Maternal, Newborn and Infant Clinical Outcome Review Programme

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

Saving Lives, Improving Mothers' Care

State of the Nation Themed Report

Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths from haemorrhage, amniotic fluid embolism and anaesthetic causes 2019-21 and morbidity following repeat caesarean birth

October 2023

HQIP Healthcare Quality Improvement Partnership
University of Leicester
University of Birmingham
The Newcastle upon Tyne Hospitals NHS Foundation Trust
TIMMS
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Chelsea and Westminster Hospital NHS Foundation Trust
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Oxford Population Health
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Contents

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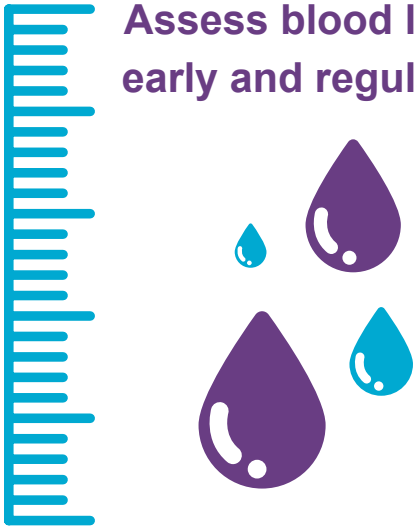
Key messages

from the themed morbidity enquiry report 2023

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

Recognition and management of bleeding

Assess blood loss early and regularly



Don't rely on a single bedside measurement of clotting or haemoglobin

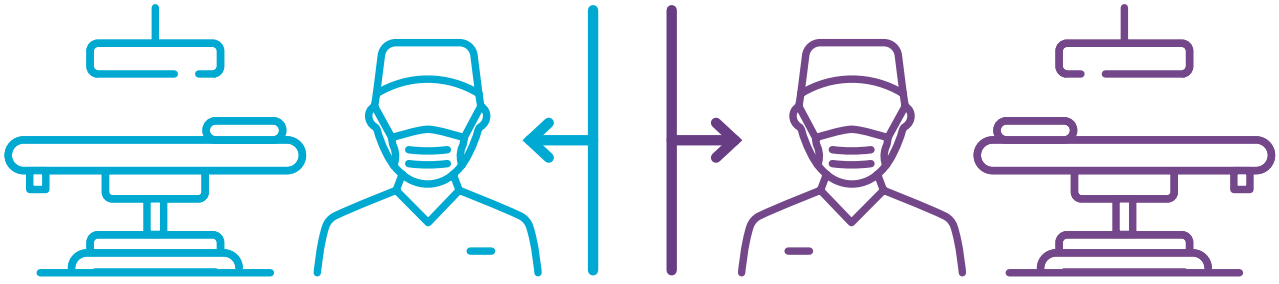
Consider and exclude concealed bleeding

Pulse rate and blood pressure are typically maintained until 30% of circulating volume is lost

A **raised pulse rate** or **drop in blood pressure** should prompt clinical evaluation of blood loss

National recommendation

Manage operating teams for urgent and elective caesarean sections separately



Category 1-3

Category 4

1. Introduction and methods

Important note **NEW FOR 2023.** In accordance with funder requirements, the findings of the MBRRACE-UK Confidential Enquiry into Maternal Deaths and Morbidity (CEMD) are now presented as multiple outputs instead of one report as produced previously. The following outputs are now required to be produced in 2023:

1. An online Data Brief with basic statistics concerning maternal mortality published in advance of the reports. In 2023 this includes information on women who died between 2019 and 2021.
2. A State of the Nation surveillance report with extended details concerning maternal mortality and the characteristics of women who died. In 2023 this includes information on women who died between 2019 and 2021. Online supplementary material with the full data is also available.
3. A State of the Nation themed confidential enquiry report concerning women who died from specific causes and from selected severe morbidities. In 2023 this includes information on women who died from obstetric haemorrhage, amniotic fluid embolism and anaesthetic causes between 2019 and 2021 and women with morbidity following repeat caesarean birth **(THIS REPORT)** and five national recommendations. Online supplementary material is also available.
4. A State of the Nation themed confidential enquiry report concerning women who died from specific causes. In 2023 this includes information on women who died from infection, neurological, haematological, respiratory, endocrine, gastro-intestinal and general surgical causes between 2019 and 2021 and five national recommendations. Online supplementary material is also available.

Together these comprise all the information that was previously included in the single report. Background, aims and scope of work, and details of methods and authors for the sections on different topics are available in online supplementary material at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***.

