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Systematic exploration of the number and quality of local reviews of the care of maternal deaths in the UK and Ireland between 2012- 2014: a case note review study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-029552
Article Type:	Research
Date Submitted by the Author:	31-Jan-2019
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Keywords:	Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, OBSTETRICS

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Manuscripts

Systematic exploration of the number and quality of local reviews of the care of maternal deaths in the UK and Ireland between 2012- 2014: a case note review study

Title	Systematic exploration of the number and quality of local reviews of the care of maternal deaths in the UK and Ireland between 2012- 2014: a case note review study
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Abstract

Objectives – Local reviews of the care of women who die in pregnancy and post-birth should be undertaken. We investigated the quantity and quality of hospital reviews.

Design – Anonymised casenotes review.

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3 Participants - All 233 women in the UK and Ireland who died during or up to six weeks after
4 pregnancy from any cause related to or aggravated by pregnancy or its management in 2012-14.
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7 Main outcome measures – The number of local reviews undertaken. Quality was assessed by the
8 composition of the review panel, whether root causes were systematically assessed and actions
9 detailed.
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12 Results – The care of 177/233 (76%) women who died was reviewed locally. The care of women who
13 died in early pregnancy and after 28 days post-birth was less likely to be reviewed as was the care of
14 women who died outside maternity services and who died from mental health-related causes.
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17 140 local reviews were available for assessment. Multidisciplinary review was undertaken for 65%
18 (91/140). External involvement in review occurred in 12% (17/140) and of the family in 14%
19 (19/140). The root causes of deaths were systematically assessed according to national guidance in
20 13% (18/140). In 88% (123/140) actions were recommended to improve future care, with a timeline
21 and person responsible identified in 55% (77/140). Audit to monitor implementation of changes was
22 recommended in 14% (19/140).
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29 Conclusions - This systematic assessment of local reviews of care demonstrated that not all hospitals
30 undertake a review of care of women who die during or after pregnancy and in the majority quality
31 is lacking. The care of these women should be reviewed using a standardised robust process
32 including root cause analysis to maximise learning and undertaken by an appropriate
33 multidisciplinary team who are given training, support and adequate time.
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42 **Strengths and limitations of this study**

- 43 • This is the first study to systematically examine the number and quality of local reviews of the
44 care of women who died during or after pregnancy in the UK and Ireland.
- 45 • This study systematically examined the quantity and quality of local reviews of maternal deaths
46 within the UK and Ireland over a three year period, which may not be representative of local
47 reviews over a wider time period or in different countries.
- 48 • Each review was assessed on the basis of what was contained within the anonymised case notes
49 provided to MBRRACE-UK, and therefore may not reflect the full procedure of review in some
50 cases.
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INTRODUCTION

For over six decades the care of all women who die during or shortly after pregnancy in the UK has been independently reviewed through a process of Confidential Enquiries (CEs). These are an internationally acknowledged method of reviewing the care of individuals who die or have severe complications in order to learn from adverse outcomes and reduce the incidence.^{1 2} The principles have been utilised globally to review care of women who have died in pregnancy or in the postnatal period.³ Countries or states that have utilised systematic confidential enquiry methodology include France,⁴ Sweden,⁵ Washington State, USA,⁶ Tanzania,⁷ Australia,⁸ India,⁹ and South Africa.¹⁰ However it is less clear as to the quality of the review and it is hard to establish from the literature whether there is a standardised approach in individual countries as to the content of the review. Since 2012 a collaboration called Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK (MBRRACE–UK) has been responsible for the continuation of the national programme of CEs and the surveillance of all perinatal and maternal deaths, as well as reviews of selected pre-determined significant morbidities. The CEs utilise multi-disciplinary teams of clinicians from outside the region where the woman's death occurred, to review anonymised medical records and assess the care given against national guidelines. Assessment is undertaken by these independent reviewers regarding whether care was good or improvements were noted, and if so, whether these may have made a difference to the woman's outcome. Findings from a maternal death CE published in 2018 identified that improvements in care may have made a difference to their outcome for 38 percent of all women who died.¹¹

There has been some controversy over the impact of these reports. Some believe that that they have acted as a catalyst for significant improvements in maternity care across the UK and contributed towards the reduction in the national mortality rate.¹² Others, however, have questioned whether incident reporting systems such as national CE or audit are responsible for these improvements.¹³ Indeed, it is argued that local review of adverse outcomes is needed, in addition to national data, in order to facilitate ownership of relevant issues and therefore increase the chance of change in practice.¹⁴

