

1 Intrapartum-related perinatal deaths in births planned in midwifery-led settings in
2 Great Britain: findings and recommendations from the ESMiE confidential enquiry

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22 **Shortened running title:**

23 Deaths in births planned in midwifery-led settings

24 **Abstract**

25 **Objective**

26 To review quality of care in births planned in midwifery-led settings, resulting in an intrapartum-
27 related perinatal death.

28 **Design**

29 Confidential enquiry

30 **Setting**

31 England, Scotland and Wales

32 **Sample**

33 Intrapartum stillbirths and intrapartum-related neonatal deaths in births planned in alongside
34 midwifery units, freestanding midwifery units or at home, sampled from national perinatal
35 surveillance data for 2015-16 (alongside midwifery units) and 2013-2016 (freestanding midwifery
36 units and home births).

37 **Methods**

38 Multi-disciplinary panels reviewed medical notes for each death, assessing and grading quality of
39 care by consensus, with reference to national standards and guidance. Data were analysed using
40 thematic analysis and descriptive statistics.

41 **Results**

42 64 deaths were reviewed, 30 stillbirths and 34 neonatal deaths. At the start of labour care, 23
43 women were planning birth in an alongside midwifery unit, 26 in a freestanding midwifery unit and
44 15 at home. In 75% of deaths, improvements in care were identified which may have made a
45 difference to the outcome for the baby. Improvements in care were identified which may have
46 made a difference to the mother's physical and psychological health and wellbeing in 75% of deaths.
47 Issues with care were identified around risk assessment and decisions about planning place of birth;

48 intermittent auscultation; transfer during labour; resuscitation and neonatal transfer; follow-up and
49 local review.

50 **Conclusions**

51 These confidential enquiry findings do not address the overall safety of midwifery-led settings for
52 healthy women with straightforward pregnancies, but suggest areas where the safety of care can be
53 improved. Maternity services should review their care with respect to our recommendations.

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60 **Keywords**

61 Stillbirth; Perinatal Death; Birth Centres; Home Birth; Midwifery; Quality of Health Care

62 **Tweetable abstract**

63 Confidential enquiry of intrapartum-related baby deaths highlights areas where care in midwifery-
64 led settings can be made even safer

65

66 **Introduction**

67 Stillbirth and neonatal mortality rates in the United Kingdom remain high compared with other
68 similar countries.^{1,2} National policy aims to halve the rates of stillbirth, neonatal death and perinatal
69 brain injury by 2025;³ intrapartum-related perinatal deaths have been identified as a group where
70 improvements in perinatal care have the potential to improve outcomes.⁴⁻⁶

71 Confidential enquiries are an established method for assessing quality of care against national
72 standards and guidance, usually when adverse events such as death or serious morbidity occur. A
73 UK-wide confidential enquiry of 78 term intrapartum stillbirths and intrapartum-related neonatal
74 deaths, carried out in 2015 by the MBRRACE-UK collaboration as part of the national Maternal,
75 Newborn and Infant Clinical Outcome Review Programme (MNI-CORP), identified overall
76 improvements in care which may have made a difference to the outcome for the baby in 80% of the
77 deaths.⁶ Key issues included: failure to recognise the transition from the latent to the active phase of
78 labour and institute appropriate monitoring; incomplete or inadequate maternal monitoring; errors
79 in the method, interpretation, escalation and response to fetal monitoring; variable quality of
80 bereavement care; and poor quality local reviews.

81 In the UK most women give birth in hospital obstetric units (OU),⁷ so most of the 78 deaths in the
82 MBRRACE-UK enquiry occurred in planned OU births.⁶ National guidance and standards recommend
83 that women who are healthy with straightforward pregnancies should have the choice of care in an
84 OU or in a midwifery-led setting, including: birth at home; in an alongside midwifery unit on the
85 same site as an OU; or in a freestanding midwifery unit, on a site geographically separate from an
86 OU.⁸⁻¹² The number of midwifery units and the number of women giving birth in midwifery-led
87 settings is increasing;^{7, 13-16} in 2015 in England around 15% of women gave birth in a midwifery-led
88 setting, compared with around 5% in 2007.^{7, 13} Intrapartum-related perinatal deaths are uncommon,
89 occurring in around 1 in every 3500 births in the UK;⁶ there is no evidence that they are more
90 common in births planned in midwifery-led settings, compared with births planned in OUs.^{17, 18}

91 However, deaths in births planned in midwifery-led settings are important to investigate because the
92 nature of any issues with care may be different compared with births planned in OUs, particularly for
93 births in freestanding units and at home.

94 In ESMiE (Enhancing the safety of Midwifery-led births Enquiry), we aimed to review the quality of
95 care during pregnancy, labour, birth and postpartum received by women and babies in births
96 planned in midwifery units and at home, which resulted in an intrapartum-related perinatal death,
97 to identify care that could be improved. This paper briefly describes issues with care that were the
98 same as those identified in planned OU births in the 2015 MBRRACE-UK enquiry,⁶ and focuses in
99 detail on issues that were different or that have particular relevance for care in midwifery-led
100 settings.

101 **Methods**

102 We carried out a confidential enquiry using MBRRACE-UK methods.⁶

103 **Inclusion criteria and sampling**

104 We included intrapartum stillbirths and intrapartum-related neonatal deaths (defined in Table S1)
105 occurring in term births where the planned place of birth at the start of labour care was an alongside
106 or freestanding midwifery unit, or at home, in England, Wales and Scotland. We identified
107 potentially eligible deaths from the MBRRACE-UK national perinatal surveillance data, drawing a
108 stratified random sample to ensure all midwifery-led settings were represented in sufficient and
109 broadly equal numbers, with similar numbers of stillbirths and neonatal deaths. To ensure similar
110 numbers in each planned birth setting, planned alongside midwifery unit births were sampled from
111 2015-16, and planned freestanding midwifery unit and home births, where there are fewer births,
112 from 2013-2016. To account for differences in admission pathways we used slightly different
113 inclusion criteria for the different settings (Table S2).