Key to colour coding

Vignettes concerning the care of women who died are described in blue boxes

Vignettes concerning the care of women who had severe morbidity but survived are described in purple boxes with the character M in the corner M

New national recommendations are presented in purple boxes with the character N in the corner N

All existing guidance requiring improved implementation is presented in green boxes in the online supplementary material for this report NICE 2345

2. National recommendations

1. Update guidance to make certain that category 4 caesarean section lists are managed separately from more urgent caesarean sections to ensure these operations are not delayed to late in the day. **ACTION: National Institute for Health and Care Excellence (NICE)**
2. Update guidance on the use of coagulation tests in the context of obstetric haemorrhage including the timelines for availability and how to interpret these, noting that women should not be inappropriately denied clotting products based on a single measure of coagulation in the face of ongoing haemorrhage. **ACTION: National Institute for Health and Care Excellence (NICE), Royal College of Obstetricians and Gynaecologists, Royal College of Physicians, Obstetric Anaesthetists Association**
3. Review guidance on when to use balloon tamponade to control haemorrhage, how to insert the balloon and inflate it. Resources such as postpartum haemorrhage checklists should include when not to use balloon tamponade and when to abandon it and move on to a different haemostatic technique. **ACTION: National Institute for Health and Care Excellence (NICE), Royal College of Obstetricians and Gynaecologists**
4. Review and revise the service specification for centres providing specialist services for managing abnormally invasive placentation to ensure that all specialist units can provide appropriate equipment, facilities and appropriately skilled personnel in an emergency situation occurring at any time of day or night. **ACTION: NHS England, Scottish, Welsh and Irish governments**
5. Clarify that review of the care of women who return to theatre may provide important safety learning but should not be perceived as a performance metric after caesarean birth, as re-operation may be the appropriate response to control internal haemorrhage. **ACTION: NHS England, Scottish, Welsh and Irish governments**

3. Key messages

Note that more in-depth analysis is available at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***

3.1 Obstetric haemorrhage and amniotic fluid embolism

3.1.1 The women who died

In the UK and Ireland there were 17 women who died from obstetric haemorrhage during or up to six weeks after the end of pregnancy in 2019-21 (Table 1). A further woman died several weeks after a placental abruption. This represents an overall mortality rate of 0.80 per 100,000 maternities (95% CI 0.48-0.1.27). This is an increase from the last triennium, although not statistically significantly so (RR 1.39, 95% CI 0.65- 3.02). Twelve women (67%) died after a caesarean birth.

Eight women died in the UK following an amniotic fluid embolism, a rate of 0.36 per 100,000 maternities (95% CI 0.15-0.70). Five of the women died followed induction of labour and three further women died after a caesarean section. Six of the women died on the day of giving birth and two further women died within three days of giving birth. One of these women was admitted to intensive care after initial resuscitation but subsequently died.

There was sufficient information to assess care for all 26 women who died. Assessors felt that different care might have made a difference to outcome for 16 women (62%).

Table 1: Direct deaths by type of obstetric haemorrhage 1994-2021

Time period	Placental Abruption	Placenta Praevia / accreta	Postpartum haemorrhage		Uterine inversion	Total deaths from haemorrhage	Direct haemorrhage death rate per 100,000 maternities	
			Atony	Genital Tract Trauma			Rate	95% Confidence Interval (CI)
1994-6	4	3	5	5	0	17	0.77	0.45-1.24
1997-99	3	3	1	2	0	9	0.42	0.19-0.80
2000-2	3	4	10	1	0	18	0.9	0.53-1.42
2003-5	2	3	9	3	0	17	0.8	0.47-1.29
2006-8	2	2	3 +1	(0/1)	1	9	0.39	0.18-0.75
2009-12†	2	1	7	7	0	17	0.49	0.29-0.78
2013-15†	3	9	9	1	0	22	0.88	0.55 - 1.33
2016-18†	3	3	2	4	2	14	0.58	0.32 – 0.97
2019-21†	4	6*	4	4	0	18	0.80	0.48 – 1.27

†Figures for UK and Ireland. All other figures are UK only.