At local level in the UK and Ireland maternal deaths ordinarily trigger a Serious Incident review from the hospital providing the majority of care or where the woman died. Maternal deaths are rare events and usually described as 'unexpected and avoidable' and as such considered under the 'Serious Incident Framework' (SIF),¹⁵ wherever the death. SIFs contain the explicit recommendation that contributory factors and/or root causes should be examined to identify fundamental issues and ensure a full understanding of the event to maximise the learning opportunity. The focus is to

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2
3 consider system errors, rather than a review of individual clinicians. The National Patient Safety
4 Agency developed a Root Cause Analysis (RCA) Investigation toolkit¹⁶ which provides a structured
5 way of examining nine potential contributory factors; patient, staff, task, communication,
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7 equipment, work environment, organisational, education and training and team factors. There is a
8
9 currently no systematic assessment of the quality of local hospital-based reviews of the care of
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11 women who die during or shortly after pregnancy. The aim of this study was to investigate the
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13 quantity and quality of local hospital reviews following maternal deaths (during pregnancy and up
14
15 until 42 days after birth) between 2012 and 2014 inclusive using MBRRACE-UK anonymised case
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17 records.

21 22 23 **METHODS**

24
25 All maternal deaths that occurred in the UK and Ireland in the three year period from 2012 to 2014
26
27 (inclusive) in early pregnancy and up to 42 days after birth were reviewed utilising anonymised case
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29 record review. Access to the anonymised case notes was via the MBRRACE-UK secure website and
30
31 included case notes, statements and summaries as well as local review reports

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33 The objectives were to identify the proportion of hospital reviews carried out when there was a
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35 maternal death relating to the time, place and cause of death; to establish which professionals were
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37 involved in reviews; if the root causes had systematically been assessed as recommended by the SIF;
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39 and whether there were resultant actions. If there were actions, whether they were individual or
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41 systematic and finally, to explore whether an audit was recommended to evaluate change in
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43 practice.

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45 A data extraction form was developed to include key components of the SIF. For each local review
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47 three authors independently undertook the data extraction and any differences between the data
48
49 were resolved between investigators.

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51 The major causes of antenatal and postnatal deaths were examined in relation to whether local
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53 reviews of care were undertaken. These were grouped according to whether the death was related
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55 to an obstetric, medical or psychiatric cause. Obstetric deaths were those due to amniotic fluid
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57 embolism, anaesthesia, deaths in early pregnancy, haemorrhage or eclampsia and pre-eclampsia.
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59 Deaths considered to be medical in cause included cardiac deaths, those due to malignancy,
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61 neurology, sepsis, thrombosis or thromboembolism and other medical causes.

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3 The quality of each review was assessed based on the SIF by examining the composition of the
4 review panel, whether a systematic examination of the root causes (contributory factors) was
5 undertaken and whether any actions resulted, and audit was undertaken to evidence changes to
6 practice. The composition of each review panel was examined and the profession of those involved
7 as documented in the review.
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14 **Patient and public involvement**

15 This research was done without patient involvement as this study utilised anonymised case notes for
16 secondary analysis.
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26 **RESULTS**

27 **Number and type of reviews of care of women who died**

28 There were 262 maternal deaths that occurred between 2012 and 2014. Women who died from
29 accidental or incidental causes such as Road Traffic Accidents (n=24) were excluded and 5 sets of
30 case notes were unavailable which resulted in 233 maternal death cases for assessment. Of the 233
31 maternal deaths, 177 (76%) were reviewed by the hospital where the majority of care had been
32 given or where the woman had died. However, there was no evidence of a review having been
33 undertaken in 56 deaths (24%) and no evidence of change in this proportion over time.
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43 **Timing, place and cause of maternal deaths**

44 The timing of maternal deaths was considered in relation to whether or not a review was completed.
45 Of the 92 women who died in pregnancy, 45 (49%) of these occurred at less than 20 weeks gestation
46 with 62% reviewed. After 20 weeks' gestation a higher proportion of the deaths were reviewed
47 (85%) (Table 1). Of the 141 maternal deaths that occurred in the postnatal period, 78 (55%) occurred
48 in the first week and of these 85% (n=66) were reviewed. Of the deaths between 28 and 42 days
49 after birth, just under half (n=9, 45%) were reviewed.
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57 **Table 1: Timing (gestation and days) of women who died in pregnancy or in the early postnatal 58 period**