114 **Case note management**

115 Invited hospitals for the sampled deaths provided all available medical notes for the mother and
116 baby. Identifiable data relating to the mother and baby were redacted and the redacted notes were
117 scanned and uploaded to the secure MBRRACE-UK case notes viewing system.

118 **Enquiry panel process**

119 Confidential enquiry panel reviews took place from October 2017 to July 2019. Panel members were
120 invited from a pool of 73 midwives, 22 consultant obstetricians, 16 consultant neonatologists and
121 nine perinatal pathologists. Each panel comprised a minimum of: two midwives (including midwives
122 with experience of working in a midwifery-led setting and bereavement midwives); two
123 obstetricians; two neonatologists; and one pathologist. Panel meetings were chaired by members of
124 the evaluation team (ESD, SK, JJK and RR) and were facilitated by JD and RR. Representatives of
125 Sands, the stillbirth and neonatal death charity, observed two panels.

126 At each panel four to six deaths were reviewed, with reference to relevant national standards and
127 guidance. Panels were convened until no new themes emerged.

128 *Data collected*

129 For each stage of the care pathway, good practice points or issues with care were graded by
130 consensus and recorded on a standardised evaluation form, using the MBRRACE-UK gradings for
131 quality and relevance to outcome (Table S3); this process generated both qualitative (text) and
132 quantitative data. An overall grading of care was agreed by consensus, for both the care of the baby
133 and the care of the mother after the baby had died, using the MBRRACE-UK classification (Table S3).
134 A narrative summary describing the overall care was written and agreed.

135 Additional quantitative data describing the care provided were recorded using an enquiry-specific
136 checklist developed from the 2015 MBRRACE-UK enquiry,⁶ with the addition of extra items, for
137 example, changes in planned place of birth and transfer.

138 A core outcome set was not used.

Data management and analysis

MBRRACE-UK perinatal surveillance data about maternal and other characteristics for the deaths reviewed and those that were potentially eligible, but not sampled, were compared using percentages and the Chi square test.

All text and grading data from the consensus evaluation form were imported into the software package NVivo (version 12).¹⁹ These data were read and re-read by RR to develop descriptive and analytical codes describing emerging themes, which were then applied across the dataset. Emerging findings were discussed by RR and JJK during analysis and codes/themes revised as necessary. The evaluation team then formally compared the findings with those from the 2015 MBRRACE-UK enquiry.⁶ Anonymised vignettes were chosen to illustrate findings.

Quantitative checklist and evaluation form data were imported into Stata SE (version 15)²⁰ and summarised using percentages.

Parent and public involvement (PPI)

The aim of PPI was to ensure that the views of bereaved parents informed the design, interpretation and dissemination of the enquiry. We benefitted from the involvement of representatives of key charities working with bereaved parents in the 2015 MBRRACE-UK enquiry.⁶ CB, from Sands was a member of the evaluation team, contributing to co-investigator group meetings throughout.

Results

Sample

Sixty-four perinatal deaths were reviewed, 30 stillbirths and 34 neonatal deaths (Figure S1), at thirteen panel meetings.