*2 placenta praevia alone, 4 accreta/increta/percreta

3.1.2 Overview of care and new national messages

Systems under pressure

A woman with a previous caesarean birth was booked for an elective repeat caesarean at term. She was admitted in spontaneous labour 12 hours following rupture of membranes, two days before her planned caesarean date. She was seen on the ward and counselled and she agreed to a trial of vaginal birth and augmentation. However, the labour ward was busy and she did not commence oxytocin. She was reviewed again in the late evening and there was a decision not to start oxytocin until the following day as her membranes had been ruptured for less than 24 hours. The following morning she was contracting and complained of pain, including scar pain. A decision was made at the morning ward round for a category 3 caesarean birth. Due to a busy labour ward, and prioritisation of category 4 caesarean sections, she was transferred to theatre more than 12 hours later, in the late evening. Thirty minutes after her caesarean birth she had a massive obstetric haemorrhage and was transferred back to theatre. Further uterotonics were given and a Bakri balloon inserted along with a vaginal pack. She continued

to bleed but there were delays in administering blood products, delays in calling senior obstetric staff, delays in them attending and a subtotal hysterectomy was carried out several hours later. Shortly following the procedure, she had a cardiac arrest and could not be resuscitated.

There was evidence of a maternity system under pressure in the care of many women who died. In particular, assessors observed that complex category 3 caesarean births were frequently undertaken late in the evening, with category 4 caesarean births and elective procedures prioritised during the day. Elective and emergency caesarean lists were not managed separately. In many instances, as in this woman's care, this led to a need for rescue surgery and additional staff being called in overnight, with consequent delays. Delays in blood product administration for this woman were compounded by a refusal by the haematology department to issue further blood products at the time of her hysterectomy.

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

Point of care coagulation testing

A morbidly obese primigravid woman was admitted at term with a history of prolonged rupture of membranes and irregular contractions. She was tachycardic and dehydrated with a raised BP. She was commenced on IV fluids and antibiotics. Her BP settled without treatment but a few hours later her urinary protein was reported to be raised and she had symptoms of pre-eclampsia. She remained oliguric over the next day and did not progress in labour. She had evidence of acute kidney injury. She had an emergency caesarean birth with a major obstetric haemorrhage. After 30 minutes in recovery, she was noted to be bleeding again and returned to theatre. Repeated attempts were made to place a Bakri balloon followed by a brace suture to control haemorrhage. Despite a measured blood loss of five litres, haematology advised that fibrinogen concentrate should not be given because of a normal point of care coagulation test. A decision was made to undertake a hysterectomy. Two consultant gynaecologists were contacted but were unable to reach the hospital in time to assist. Following the hysterectomy, the woman continued to deteriorate and died.

This woman underwent a complex caesarean birth with signs of sepsis late in the day. Assessors felt she was unlikely to have a vaginal birth following her admission with prolonged rupture of membranes, pre-eclampsia, meconium, a raised BMI and suspected sepsis, and that a caesarean birth earlier in the day should have been offered. It is unclear whether a high workload influenced this decision but inducing labour allowed her to become sicker overnight. In the presence of infection a prolonged attempt at labour will have increased her risk of a postpartum haemorrhage. Also, similar to the previous woman, she was denied appropriate clotting products when she had clearly had a massive haemorrhage. Haematology staff should be aware that haematological decline in women undergoing obstetric haemorrhage can be very rapid and life threatening; early intervention is essential. Assessors noted that several women were similarly denied fibrinogen or cryoprecipitate on the basis of an apparently normal point of care coagulation test, or because laboratory measures of coagulation were not available in a timely fashion.

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

Bakri balloon use

As in the care of the woman described above, repeated attempts to control haemorrhage using a Bakri balloon were made in many of the women who died from haemorrhage after a caesarean birth. Balloons were inserted incorrectly, use was attempted inappropriately, persisting haemorrhage with a balloon in place was not recognised, and there was evident uncertainty and delay in when to abandon the technique and move on.

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

Specialist care for women with abnormally invasive placentation

Following a diagnosis of abnormal placentation, the care of several women who died was noted to be fragmented. Care moved between local hospitals and specialist centres designated for abnormally invasive placenta specialist care, with gaps in communication and neither able to provide the care women needed at the moment they needed it.

A woman with a complex abnormally invasive placenta underwent a planned caesarean section at a specialist centre based in a stand-alone maternity unit. There were unanticipated difficulties with the surgery. Due to the standalone location, facilities and specialist staff, such as vascular surgery, were not available. She died from uncontrolled haemorrhage.