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Deaths of women (gestation or days)		Reviewed	Not reviewed	TOTAL
		Number (%)	Number (%)	
Deaths in Antenatal Period (gestation)	0 - 20/40	28 (62)	17 (38)	45
	21 - 35/40	26 (87)	4 (13)	30
	36 - 42/40	14 (82)	3 (18)	17
Antenatal Total		68 (74)	24 (26)	92
Deaths in Postnatal period	0-6 days	66 (85)	12 (15)	78
	7-13 days	15 (79)	4 (21)	19
	14-27 days	19 (79)	5 (21)	24
	28-42 days	9 (45)	11 (55)	20
Postnatal Total		109 (77)	32 (23)	141
TOTAL		177 (76%)	56 (24%)	233

Place of death

An intensive care unit (ICU) was the most common location where women died (n=88); the care of 75% of the women who died in ICU was reviewed although maternity services were not always involved. Of the 30 women who died while being cared for in maternity services such as delivery suite, theatre, and wards, 93% (n=28) were reviewed (Table 2). Women who died in Accident and Emergency departments however, were less likely to have their cases reviewed (28/42, 67%) along with those who died in specialist units such as neurological, liver, vascular or cardiac units, or in palliative care (9/13, 69%).

Table 2: Place of death:

Place of death	Reviewed	Not reviewed	TOTAL
	Number (%)	Number (%)	
Accident & Emergency	28 (67)	14 (33)	42
General hospital	12 (80)	3 (20)	15
Home	26 (70)	11 (30)	37
Intensive Care Unit	66 (75)	22 (25)	88
Maternity services	28 (93)	2 (9)	30
Outdoors	8 (100)	0 (0)	8
Specialist units	9 (69)	4 (31)	13
TOTAL	177 (76)	56 (24)	233

Causes of Death

Of the major causes of maternal death, both obstetric and medical related deaths had higher proportions of reviews compared to deaths related to psychiatric causes (Table 3).

Table 3: Cause of death

Cause of death	Antenatal		Postnatal		TOTAL (%)
	Reviewed Number (%)	Not reviewed Number (%)	Reviewed Number (%)	Not reviewed Number (%)	
Obstetric deaths	12 (27)	4 (9)	24 (55)	4 (9)	44 (19)
Mental health related deaths	8 (38)	4 (19)	6 (29)	3(14)	21 (9)
Medical deaths	48 (28)	16 (10)	79 (47)	25 (15)	168 (72)
TOTAL	68 (29)	24 (10)	109 (47)	32 (14)	233 (100)

The quality of the review

Of the women who died 60% (n=140) had a documented review on the care received contained within the medical records. For a further 16% (n=37) a review was mentioned but this was not included in the medical records and so the quality could not be assessed, and 24% (n=56) had no review included in the notes. The most common type of review was entitled a Serious Incident Report (29%, n=68,), with Root Cause Analysis being the title of 18% (n=41), Hospital review of 12% (n=27) and 2% (n=4) having another title.

Composition of review panels

Sixty-five percent (91/140) of reviews were conducted by a multidisciplinary team (MDT), although this did not always include maternity services, and 18% (25/140) were conducted by a single reviewer (Table 4). Of the reviews undertaken 60% (84/140) involved obstetricians or gynaecologists and 59% (82/140) included midwives. Absence of maternity service representation was evident in cases where the death occurred at a different hospital or non-maternity department of the same hospital (for example, Accident and Emergency or Intensive Care Unit). For 16% (23/140) of reviews, the job title(s) of the professional(s) who undertook them was not documented. The family was documented as having specific questions or issues addressed by the panel in 14% (19/140) of reviews and external reviewers were involved in 12% (17/140) reviews.