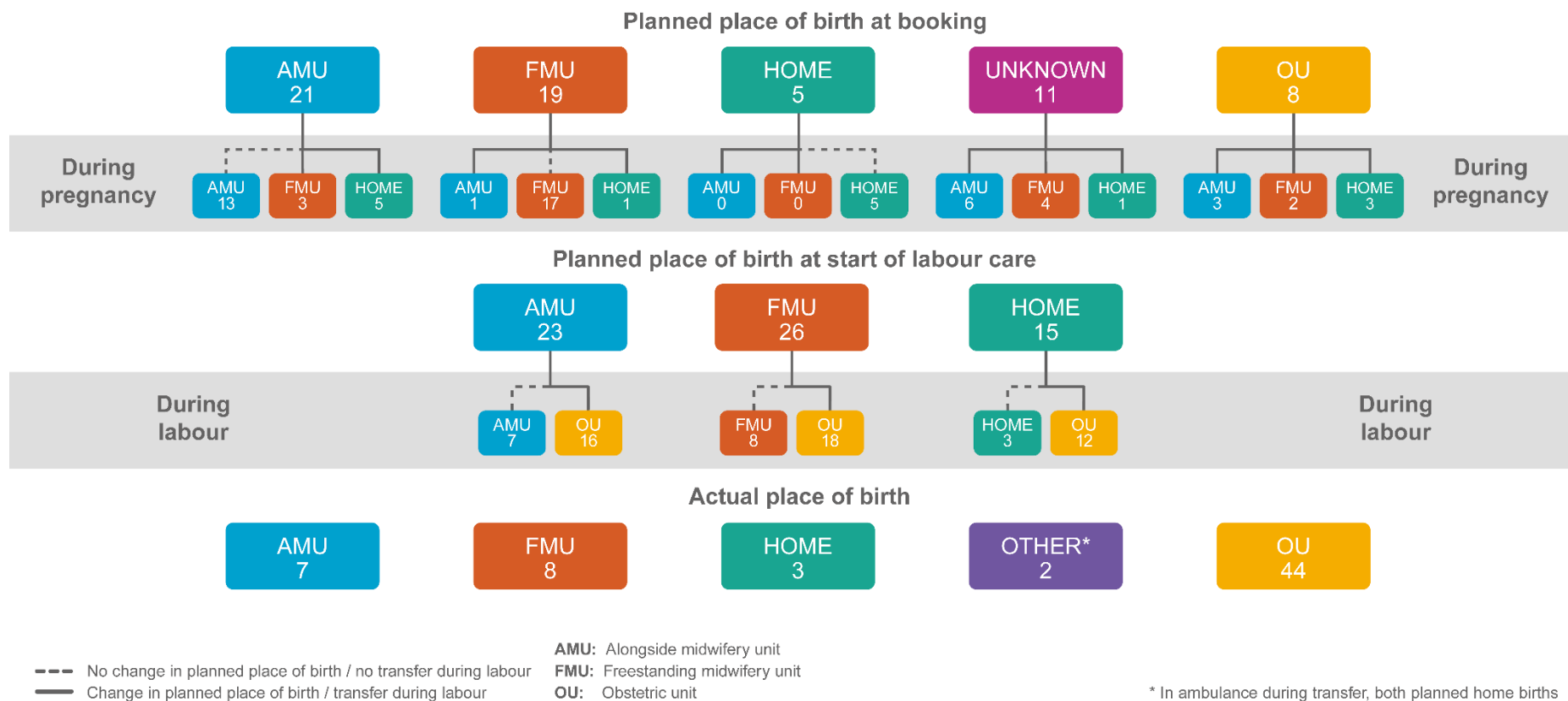
Representativeness of the sample

Apart from planned place of birth and outcome, there were no significant differences between the 64 deaths reviewed and the 93 other deaths that were potentially eligible, but not sampled, for any

163 of the socio-demographic, behavioural and care characteristics for which data were available (Table
164 S4). The oversampling used to ensure sufficient numbers of deaths from each planned birth setting,
165 and similar numbers of stillbirths and neonatal deaths, is reflected in the significant differences
166 between the deaths reviewed and those potentially eligible, but not reviewed.

167 *Planned and actual place of birth*

168 At the start of labour care, 23 women were planning birth in an alongside midwifery unit, 26 in a
169 freestanding midwifery unit and 15 at home (Figure 1). Overall, 18 women (28%) gave birth in the
170 setting they were planning to give birth in at the start of labour care. Two women, both planning a
171 home birth, gave birth in an ambulance.



Grading of quality of care

In 70% (n=21) of intrapartum stillbirths and 79% (n=27) of intrapartum-related neonatal deaths, panels identified improvements in care which may have made a difference to the outcome for the baby; 75% overall (Table 1). In terms of the mother's physical and psychological outcome and/or future wellbeing, improvements in care were identified which may have made a difference to the outcome in 53% (n=16) of intrapartum stillbirths and 94% (n=32) of intrapartum-related neonatal deaths; 75% overall. Data about the poorest quality of care at each point on the care pathway, in cases where care had a potential adverse impact on outcome, are summarised in Table S5.

Table 1. Overall grading of quality of care

Panel consensus	Stillbirth		Neonatal death		All	
	n=30		n=34		n=64	
	n	%	n	%	n	%
Outcome for the baby						
Good; no improvements in care identified	3	10	0	0	3	5
Improvements in care identified which would have made no difference to outcome	6	20	7	21	13	20
Improvements in care identified which may have made a difference to outcome	21	70	27	79	48	75
Outcome for the mother						
Good; no improvements in care identified	6	20	0	0	6	9
Improvements in care identified which would have made no difference to outcome	8	27	2	6	10	16
Improvements in care identified which may have made a difference to outcome	16	53	32	94	48	75

Themes recurring from previous intrapartum-related enquiry

A number of themes arising from this enquiry echoed those identified in the 2015 MBRRACE-UK enquiry in which most births were planned in OUs.⁶ These are summarised briefly in Box 1.

Antenatal care

Screening for fetal growth

No growth chart in notes; inconsistent or incorrect plotting or frequency of symphysis fundal height measurements; failure to refer for ultrasound when indicated or to act appropriately after referral.

Management of reduced fetal movements

Care following reported reduced fetal movements which did not follow national guidance.

Intrapartum care

Care of women in the latent phase

Inappropriate frequency of observations and lack of care planning; failure to recognise start of established labour leading to failure to initiate monitoring of fetal wellbeing.

Maternal monitoring

Lack of or infrequent vaginal examinations; incomplete or poor partogram completion; inadequate maternal observations leading to uncertainty about stage of labour or progress in labour and failure to appropriately assess maternal and fetal wellbeing.

Continuous electronic fetal monitoring (CEFM)

Lack of systematic review, or delay in obstetric review, of continuous electronic fetal monitoring (CEFM); failure to recognise, or delay in recognising, pathological cardiotocographs (CTG) and/or to act appropriately; delay in establishing CEFM after transfer; poor quality CTG trace.

Resuscitation

Failure to follow resuscitation guidance or documentation which was insufficiently clear; inadequate leadership around resuscitation.

Postnatal and bereavement care

Poor or undocumented postnatal care, including failure to carry out appropriate tests or investigations; undocumented, inadequate or fragmented bereavement care.

Follow-up appointment

Inappropriate timing of follow-up (too soon or too late); insensitive, inadequate or inaccurate follow-up letter to parents, including letters to another health professional copied to parents, or no letter at all.

Post-mortem

Placenta not available for histology; placental histology poor or not incorporated with the rest of the post-mortem findings; lack of appropriate clinico-pathological correlation; poor post-mortem which failed to identify cause of death.

Local review of care

Inappropriate composition of review panel; review did not consider the whole care pathway; review did not incorporate results of pathology or post-mortem.

