4+ times per hour)	445 (99.1%)	354 (98.3%)
Pulse monitored (4+ times per hour)	445 (99.1%)	347 (96.4%)
Pulse oximeter used	439 (98.4%)	348 (96.7%)
Foley catheter in situ	448 (99.6%)	354 (98.3%)
Urine output measured regularly	435 (96.7%)	327 (90.8%)
Central venous pressure line	102 (23%)	50 (13.9%)
Arterial line	249 (56%)	178 (49.4%)
Other	-	15 (4.2%)

Note: More than one location of care, method of resuscitation and monitoring may apply. *A national roll-out of the Irish Maternity Early Warning System (IMEWS) chart in obstetric care was introduced nationally in 2013, though some units would have used this system locally before that date

[a]Not captured in the 2011-13 data.

Table D: Method for blood loss measurement in cases of major obstetric haemorrhage in 2021-22 by location of care and mode of delivery.

	Vaginal delivery (N=109)	Operative Vaginal delivery	Elective CS (N=75)	Emergency CS (N=108)	Total (N=342)
IN THE LABOUR WARD	84 (80.0%)	47* (83.9%)	1 (1.3%)	18 (16.7%)	150* (43.9%)
Visual estimation	**28 (33.3%)**	**7 (14.9%)**	**0 (0%)**	**5 (27.8%)**	**40 (26.7%)**
Direct quantitative measurement (vol./weight assess.)	**80 (95.2%)**	**46 (97.9%)**	**1 (100%)**	**17 (94.4%)**	**144 (96.0%)**
Sanitary Pad	49 (58.3%)	29 (61.7%)	1 (100%)	12 (66.7%)	91 (60.7%)
Gauze Swabs	39 (46.4%)	26 (55.3%)	1 (100%)	9 (50.0%)	75 (50.0%)
Tampon or similar	12 (14.3%)	15 (31.9%)	0 (0%)	0 (0%)	27 (18.0%)
Inco sheet or similar	75 (89.3%)	36 (76.6%)	1 (100%)	16 (88.9%)	128 (85.3%)
Under buttocks sheets	44 (52.4%)	34 (72.3%)	1 (100%)	8 (44.4%)	87 (58.0%)
25x25 Swabs	23 (27.4%)	17 (36.2%)	1 (100%)	8 (44.4%)	49 (32.7%)
Kidney Dish	17 (20.2%)	11 (23.4%)	0 (0%)	3 (16.7%)	31 (20.7%)
Measurement of floor spills	17 (20.2%)	11 (23.4%)	0 (0%)	5 (27.8%)	33 (22.0%)
Other	4 (4.8%)	2 (4.3%)	0 (0%)	0 (0%)	6 (4.0%)
IN THEATRE	80 (76.2%)	35 (62.5%)	74 (98.7%)	99* (91.7%)	288* (84.2%)
Visual estimation	**9 (11.3%)**	**6 (17.1%)**	**14 (18.9%)**	**24 (24.2%)**	**53 (18.4%)**
Direct quantitative measurement (vol./weight assess.)	**77 (96.3%)**	**34 (97.1%)**	**74 (100%)**	**96 (97.0%)**	**281 (97.6%)**
Sanitary Pad	21 (26.3%)	7 (20.6%)	18 (24.3%)	29 (29.0%)	75 (26.0%)
Gauze Swabs	44 (55.0%)	20 (58.8%)	58 (78.4%)	81 (81.0%)	203 (70.5%)
Tampon or similar	13 (16.3%)	5 (14.7%)	7 (9.5%)	9 (9.0%)	34 (11.8%)
Inco sheet or similar	50 (62.5%)	18 (52.9%)	44 (59.5%)	63 (63.0%)	175 (60.8%)
Under buttocks sheets	52 (65.0%)	21 (61.8%)	33 (44.6%)	40 (40.0%)	146 (50.7%)
25x25 Swabs	39 (48.8%)	17 (50.0%)	36 (48.6%)	63 (63.0%)	155 (53.8%)
Kidney Dish	13 (16.3%)	8 (23.5%)	21 (28.4%)	29 (29.0%)	71 (24.7%)
Measurement of floor spills	10 (12.5%)	9 (26.5%)	13 (17.6%)	22 (22.0%)	54 (18.8%)
Other	19 (23.8%)	4 (11.8%)	30 (40.5%)	42 (42.0%)	95 (33.0%)

Note: More than one method of blood loss measurement may apply. *Method not recorded for one case in labour ward and one in theatre.