Table 4: Professional group of reviewers

Professional group of reviewers	TOTAL n=140 (%)
Obstetrics/Gynaecology	84 (60)
Midwifery	82 (59)
Anaesthetics	41 (29)
Senior Management	48 (34)
Risk/Governance	69 (49)
Pathologist	4 (3)
External	17 (12)
Family	19 (14)
Other professional(s)	70 (50)
Not documented	23 (16)

The exact composition of the group was sometimes lacking and, while not explicitly recommended, the authors considered the optimum minimum composition of the MDT for review to be different for each of the three causes of death: Review of a maternal death from an obstetric cause should include an obstetrician, midwife and anaesthetist and yet this was only documented in 12/30 (40%) of local reviews examined. Review of a maternal death from a medical cause should include an obstetrician, midwife and specialist in whatever the medical condition, such as a cardiac specialist and yet this was documented in only 43/102 (42%) reviews examined. Review of a maternal death relating to a psychiatric cause should include an obstetrician, midwife and psychiatric specialist and yet none of those examined did (0/8). Only 55/140 (39%) of maternal deaths were considered to have been reviewed by an optimum MDT, with the composition being unclear for 71/140 (51%).

Contributory factors

Contributory factors were systematically assessed in only 13% (18/140) of local reviews using the headings listed in national guidance (see Table 5). A further 11% (15/140) used some of these factors: overall the most frequently reported factor was Communication (31/140, 22%). A small proportion of reviews (4%) utilised headings to assess care which differed to those listed in national guidance, such as Individual Knowledge and Skill, Clinical, External, Other Factors, Documentation, or Systems. In 32% (45/140) of reviews contributory factors were described in a summary paragraph only and there was no evidence that contributory factors had been examined in 36% (50/140) of local reviews examined.

Table 5: Inclusion of contributory factors and follow-up in RCAs:

Root Cause Analysis content	Number n=140 (%)
All individual contributory factors listed	18 (13)
Some factors using National Patient Safety Agency headings	15 (11)
Some factors using different headings	5 (4)
Mixed headings	7 (5)
Summary only	45 (32)
No contributory factors	50 (35)
Actions (or recommendations / learning points)	123 (88)
No actions	17 (12)
Systemic actions	111 (79)
Systemic and individual actions	12 (9)
Non-clinical actions only	9 (6)
Timeline and person responsible identified	77 (55)
Audit	19 (14)

The majority of local reviews examined (88%) included actions to improve ongoing care; most of which were systemic (79%). None of the reviews reported individual actions alone, whilst 9% (12/140) included both systemic and individual actions. A small number of reviews (9/140) only included non-clinical actions such as conducting the review, completing death notifications, or supporting hospital staff. Only 14% (19/140) of all reviews of the care of women who died recommended or undertook an audit to monitor implementation of changes.

DISCUSSION

This is the first study to systematically examine the number and quality of local reviews of the care of women who died during or after pregnancy in the UK and Ireland. It shows that only three quarters of maternal deaths are reviewed and has highlighted that the care of women who died at less than 20 weeks gestation and between 28-42 days after birth was less likely to be reviewed. The care of women who died outside maternity services (for example at home) and women who died from mental health-related causes was also less likely to be reviewed. The study also suggests that a substantial proportion of these local reviews of care were not optimal, in that they were not undertaken by a multidisciplinary group, did not include root cause analysis and made relatively weak recommendations and actions.

This study systematically examined the quantity and quality of local reviews of maternal deaths within the UK and Ireland over a three year period. As such, this may not be representative of local