A woman in her second pregnancy after a previous caesarean birth was noted to have a placenta praevia. No suspicion of abnormal placentation was seen on ultrasound but a planned MRI scan was not carried out. She was not referred to a specialist centre. At a planned caesarean birth at 39 weeks the placenta was found to be adherent and was removed piecemeal. She had a massive obstetric haemorrhage which was thought to have been controlled with balloon tamponade. She collapsed 15 minutes after returning to a room on the delivery unit for post-operative care. She was returned to theatre and after discussion between three consultants, a hysterectomy was carried out. She was going to be transferred to intensive care following the procedure however there was a disagreement among the staff and intensive care were 'tight' for beds. She remained on labour ward despite there being no midwives trained in enhanced care. M

It was evident that services for women with abnormally invasive placentation still vary widely. Specialist services were introduced in England in 2019 and most women were referred for specialist care. However, there was evidence of many similar recurring messages concerning their care in both the mortality and morbidity enquiries despite introduction of this specialist service. Of particular concern, there was evidence of a lack of advanced surgical skills, for example in carrying out caesarean hysterectomy, a lack of availability of appropriately trained midwives, and specialist services lacking all the required facilities and specialties to manage women with complex abnormally invasive placentation on a 24-hour basis. Pathways to ensure women requiring urgent care can reach appropriate specialist units are needed as centralisation of services means that skilled personnel may not be available in local centres.

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

3.1.3 Recurring lessons to be learned

The assessors noted that in general there was improved accuracy in the assessment of estimated blood loss. However, there was still some evidence of underestimation and underappreciation of relative blood loss in women with a low BMI (Knight, Bunch et al. 2020b). Development of charts or infographics for volume loss related to the women's weight could facilitate rapid recognition and improvement in care. Assessors emphasised the importance of multidisciplinary team training to ensure optimal postpartum haemorrhage prevention, recognition and management (Royal College of Obstetricians and Gynaecologists 2016a, Knight, Bunch et al. 2020b). Electronic records

sometimes appeared to be challenging to access and assess in emergencies, and the models varied across trusts. Assessors noted several opportunities for better visual cues by enhancing warning signs and red flags within different electronic systems.

As has previously been highlighted, concerns were raised about misoprostol use, dosage and lack of appropriate formulations with a certified manufacture process. Current practice includes local, non-pharmacist preparation of tablets and suspensions, as well as off-label use of dinoprostone pessaries. These practices increase the risk of adverse events such as overdosage and uterine rupture, while there is also potential for women not to receive the appropriate treatment dose. Appropriate dosage and preparation should be available in all units.

Several women with known abnormally invasive placentation died following caesarean births at 37 weeks or greater gestation. The Royal College of Obstetricians and Gynaecologists' guidance emphasises that women with known or suspected placenta accreta should have a caesarean birth planned for prior to 37 weeks (Royal College of Obstetricians and Gynaecologists 2018). The importance of this practice of early delivery needs to be emphasised. Assessors also noted several examples of allocation of monitoring tasks to staff lacking relevant training and equipment, such as midwives on delivery wards being asked to undertake postoperative monitoring of women following complex surgical procedures. This indicates the need for additional staff expertise and training.

Further detail of the existing guidance requiring enhanced implementation and underpinning evidence is available in supplementary material at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***

3.2 Anaesthetic care

Supporting evidence available as supplementary material at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***

3.2.1 The women who died

Deaths in association with obstetric anaesthesia continue to be extremely uncommon. One woman died in association with obstetric anaesthesia in the UK between 2019 and 2021, a rate of 0.05/100,000 maternities (95% CI 0.001-0.27).

3.2.2 Recurring lessons to be learned

The assessors noted that while deaths directly related to obstetric anaesthesia are extremely rare, there were several instances where anaesthetic care could be improved that echo lessons in other parts of this report. Examples included false reassurance from point of care haemoglobin tests, and over-reliance on vasopressors to sustain blood pressure in women with obstetric haemorrhage. There were also several instances of delays in involving senior anaesthetists. In the event of major obstetric haemorrhage senior support must be sought early. Senior anaesthetist support should always be available. Competing senior clinical duty commitments to areas outwith maternity care must be avoided unless appropriate emergency contingency support plans are in place. The 'outside' need for timely, appropriate management with emergency anaesthetic support, such as tracheal intubation and ventilation, was also reiterated in several women's deaths attributed to other causes, for example neurological disorders.

Further detail of the existing guidance requiring enhanced implementation and underpinning evidence is available in supplementary material at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***

3.3 Morbidity after repeat caesarean birth

Supporting evidence available as supplementary material at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***

3.3.1 The women whose care was reviewed

The women whose care was reviewed were identified through a UK Obstetric Surveillance System (UKOSS) study of re-exploration after caesarean birth conducted between June 2021 and May 2022. Records for all 36 women who had a prior caesarean birth were sought for inclusion in the confidential enquiry. Records were not forthcoming for 4 women, thus the care of 32 women was examined for the purposes of this chapter. Most women (n=21, 66%) had one prior caesarean birth, six women (19%) had two prior caesarean births and five women (16%) had three.