Situational awareness and capacity

Lack of situational awareness or the ability to stand back, see the whole picture and respond appropriately; insufficient staff and/or space, and equipment issues, often as result of increased activity.

187

188 **Box 1.** Summary of issues with care which were also identified in the 2015 MBRRACE-UK

189 intrapartum-related confidential enquiry

190 **New themes or those with particular relevance for midwifery-led**
191 **settings**

192 *Planning place of birth and risk assessment*

193 During pregnancy

194 For 28 women (44%), risk factors relevant to discussions and decisions about planned place of birth
195 (e.g. previous postpartum haemorrhage, fetal growth concerns, mental health problems) were
196 present at booking or developed during pregnancy; for 12 women these risk factors were not
197 recognised by the health professionals providing care. For only five women with risk factors (18%)
198 was there any evidence of a care plan being put in place to manage risks in a midwifery-led setting.

199 For 21 women (34%), panels identified good care in relation to risk assessment, including
200 appropriate booking for midwifery-led care, or a good discussion and documentation around
201 planned place of birth (Vignette 1, Box 2).

Vignette 1: Good practice in risk assessment and planning

A nulliparous woman originally booked for care in an OU had documented discussions about place of birth at booking, at 25 and 28 weeks' gestation. At 28 weeks there was a documented decision for a home birth. At 34 weeks care was transferred to the home birth team and documented discussions about the decision for a home birth continued. At 41 weeks labour started at home. There was a documented risk assessment which confirmed she was still suitable for a home birth. During labour, fetal heart rate abnormalities were recognised promptly. Transfer to the OU was arranged immediately and there were no delays in transfer or the provision of care on arrival. The baby was born shortly afterwards with no signs of life and resuscitation was unsuccessful.

Vignette 2: Risk assessment and planning – failure to risk assess appropriately during pregnancy and on admission

A woman with previous small for gestational age babies and a BMI >35kg/m² booked for FMU birth with no documented discussion about place of birth and no care plan. Serial growth scans showed normal growth. The woman self-referred to the FMU twice in the same week at term in the latent stage of labour, but there was no documented risk assessment at either visit. Following a third attendance in the same week in the latent stage the woman was admitted. Five hours after admission, the fetal heart could not be heard; there was a delay in calling the ambulance. The woman arrived at the OU over an hour after the fetal heart was last heard and was seen promptly, but the baby's death was confirmed by ultrasound and the baby was stillborn.

Vignette 3: Delay in decision to transfer and assess on arrival at the OU

A low risk woman with straightforward antenatal care received good continuity of care and planned a home birth after a clear documented discussion. During labour the midwives appropriately called for advice when they had concerns about fetal wellbeing and transfer was agreed. However, there was a delay in calling for an ambulance and the ambulance took a long time to arrive resulting in a one hour delay from the decision to transfer to arrival in the OU. Once she arrived there was a further delay before obstetric review and there was no recognition or review of a pathological CTG in the second stage. The baby was born in a poor condition and resuscitated, but later died.

Vignette 4: Intermittent auscultation (IA) not following national guidance

A low risk woman was booked appropriately for an AMU birth. On arrival at the AMU in early labour she reported reduced fetal movements in the 24 hours before admission, however, there was no documentation of a risk assessment taking this into account. The fetal heart rate was not monitored according to national guidance throughout labour: the heart rate was always rounded to the nearest five; baseline tachycardia was inappropriately recorded as a range; the frequency of IA was inappropriate; and there was no appropriate response to decelerations in the second stage of labour. The baby was born in a poor condition and resuscitated, but later died.

Vignette 5: Resuscitation and transfer of a compromised baby

Following inadequate risk assessment on arrival in labour and inappropriate monitoring in labour a baby was born in an FMU in poor condition. Resuscitation was commenced by the midwife. At eight minutes a consultant paediatrician was phoned for advice who advised continuing resuscitation and then calling an ambulance. An emergency crash call was placed for the local emergency team, but there were issues with their prompt attendance. At 16 minutes after birth an ambulance was called, which arrived quickly. The time from birth to arrival at the hospital was over an hour. The baby was subsequently transferred to a tertiary centre for treatment, but later died.

203 For 24 women (39%), panels identified issues with care in relation to management of risk factors,
204 lack of appropriate risk assessment for planning birth in a midwifery-led setting, lack of care planning
205 in the presence of risk factors, or lack of discussion or documentation about the risks and benefits of
206 different birth settings. For 12 women this was judged to be probably or almost certainly relevant to
207 the outcome for the baby.

208 At the start of labour care

209 Overall, 25 women (39%) presented at the start of labour care with existing risk factors or emerging
210 complications indicating that transfer to obstetric-led care should have been considered or discussed
211 (Vignette 2, Box 2). These complications included: reduced fetal movements, meconium stained
212 liquor, prolonged rupture of membranes and post-term pregnancy. In 15 (60%) of these women the
213 panels considered that management of the woman's care was not appropriate.

214 For 20 women (32%), panels identified inadequate risk assessment at the start of labour care; in 13
215 of these women there were also issues in relation to risk assessment or birth place planning during
216 pregnancy. For 12 women this was judged to be probably or almost certainly relevant to the
217 outcome for the baby.

218 Planning home birth against advice

219 Ten of the fifteen women planning home birth had risk factors for complications during labour or
220 birth identified during pregnancy. Five of these ten women planned birth at home against advice
221 from health professionals. For four of these the panel considered that this was a contributory factor
222 in the outcome for the baby, although for three women they also concluded that health
223 professionals could have done more to engage with the mother. Issues common to these cases
224 included the woman not engaging with antenatal care and/or not revealing health concerns; health
225 care professionals not escalating their concerns about risk factors or the woman's wellbeing; and the
226 woman declining care and/or interventions when offered, including scans, induction, fetal
227 monitoring, vaginal examinations and transfer.