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3 reviews over a wider time period or in different countries. Assessment was made on the basis of
4 what was contained within the anonymised case notes provided to MBRRACE-UK, and therefore may
5 not reflect the full procedure of review in some cases.
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9 The study findings appears to be consistent within a wider context of reviews of care related to both
10 maternal morbidity and perinatal death in maternity services in the UK. Shah et al¹⁷ examined severe
11 maternal morbidity reviews from six UK hospitals and identified that the care of some women who
12 had severe morbidities was not reviewed and in those that were, key issues affecting the outcome
13 were not always identified, nor were lessons evidenced as being learned. National CEs into the care
14 of women who had term, normally formed antepartum stillbirths found that 23% had a local review
15 carried out and only 10% were undertaken according to Royal College of Obstetrics and Gynaecology
16 guidance.¹⁸ While these CEs were not focused on maternal deaths, it appears that there is a lack of
17 effective investigation of care within a hospital after a significant adverse outcome.
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21 There is increasing evidence that the use of root cause analysis within healthcare is problematic with
22 variable use of the investigation tools in reviews of serious incidents.¹⁹ This is further compounded
23 by the complexity of reviews being undertaken within tight deadlines and by a local team who may
24 not be independent. Indeed, this may explain why such reviews commonly result in weak corrective
25 actions and poor dissemination of findings and that repetition of similar events continues,^{20 21}
26 suggesting that lessons were not being learned and that action to address issues was inadequate.
27
28 There also appears to be tension between a 'no blame' culture and a 'just culture'²² and professional
29 hierarchies together with the emotional tensions felt by those undertaking the review of care
30 provide further challenges. Solutions identified include the need for professionalisation of incident
31 investigation (including appropriate training), a need for the involvement of patient's relatives to be
32 recognised and valued and for a better understanding of the role of blame.
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36 The purpose of review is to learn from events and this should involve reporting, investigation,
37 learning and action planning, implementation and closure¹⁵ and yet of the reviews examined, not all
38 had action plans, and just over half had a nominated person responsible for the action, with audit
39 only recommended to check change in practice in 14%. While not systematically assessed many of
40 the recommendations were for guidelines to be updated, training to be undertaken or dissemination
41 of the findings. There is some evidence that easily achieved actions do not work as effectively as
42 system changes but these are most commonly found in reviews, due to the comparatively lower
43 financial and time costs, as well as the reduced pressure to change the culture of organisations²⁰.
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45 These 'weaker' types of actions may not prevent the event from happening again.²³ Further research
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3 is needed to explore the follow-up to local review including the short and long term impact of
4 actions.
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10 **Conclusions**

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12 This study is the first to show that not all women who die in pregnancy or in the first 42 days post-
13 birth in the UK and Ireland have their care reviewed by the local hospital. It also identified variation
14 across hospitals concerning who was involved in reviews as well as the quality.
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18 The care of all women who die during or after pregnancy needs to be reviewed using a standardised
19 robust process by an appropriate multidisciplinary team. If care that can be improved is identified
20 through the review, strong actions that will change practice are necessary with audit to monitor
21 implementation to improve practice.
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25 Hospitals need to allocate sufficient time for preparation, participation and appropriate follow-up
26 for the review of care. Training is required for those involved in reviews to ensure adequate
27 assessment of maternity service systems, culture and care, not just at the time of death, in order to
28 come to a clear understanding of the mother's care and what if anything, could be done to prevent
29 the same outcome happening again.
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35 **Word count:** 3368 / 4000
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40 **What is already known about this topic:**

- 41 • National confidential enquiries have identified that many maternal deaths are preventable
- 42 • Local hospital improvements in care are needed in order to further reduce the number of
- 43 maternal deaths
- 44 • Maternal deaths should prompt a multidisciplinary review with root cause analysis within
- 45 the hospital providing care with actions to address any identified issues
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50 **What this study adds:**

- 51 • Systematic exploration of the reviews showed three quarters of women who died in
- 52 pregnancy or within six weeks of giving birth had their care reviewed and when done rarely
- 53 by an appropriate multidisciplinary team
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- When maternal deaths were reviewed, the quality of the review could be improved suggesting that improvements in training, support and adequate time are required together with using a standardised robust process

Acknowledgments: We would like to acknowledge the contribution of the many healthcare professionals and staff from the health service and other organisations who were involved in the notification of cases, the provision of data and the assessment of individual cases in both the UK and Ireland.

Data sharing: Data are available for sharing on request from HQIP at <https://www.hqip.org.uk/national-programmes/accessing-ncapop-data/#.XAFiOi10do4>

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Funding: This paper presents independent research arising from a Research Professorship award to Prof Marian Knight, NIHR-RP-011-032, supported by the National Institute for Health Research. The views expressed in this publication are those of the author(s) and not necessarily those of the NHS, the National Institute for Health Research or the Department of Health. This work was also supported by the Collaborations for Leadership in Applied Health Research and Care in the West Midlands (Grant number RGCQ17612).

Authorship: The study was designed by SK and MK. Data extraction was undertaken by FCS, LG and SK. FCS wrote the first draft of the paper which was commented on by all authors, who have approved the submitted version. All authors had access to the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Transparency declaration: The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Ethical approval: Permission was obtained from the Healthcare Quality Improvement Partnership as data controllers to enable access to the anonymised case notes for this secondary case note review study. Research Ethics Committee approval was not required for this secondary analysis of anonymous data.