Table E: Use of prophylactic agents by mode of delivery for women who experienced major obstetric haemorrhage cases, 2011-13 and 2021-22.

	2011-2013			2021-22		
	Vaginal delivery (N=146)	CS (N=289)	Total (N=435)	Vaginal Delivery (N=161)	CS (N=183)	Total (N=344)*
Oxytocin/Syntocinon (5-10 units IM/IV injection)	116 (79.5%)	265 (91.7%)	381 (87.6%)	119 (73.9%)	150 (82.0%)	269 (78.2%)
Syntocinon infusion (40 units)	20 (13.7%)	76 (26.3%)	96 (22.1%)	40 (24.8%)	86 (47.0%)	126 (36.6%)
Syntometrine (5mg)	43 (29.5%)	35 (12.1%)	78 (17.9%)	43 (26.7%)	16 (8.7%)	59 (17.2%)
Tranexamic acid 1g	-	-	-	5 (3.1%)	13 (7.1%)	18 (5.2%)
Prostaglandin F2-alpha (Carboprost/ Haemabate)	-	-	-	2 (1.2%)	5 (2.7%)	7 (2.0%)
Misoprostol	6 (4.1%)	16 (5.5%)	22 (5.1%)	1 (0.6%)	5 (2.7%)	6 (1.7%)
Ergometrine (0.5mg IM/IV injection)	9 (6.2%)	11 (3.8%)	20 (4.6%)	0 (0%)	3 (1.6%)	3 (0.9%)
Other type of drug	-	-	-	0 (0%)	2 (1.1%)	2 (0.6%)
No drugs given	-	-	-	2 (1.2%)	15 (8.2%)	17 (4.9%)

Note: More than one prophylactic agent can apply. *Analysis excludes 16 cases associated with pregnancy loss in 2021-2022. CS= caesarean section.

Table F: Use of uterotonic agents in cases of major obstetric haemorrhage by mode of delivery and for cases associated with uterine atony in 2011-13 and 2021-22.

	2011-13			2021-22		
	Vaginal delivery (N=146)	CS (N=282)**	Uterine Atony	Vaginal delivery (N=161)	CS (N=182)*	Uterine Atony (N=150)
Tranexamic acid 1g	12 (8.2%)	35 (12.4%)	21 (12.1%)	143 (88.8%)	148 (81.3%)	130 (86.7%)
Syntocinon infusion (40 units)	135 (92.5%)	253 (89.7%)	168 (96.6%)	127 (78.9%)	88 (48.4%)	104 (69.3%)
Prostaglandin F2-alpha (Carboprost/Haemabate)	84 (57.5%)	125 (44.3%)	123 (70.7%)	86 (53.4%)	93 (51.1%)	101 (67.3%)
Misoprostol	105 (71.9%)	130 (46.1%)	132 (75.9%)	87 (54.0%)	63 (34.6%)	90 (60.0%)
Oxytocin/Syntocinon (5-10 units IM/IV injection)	83 (56.8%)	170 (60.3%)	106 (60.9%)	52 (32.3%)	52 (28.6%)	58 (38.7%)
Ergometrine (0.5mg IM/IV injection)	49 (33.6%)	53 (18.8%)	66 (37.9%)	43 (26.7%)	50 (27.5%)	47 (31.3%)
Syntometrine (5mg)	47 (32.2%)	55 (19.5%)	57 (32.8%)	40 (24.8%)	38 (20.9%)	41 (27.3%)
Other type of drug	-	-	-	4 (2.5%)	6 (3.3%)	7 (4.7%)
No drugs given	-	-	-	3 (1.9%)	8 (4.4%)	3 (2.0%)

Note: More than one uterotonic agent can apply. *Use of uterotonic agents not recorded for one case in 2021-22. [Data for 2021-22 also excludes the 16 pregnancy losses]. **Use of uterotonic agents not recorded for seven cases of CS in 2011-2013. CS= caesarean section.