228 *Transfer during labour*

229 Overall, 46 (72%) women were transferred to obstetric care during labour; two women gave birth
230 during transfer. Of the 18 women who were not transferred, in nine women there was no identified
231 indication for transfer and in the remaining nine, by the time transfer was considered, labour was
232 too advanced to transfer the woman safely.

233 For 11 women (24%), panels identified good care in relation to transfer, including appropriate
234 decision-making or timing. For 35 women, issues with care were identified in relation to transfer,
235 including three women for whom the panels considered that the woman should have been
236 transferred, but wasn't. For 24 women, panels noted delay in recognising the need for transfer, in
237 arranging transfer with appropriate urgency, in the attendance of an ambulance, or in timely and
238 appropriate assessment or care after transfer; for 16 of these (11 in planned freestanding midwifery
239 unit/home births and 5 in an alongside midwifery unit) this was considered to be probably or almost
240 certainly relevant to the outcome for the baby (Vignette 3, Box 2). For one woman planning birth at
241 home, the panel identified delay in the decision to transfer, delay in the arrival of the ambulance and
242 delay in obstetric review after arrival at the hospital. For two women, both planning birth at home,
243 delays in transfer were considered to have occurred in part because the woman delayed or declined
244 transfer.

245 *Intermittent auscultation*

246 Overall, 46 women (72%) had intermittent auscultation (IA) at some stage during labour. For over
247 half of these (28 women), panels identified issues in relation to IA (Vignette 4, Box 2). In all but two
248 of these instances the woman was in her original planned birth setting at the time. For 19 women
249 this was considered to be probably or almost certainly relevant to the outcome for the baby. Issues
250 included incorrect frequency or timing of IA in relation to contractions; poor, inadequate or
251 confusing recording of IA or the fetal heart rate; and failure or delay in recognising or acting on fetal
252 heart rate concerns. For two women planning birth at home, IA was either not carried out at all,

253 or with a frequency and timing which was inconsistent with national guidance, at the request of
254 the mother.

255 *Resuscitation and neonatal transfer*

256 Of the 18 women who were not transferred during labour, 11 gave birth in a freestanding midwifery
257 unit or at home, and resuscitation of the baby took place in a midwifery-led setting with no neonatal
258 service on site. For two of these, panels identified good or excellent resuscitation care and neonatal
259 transport, but in six, all in freestanding units, issues were identified in relation to resuscitation,
260 management and transfer of a compromised baby; for four this was considered to be almost
261 certainly relevant to the outcome for the baby (Vignette 5, Box 2). Issues included uncertainty over
262 leadership of resuscitation, with midwives deferring to paramedics or other colleagues who may
263 have had less experience with neonatal resuscitation; apparent confusion about how to arrange
264 transfer; and unclear communication of urgency, leading to delay. For all six there were indications
265 of an absence of clear local guidance or protocol for the management of a neonatal emergency in
266 the freestanding unit, leading to significant delay and/or inadequate resuscitation.

267 *Follow up and review*

268 A follow up appointment between parents and health professionals took place for 49 deaths (77%)
269 overall, but in only 13 of these (27%) was a midwife involved in the follow-up appointment.

270 A local review of care took place in 58 cases (91%), but only nine (16%) of these reviews were judged
271 to be of good quality, with 28 (48%) described as 'poor' by panels. A midwife was involved in the
272 review in 35 of the 49 deaths (71%) for which the composition of the review panel was documented.

273 **Parent and public involvement**

274 Our PPI ensured that topics of key importance to bereaved parents, including bereavement care,
275 post mortem consent, and local review were central to this enquiry. Our links with charities
276 representing bereaved parents will ensure effective dissemination.

Discussion

Main findings

In 75% of intrapartum-related perinatal deaths occurring in births planned in midwifery-led settings, improvements in care were identified which may have made a difference to the outcome for the baby. In 75% of deaths, improvements in care may also have made a difference to the mother's physical and psychological outcome or future wellbeing.

Many of the themes arising from panels' judgements about care were the same or similar to those arising from the 2015 MBRRACE-UK enquiry into intrapartum-related perinatal deaths, in which most deaths occurred in planned OU births.⁶ Several emerging themes, however, were new or of specific relevance to midwifery-led settings.

Strengths and limitations

We used an established confidential enquiry process to review systematically, for the first time, the quality of care in term intrapartum-related perinatal deaths in births planned in midwifery-led settings. Oversampling ensured sufficient representation of birth settings and types of perinatal death. Otherwise our sample was representative of all potentially eligible deaths in births planned in midwifery-led settings. Enquiry panels were multi-disciplinary and included at least two midwives with experience of working in a midwifery-led setting.

The confidential enquiry process uses all available medical notes and therefore, in contrast to other investigations, which may interview staff and parents, some important contextual information may not always be available. By its nature, a confidential enquiry is retrospective, involving panel members who are aware of the outcome, critically looking for any and all issues with care, based on extant national standards and guidance. No inferences can be made about the prevalence of issues with care for births where the baby did not die. Nevertheless, improvements in care arising as a consequence of our findings have the capacity to affect all women receiving care.

Interpretation (in light of other evidence)

For women at low risk of complications, with the exception of first-time mothers planning birth at home, planning birth in a midwifery-led setting is as safe for babies as planning birth in an OU, and has benefits for women in terms of substantial reductions in medical intervention.^{17, 18, 21} National policy supports choice of birth setting and the expansion of midwifery-led services.^{10, 11} Our findings do not call into question this body of evidence or policy direction, but highlight areas where care for women planning birth in midwifery-led settings can be improved and made even safer.