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BMJ Open

Systematic exploration of local reviews of the care of maternal deaths in the UK and Ireland between 2012- 2014: a case note review study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-029552.R1
Article Type:	Research
Date Submitted by the Author:	21-May-2019
Complete List of Authors:	Cross-Sudworth, Fiona; University of Birmingham, UK, Institute of Applied Health Research Knight, Marian; University of Oxford, National Perinatal Epidemiology Unit Goodwin, Laura; University of Birmingham, Institute of Applied Health Research Kenyon, Sara; University of Birmingham, Institute of Applied Healthcare
Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	Health services research
Keywords:	Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Risk management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, OBSTETRICS, Clinical governance < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Systematic exploration of local reviews of the care of maternal deaths in the UK and Ireland between 2012- 2014: a case note review study

Title	Systematic exploration of local reviews of the care of maternal deaths in the UK and Ireland between 2012- 2014: a case note review study
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Abstract

Objectives – Local reviews of the care of women who die in pregnancy and post-birth should be undertaken. We investigated the quantity and quality of hospital reviews.

Design – Anonymised case notes review.

Participants - All 233 women in the UK and Ireland who died during or up to six weeks after pregnancy from any cause related to or aggravated by pregnancy or its management in 2012-14.

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3 12 Main outcome measures – The number of local reviews undertaken. Quality was assessed by the
4 13 composition of the review panel, whether root causes were systematically assessed and actions
5 14 detailed.
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9 15 Results – The care of 177/233 (76%) women who died was reviewed locally. The care of women who
10 16 died in early pregnancy and after 28 days post-birth was less likely to be reviewed as was the care of
11 17 women who died outside maternity services and who died from mental health-related causes.

12 18 140 local reviews were available for assessment. Multidisciplinary review was undertaken for 65%
13 19 (91/140). External involvement in review occurred in 12% (17/140) and of the family in 14%
14 20 (19/140). The root causes of deaths were systematically assessed according to national guidance in
15 21 13% (18/140). In 88% (123/140) actions were recommended to improve future care, with a timeline
16 22 and person responsible identified in 55% (77/140). Audit to monitor implementation of changes was
17 23 recommended in 14% (19/140).
18

19 24 Conclusions - This systematic assessment of local reviews of care demonstrated that not all hospitals
20 25 undertake a review of care of women who die during or after pregnancy and in the majority quality
21 26 is lacking. The care of these women should be reviewed using a standardised robust process
22 27 including root cause analysis to maximise learning and undertaken by an appropriate
23 28 multidisciplinary team who are given training, support and adequate time.
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30 **Strengths and limitations of this study**

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- 31 • This is the first study to systematically examine the number and quality of local reviews of the
32 care of women who died during or after pregnancy in the UK and Ireland.
 - 33 • This study systematically examined the quantity and quality of local reviews of maternal deaths
34 within the UK and Ireland over a three year period, which may not be representative of local
35 reviews over a wider time period or in different countries.
 - 36 • Each review was assessed on the basis of what was contained within the anonymised case notes
37 provided to MBRRACE-UK, and therefore may not reflect the full procedure of review in some
38 cases.
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40 **INTRODUCTION**

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3 41 For over six decades the care of all women who die during or shortly after pregnancy in the UK has
4 42 been independently reviewed through a process of Confidential Enquiries (CEs). These are an
5 43 internationally acknowledged method of reviewing the care of individuals who die or have severe
6 44 complications in order to learn from adverse outcomes and reduce the incidence.^{1 2} The principles
7 45 have been utilised globally to review care of women who have died in pregnancy or in the postnatal
8 46 period.³ Countries or states that have utilised systematic confidential enquiry methodology include
9 47 France,⁴ Sweden,⁵ USA states of Washington⁶ and California,⁷ Tanzania,⁸ Australia,⁹ India,¹⁰ and
10 48 South Africa.¹¹ However it is less clear as to the quality of the review and it is hard to establish from
11 49 the literature whether there is a standardised approach in individual countries as to the content of
12 50 the review. Since 2012 a collaboration called Mothers and Babies: Reducing Risk through Audits and
13 51 Confidential Enquiries across the UK (MBRRACE-UK) has been responsible for the continuation of
14 52 the national programme of CEs and the surveillance of all perinatal and maternal deaths, as well as
15 53 reviews of selected pre-determined significant morbidities. These CEs use multi-disciplinary teams of
16 54 clinicians from outside the region where the woman's death occurred, to review anonymised case
17 55 notes (medical records) and assess the care given against national guidelines. Assessment is
18 56 undertaken by these independent reviewers and a consensus regarding whether care was good or
19 57 improvements were noted, and if so, whether these may have made a difference to the woman's
20 58 outcome is made at a multi-disciplinary meeting. Findings from a maternal death CE published in
21 59 2018 identified that improvements in care may have made a difference to their outcome for 38
22 60 percent of all women who died.¹²