Fourteen women underwent relaparotomy due to haemorrhage; ten had surgical bleeding in relation to the uterine incision, one had abnormal placentation and recurrent bleeding, and one had uterine atony. Two women had surgical bleeding in relation to the abdominal wall incision, including the inferior epigastric artery. Five women had wound dehiscence and/or infection. One woman had an emergency laparotomy for reasons unrelated to the caesarean section (biliary peritonitis).

Information was sufficient to assess care for all 32 women. Assessors felt that different care might have made a difference for 23 women (72%).

3.3.2 Overview of care and new national messages

A multiparous woman had a category 1 caesarean section at 30 weeks under spinal anaesthesia for suspected chronic fetal hypoxia. The procedure was performed during the night by an obstetric trainee with an estimated blood loss of 400mls. The operation note described a 4cm broad ligament haematoma, which was not increasing in size. A drain was left in. She was reviewed the following morning when there was 200mls blood, described as 'bright red', in the drain. Her pre-operative haemoglobin was 130g/l and had fallen to 90g/l. Approximately 10 hours later, she had a further 200mls of bright red blood in the drain and her Hb was 70g/l. She was symptomatic (dizzy and felt unwell) and a decision was made to return to theatre for exploratory laparotomy. She was resuscitated with crystalloid and four units of both FFP and red cell concentrate. A broad ligament haematoma was drained and a bleeding vessel ligated. She went on to make an uneventful recovery. M

This was a potentially difficult preterm caesarean birth. There was clearly some concern post-operatively as an intra-abdominal drain was left in. Her drop in haemoglobin was not in keeping with the 400mls blood loss recorded at the emergency caesarean section. The presence of fresh red blood in the drain 8 hours later indicated ongoing bleeding. The doctor who reviewed her was suspicious of this, but there was a clear reluctance to return to theatre. When her observations deteriorated further, she was promptly taken to theatre and consultant staff involved.

A similar reluctance to return to theatre was noted in the care of several women, leading to a delay in management of internal haemorrhage until women were in extremis. In some instances, assessors felt that decisions to return to theatre were being adversely influenced by fear of performance metrics based on unscheduled re-operation rates. It is important to emphasise that surgical complications will inevitably occur after some caesarean births and early definitive management, including re-operation, is an appropriate response. Metrics should be chosen appropriately to ensure that they do not lead to delays in the correct management. It is more important that the care of all women who require a return to theatre are suitably reviewed so that lessons are learned.

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

3.3.3 Recurring lessons to be learned

Surgical haemorrhage related to the uterotomy was the most frequent indication for re-operation and several recommendations from previous MBRRACE reports regarding haemorrhage deaths were noted to need reinforcement (Royal College of Obstetricians and Gynaecologists 2010, Knight, Kenyon et al. 2014, Royal College of Obstetricians and Gynaecologists 2016a, Knight, Nair et al. 2017, Royal College of Obstetricians and Gynaecologists 2018, Knight, Bunch et al. 2020b, National Institute for Health and Care Excellence 2021a). There is an ongoing need for senior input, helicopter overview and the benefit of frequent situational reports to alert teams and coordinate responses. Women who have undergone complex surgery or had extensive haemorrhage should not leave theatre until clinical control is confirmed.

Prompt clinical recognition and treatment of haemorrhage was highlighted once again, and several assessors highlighted learning potential from emergency trauma care: early recognition and definitive care including surgical exploration with appropriate anaesthesia, early transfusion and use of other blood products, including early use of O-negative blood, easy access to coagulation tests, and warming of both patients and infusions. Assessors also noted dependence on the use of vasopressors for hypovolaemic women without correction of their hypovolaemia or treatment of their concealed haemorrhage, a topic which recurred across several chapters.

The care of several women who had a re-laparotomy after a repeat caesarean birth also illustrated "systems under pressure". Lack of capacity in recovery or ITU led to post-operative observation of very ill women by midwives in postnatal or delivery wards. There appeared to be a reluctance to acknowledge parallel emergencies with no plans in place to escalate concerns or access additional capacity. Assessors noted that system pressure left little space for reflective learning amongst the teams caring for these women.

Further detail of the existing guidance requiring enhanced implementation and underpinning evidence is available in supplementary material at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***

References available as supplementary material at: ***www.npeu.ox.ac.uk/mbrrace-uk/reports***.

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