Documented evidence-based discussion with women about the risks and benefits of different settings is fundamental to the implementation of national guidance about planned place of birth.¹¹ Optimal assessment, and consideration of appropriate place of birth, is an ongoing process, during pregnancy, on admission in labour and as labour progresses, taking into account women's values and preferences.^{11, 22} Panels noted some well-documented evidence-based discussions, but in over half the deaths reviewed there was little evidence of discussion; a failure to appropriately risk assess; and a lack of planning for the management of risk factors. Midwives may lack confidence in talking to women about place of birth,²³ but, with appropriate support, the quality of these discussions can be improved.²⁴ Discussion and assessment of 'risk' is complex; women's and health professionals' assessments of risk may differ, and may not fit with assumptions.²⁵⁻²⁹ However, common ground between women and health professionals can be found if there is openness, mutual respect and a shared commitment to an agreed care plan.³⁰⁻³³ The potential benefits of this approach have been demonstrated in one 'maternity care outside guidelines' clinic in the Netherlands.³⁴

Intermittent auscultation (IA) of the baby's heart rate is a key element of monitoring and assessment during labour, with clear national guidance about the timing and frequency of IA in the first and second stages.^{11, 35} The issues with IA identified in this enquiry were similar to those identified in other similar enquiries.^{5, 6} Given the widespread use of IA, and the improbability that the issues

325 found are limited to cases where the baby died,³⁶ maternity units should consider conducting routine
326 audits of the frequency and timing of IA in their service, and acting on the findings.³⁷

327 Almost three quarters of the women in this enquiry were transferred to obstetric care. Some good
328 care was identified in relation to transfer, but there were also significant issues with care, in
329 transfers from all three midwifery-led settings, with delay occurring because of failures of
330 monitoring and risk assessment; failure to recognise a developing problem; poor communication of
331 urgency; and apparent lack of resource. Similar issues have been identified in births planned in OUs
332 where escalation of care is required,⁶ however, transfer is an intrinsic part of care in a midwifery-led
333 setting, and something which women are particularly concerned about.³⁸ Tools such as SBAR
334 (situation, background, assessment, recommendation) are recommended to support structured
335 communication in handover or escalation of care;³⁹ our panels identified a number of deaths in
336 which their use might have improved communication. 'Safety huddles' have also been
337 recommended in similar situations.^{5,40} In London, the ambulance service, midwives and a voluntary
338 organisation have worked together to develop structured information for use by midwives
339 requesting urgent ambulance transfer.⁴¹ There may be benefit in such approaches being extended.

340 We also found issues with neonatal transfer from a community setting, with resuscitation that did
341 not meet national standards, and other issues indicative of an absence of clear protocols for the
342 management of a neonatal emergency.^{42,43} National guidance recommends that all birth
343 professionals attend annual nationally accredited training in neonatal resuscitation and that, in all
344 birth settings, plans are in place to enable a call for help with resuscitation; facilities for resuscitation
345 and transfer; and emergency referral pathways.¹¹ The findings of this enquiry suggest that this
346 guidance needs reinforcing locally.

347 Compared with the 2015 MBRRACE-UK enquiry, a higher proportion of deaths had improvements in
348 care identified which may have made a difference to the mother's outcome and/or future wellbeing
349 (75% vs 47%).⁶ This may have arisen in part because of increased fragmentation of care, with

350 consequent failures in follow up care and review. Most deaths were reviewed locally, but, as in
351 other investigations and enquiries,^{5, 44, 45} most local reviews were judged to be of poor quality, and
352 were hampered by the absence of health professionals with relevant skills or experience, including
353 midwives working in midwifery-led settings, paramedics and ambulance staff, and neonatologists.
354 Similar issues were identified in relation to follow up appointments with parents after the death of
355 their baby. The national Perinatal Mortality Review Tool now supports high quality standardised
356 local review.⁴⁶

357 **Conclusions and recommendations**

358 The findings of this national enquiry offer an opportunity to improve care for women considering or
359 planning birth in midwifery-led settings, and their babies, to prevent future similar deaths. We make
360 a number of recommendations based on our findings.

361 All women who are at low risk of complications, and others considering birth in a midwifery-led
362 setting, should have an evidence-based discussion with a midwife and/or a doctor about the risks
363 and benefits of different birth settings, taking into account the presence of any risk factors for
364 complications, and their values and preferences. This discussion should be fully documented in
365 women's notes, with evidence about safety, intervention and transfer rates, and a specific care plan
366 for the management of any risk factors in a midwifery-led setting. Decisions about planned place of
367 birth and any care plan should be revisited during pregnancy and at the start of labour care.

368 The development of a standardised risk assessment tool should be considered, for use at the start of
369 labour care and as labour progresses.

370 Routine audit of the frequency and timing of monitoring in labour is recommended to ensure
371 alignment with guidance

372 Providers of maternity care with freestanding midwifery units or supporting home birth should:

- 373 • work with their local ambulance service to develop appropriate pathways and protocols to
374 ensure prompt ambulance attendance and transfer in emergencies;
- 375 • adopt standardised communication of urgency in relation to transfer, with ambulance
376 services and the receiving hospital;
- 377 • develop and maintain clear guidance for the management of neonatal emergencies in a
378 community setting, including mandatory annual multi-disciplinary skills and drills or in-situ
379 simulation training.

380 When a woman is transferred urgently for obstetric care there should be a process that ensures
381 prompt obstetric and neonatal assessment.

382 When a baby dies after planned birth in a midwifery-led setting, a senior midwife with experience of
383 providing care in a midwifery-led setting should be involved in follow-up care and the local review.