Table G: Haemostatic procedures undertaken to arrest bleeding for women experiencing major obstetric haemorrhage by mode of delivery (2011-13 and 2021-22).

	2011-13			2021-22		
	Vaginal delivery	CS	Total	Vaginal delivery	CS	Total
Manual procedures	**(N=145)**	**(N=281)**	**(N=426)**	**(N=134)**	**(N=115)**	**(N=249) ****
Rubbing up of the Uterus to produce a contraction	110 (75.9%)	155 (55.2%)	265 (62.2%)	111 (82.8%)	75 (65.2%)	186 (74.7%)
Bimanual uterine Compression	63 (43.4%)	74 (26.3%)	137 (32.2%)	61 (45.5%)	48 (41.7%)	109 (43.8%)
Other manual procedures	-	-	-	12 (9.0%)	16 (13.9%)	28 (11.2%)
Surgical Procedures	**(N=146)**	**(N=284)**	**(N=430)**	**(N=161)**	**(N=181)**	**(N=342) *****
Intra-uterine Balloon Tamponade	55 (37.7%)	77 (27.1%)	132 (30.7%)	64 (39.8%)	50 (27.6%)	114 (33.3%)
Manual Evacuation of Placenta	73 (50.0%)	25 (8.8%)	98 (22.8%)	67 (41.6%)	22 (12.2%)	89 (26.0%)
Suturing lacerations (cervical/vaginal)	65 (44.5%)	10 (3.5%)	75 (17.4%)	49 (30.4%)	6 (3.3%)	55 (16.1%)
Laparotomy	-	-	-	3 (1.9%)	35 (19.3%)	38 (11.1%)
Hysterectomy	1 (1%)	33 (17.5%)	34 (7.9%)	0 (0%)	33 (18.2%)	33 (9.6%)
Re-suturing of C section uterine incision and/or suturing of lateral extension	1 (0.7%)	48 (16.9%)	49 (11.4%)	0 (0%)	25 (13.8%)	25 (7.3%)
Intra-myometrial carboprost	7 (4.8%)	49 (17.3%)	56 (13.1%)	1 (0.6%)	16 (8.8%)	17 (5.0%)
Haemostatic brace uterine suturing	7 (4.8%)	33 (11.6%)	40 (9.3%)	1 (0.6%)	16 (8.8%)	17 (5.0%)
Bilateral ligation of uterine arteries	1 (0.7%)	19 (6.7%)	20 (4.7%)	0 (0%)	5 (2.8%)	5 (1.5%)
Other type of surgical procedure	22 (15.1%)	68 (24.1%)	90 (21.0%)	13 (8.1%)	29 (16.0%)	42 (12.3%)
No surgical procedures undertaken	14 (9.6%)	68 (23.8%)	82 (19.0%)	29 (18.0%)	32 (17.7%)	61 (17.8%)

Note: More than one procedure might apply therefore values are not mutually exclusive. * Data not available for 140 cases (2011-2013). ** Data not available for 95 of the 344 women who gave birth. ***Data not available for two of the 344 women who gave birth. CS= caesarean section.

Table H: Quality of care and management of major obstetric haemorrhage 2021-2022.

Management Case (N=347)	Appropriate care, well managed	300 (86.5%)
	Incidental suboptimal care; lessons can be learned but did not affect final outcome	36 (10.4%)
	Minor suboptimal care; different management may have resulted in a different outcome	9 (2.6%)
	Major suboptimal care; poor management contributed significantly to morbidity	2 (0.6%)
View of the management reached in (N=347)	Risk management meeting	140 (40.3%)
	Clinical case presentation	65 (18.7%)
	Informal clinical discussion	40 (11.5%)
	Your own opinion	104 (30.0%)

Table I: Quality of documentation 2021-2022.

Quality of documentation	N= 349* (%)
Excellent: easy to follow, entries signed and timed	155 (44.4%)
Good: clear, though some gaps	158 (45.3%)
Fair: significant gaps, not all entries signed and timed	34 (9.7%)
Poor: major omissions, many unsigned and untimed entries	2 (0.6%)

Note: *Data on quality of documentation missing for 11 of 360 MOH cases.

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