384 In deaths that have involved ambulance transfer, reviews should also include information from
385 paramedics and the ambulance service.

386 All services providing midwifery-led care should review their practice with respect to these
387 recommendations.

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410 **Contribution to authorship**

411 JJK co-conceived the study and developed the protocol with input from ESD, SK, DT, RR, JD, MF and
412 CB; JJK, SK, ESD and RR developed the evaluation form and checklist; ESD, SK, JJK and RR chaired
413 enquiry panels; JD and RR facilitated enquiry panels; JD collated data; RR analysed the data with
414 input from ESD, SK, JJK and RS; RR drafted the manuscript. All authors were involved in
415 interpretation of data, review and revision of the manuscript and approval of the final version.

416 **Details of ethics and other approvals**

417 Using the Health Research Authority classification for research for England,⁴⁷ this study was classified
418 as research not requiring NHS research ethics approval. Consent from parents was not sought.
419 Approval to use confidential patient information without consent was obtained from the
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554 **Supplementary material**

555 **Table S1. Intrapartum stillbirth and intrapartum-related neonatal death definitions.**

Type of death	Definition
Intrapartum stillbirth	Stillbirth where the baby was known to be alive at the onset of care in labour and/or the primary cause of death was from intrapartum causes
Intrapartum-related neonatal death	Neonatal deaths identified from a first level CODAC (Cause Of Death & Associated Conditions) cause of death of 2xx and/or a textual description of the death including hypoxic ischaemic encephalopathy (HIE) or an intrapartum cause.

556 **Table S2. Inclusion criteria in different planned birth settings.**

Planned birth setting	Inclusion criteria
Alongside midwifery unit	Women admitted for labour care in an alongside midwifery unit, excluding those transferred following early labour assessment or triage
Freestanding midwifery unit and home	Women intending birth in a freestanding midwifery unit or at home at the start of labour or 'undecided' for home birth and booked for labour assessment at home. Women who received early labour assessment or advice (face-to-face or by phone) from the freestanding

midwifery unit or home birth team, or face-to-face care
in labour in the freestanding midwifery unit or at home

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Table S3. Grading of quality of care.

Quality of care measure

Grading

Grading of quality of care provision for each point on the care pathway

- 0: None – good quality care
- 1: Minor – minor issues with quality of care
- 2: Significant – significant issues with quality of care
- 3: Major – major issues with quality of care

Relevance to outcome of care quality for each point on the care pathway

- 0: Not relevant
- 1: Possibly relevant
- 2: Probably relevant
- 3: Almost certainly relevant

Grading of overall care

- Good care, no improvements identified
 - Improvements in care identified which would have made no difference to the outcome
 - Improvements in care identified which may have made a difference to the outcome
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Source: Draper ES, Kurinczuk JJ, Kenyon S, on behalf of MBRRACE-UK, editors. MBRRACE-UK 2017 Perinatal Confidential Enquiry: Term, singleton, intrapartum stillbirth and intrapartum-related neonatal death. Leicester: The Infant Mortality and Morbidity Studies, Department of Health Sciences, University of Leicester; 2017.

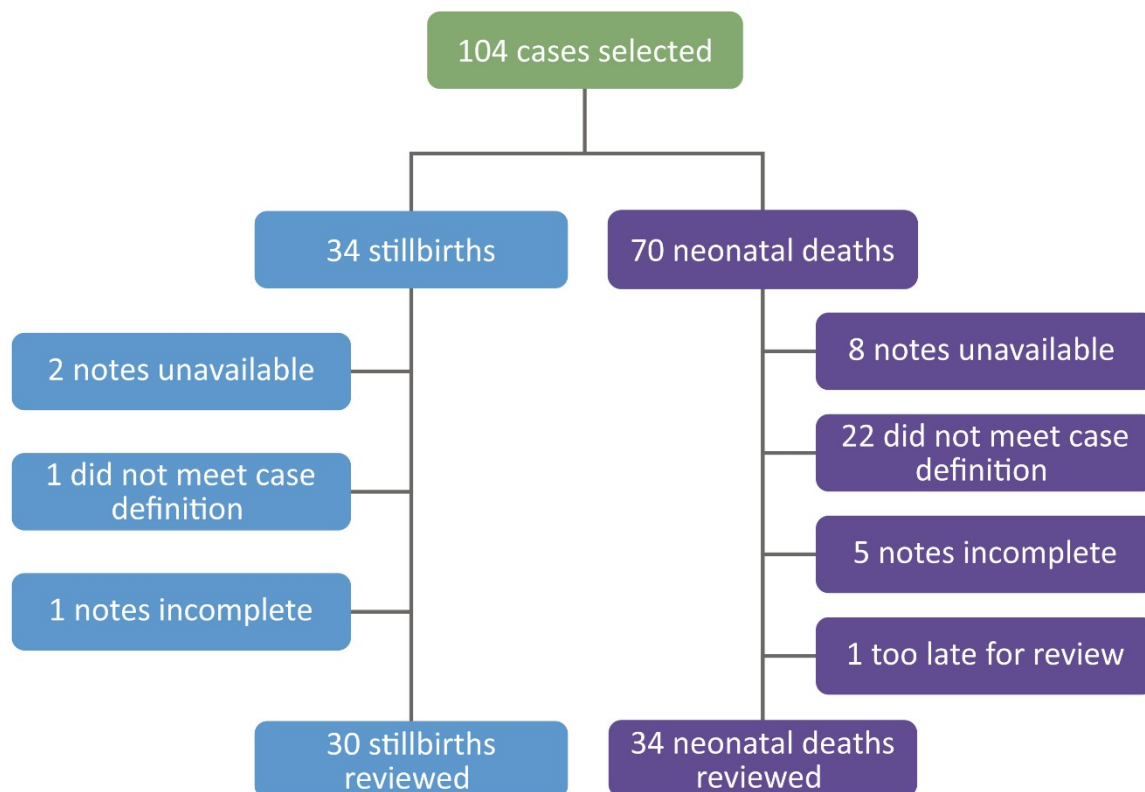


Figure S1. Flow chart for perinatal deaths selected for confidential enquiry.

566 **Table S4. Characteristics of potentially eligible, but not selected, and reviewed intrapartum-**
567 **related perinatal deaths.**

Characteristic	Potentially eligible, but not selected (n=93)		Reviewed (n=64)		p-value ¹
	n	%	n	%	
Maternal age (years)					0.90
<20	3	3.2	1	1.6	
20-24	18	19.4	12	18.8	
25-29	20	21.5	14	21.9	
30-34	32	34.4	24	37.5	
35-39	18	19.4	10	15.6	
≥40	2	2.2	3	4.7	
Missing	0	0.0	0	0.0	
Baby's ethnicity					0.84
White	75	80.7	50	78.1	
Asian	9	9.7	7	10.9	
Black	1	1.1	0	0.0	
Mixed	3	3.2	1	1.6	
Other	1	1.1	1	1.6	
Not known	4	4.3	5	7.8	
Area-based deprivation quintile²					0.20
Least deprived	23	24.7	14	21.9	
2 nd	19	20.4	14	21.9	
3 rd	13	14.0	15	23.4	
4 th	16	17.2	15	23.4	
Most deprived	20	21.5	5	7.8	
Missing	2	2.2	1	1.6	
Country of residence					0.77
England	76	81.7	55	85.9	
Scotland	10	10.8	5	7.8	
Wales	7	7.5	4	6.3	
Missing	0	0.0	0	0.0	
Parity					0.33
Nulliparous	46	49.5	37	57.8	
Multiparous	47	50.5	27	42.2	
Missing	0				
Maternal body mass index (BMI)					0.57
<18.5	1	1.1	0	0.0	
18.5-24.9	50	53.8	33	51.6	
25.0-29.9	25	26.9	17	26.6	
30.0-35.0	10	10.8	6	9.4	
>35.0	0	0.0	2	3.1	
Missing	7	7.5	6	9.4	
Smoking status					0.23
Non-smoker during pregnancy	78	83.9	55	85.9	
Smoker during pregnancy	13	14.0	5	7.8	
Not known	2	2.2	4	6.3	

Employment status					0.48
Employed/self-employed	71	76.3	51	79.7	
Unemployed	4	4.3	2	3.1	
Student	3	3.2	0	0.0	
Looking after home/family	10	10.8	5	7.8	
Missing	5	5.4	6	9.4	
Support during pregnancy					0.36
Partner, cohabiting	83	89.3	58	90.6	
Partner, not cohabiting	6	6.5	6	9.4	
Family/friend	3	3.2	0	0.0	
Not known	1	1.1	0	0.0	
Gestation at booking					0.96
Before 10 weeks	45	48.4	31	48.4	
At or after 10 weeks	38	40.9	27	42.2	
Missing	10	10.8	6	9.4	
Sex of baby					0.27
Male	41	44.1	34	53.1	
Female	52	55.9	30	46.9	
Not known	0	0.0	0	0.0	
Mode of delivery					0.47
Spontaneous vertex	48	51.6	39	60.9	
Vaginal breech	4	4.3	2	3.1	
Instrumental	19	20.4	14	21.9	
Caesarean section	22	23.7	9	14.1	
Planned place of birth at start of labour care					0.001
Alongside midwifery unit	62	66.7	23	35.9	
Freestanding midwifery unit	22	23.7	26	40.6	
Home	9	9.7	15	23.4	
Outcome					0.03
Stillbirth	28	30.1	30	46.9	
Neonatal death	65	69.9	34	53.1	

¹ p-value for Chi-square test comparing reviewed vs potentially eligible, but not selected for review

² Quintiles based on percentage of families with children living in low-income families

Table S5. Poorest quality of care, at each point on the care pathway, potentially affecting outcome for the baby or for the woman. *

	Stillbirth n=30		Neonatal death n=34		All n=64	
	n	%	n	%	n	%
Antenatal care						
None or minor	13	43	16	47	29	45
Significant	11	37	9	26	20	31
Major	6	20	9	26	15	23
Intrapartum/birth care						
None or minor	3	10	7	21	10	16
Significant	4	13	4	12	8	13
Major	23	77	23	68	46	72
Resuscitation care¹						
None or minor	10	71	19	61	29	64
Significant	0	0	1	3	1	3
Major	4	29	11	35	15	33
Neonatal care						
None or minor	-	-	19	56	-	-
Significant	-	-	5	15	-	-
Major	-	-	10	29	-	-
Postnatal/bereavement care						
None or minor	18	60	11	32	29	45
Significant	6	20	8	24	14	22
Major	6	20	15	44	21	33
Follow up & review						
None or minor	10	33	6	18	16	25
Significant	8	27	1	3	9	14
Major	12	40	27	79	39	61
Post-mortem²						
None or minor	16	53	12	40	28	47
Significant	3	10	2	7	5	8
Major	11	37	16	53	27	45

* Where care was possibly, probably or almost certainly relevant to outcome for the baby (antenatal, intrapartum/birth, resuscitation, neonatal) or the woman (postnatal/bereavement, follow up & review, post-mortem).

¹ As a proportion of those for whom resuscitation was attempted (stillbirths n=14, neonatal deaths n=31)

² Denominator excludes four neonatal deaths with no post-mortem or placental histology and no grade given for quality of care