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38 61 There has been some controversy over the impact of these reports. Some believe that that they
39 62 have acted as a catalyst for significant improvements in maternity care across the UK and
40 63 contributed towards the reduction in the national mortality rate.¹³ Others, however, have
41 64 questioned whether incident reporting systems such as national CE or audit are responsible for
42 65 these improvements.¹⁴ Indeed, it is argued that local review of adverse outcomes is needed, in
43 66 addition to national data, in order to facilitate ownership of relevant issues and therefore increase
44 67 the chance of change in practice.¹⁵

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50 68 At local level in the UK and Ireland maternal deaths ordinarily trigger a Serious Incident review from
51 69 the hospital providing the majority of care or where the woman died. Maternal deaths are rare
52 70 events and usually described as 'unexpected and avoidable' and as such considered under the
53 71 'Serious Incident Framework' (SIF),¹⁶ wherever the death. SIFs contain the explicit recommendation
54 72 that contributory factors and/or root causes should be examined to identify fundamental issues and
55 73 ensure a full understanding of the event to maximise the learning opportunity. The focus is to

74 consider system errors, rather than a review of individual clinicians. The National Patient Safety
75 Agency developed a Root Cause Analysis (RCA) Investigation toolkit¹⁷ which provides a structured
76 way of examining nine potential contributory factors; patient, staff, task, communication,
77 equipment, work environment, organisational, education and training and team factors. There is a
78 currently no systematic assessment of the quality of local hospital-based reviews of the care of
79 women who die during or shortly after pregnancy. The aim of this study was to investigate the
80 quantity and quality of local hospital reviews following maternal deaths (during pregnancy and up
81 until 42 days after birth) between 2012 and 2014 inclusive using MBRRACE-UK anonymised case
82 records.

85 METHODS

86 All maternal deaths that occurred in the UK and Ireland in the three year period from 2012 to 2014
87 (inclusive) in early pregnancy and up to 42 days after birth were reviewed utilising anonymised case
88 record review. Access to the anonymised case notes was via the MBRRACE-UK secure website and
89 included case notes, statements and summaries as well as local review reports

90 The objectives were to identify the proportion of hospital reviews carried out when there was a
91 maternal death relating to the time, place and cause of death; to establish which professionals were
92 involved in reviews; if the root causes had systematically been assessed as recommended by the SIF;
93 and whether there were resultant actions. If there were actions, whether they were individual or
94 systematic and finally, to explore whether an audit was recommended to evaluate change in
95 practice.

96 A data extraction form was developed to include key components of the SIF. For each local review
97 three authors independently undertook the data extraction and any differences between the data
98 were resolved.

99 The major causes of antenatal and postnatal deaths were examined in relation to whether local
100 reviews of care were undertaken. These were grouped according to whether the death was related
101 to an obstetric, medical or psychiatric cause. Obstetric deaths were those due to amniotic fluid
102 embolism, anaesthesia, deaths in early pregnancy, haemorrhage or eclampsia and pre-eclampsia.
103 Deaths considered to be medical in cause included cardiac deaths, those due to malignancy,
104 neurology, sepsis, thrombosis or thromboembolism and other medical causes.

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3 106 The quality of each review was assessed based on the SIF by examining the composition of the
4 107 review panel, whether a systematic examination of the root causes (contributory factors) was
5 108 undertaken and whether any actions resulted, and audit was undertaken to evidence changes to
6 109 practice. The composition of each review panel was examined and the profession of those involved
7 110 as documented in the review.
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112 **Patient and public involvement**

113 This research was done without patient involvement as this study utilised anonymised case notes for
114 secondary analysis.
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118 **RESULTS**

119 **Number and type of reviews of care of women who died**

120 There were 262 maternal deaths that occurred between 2012 and 2014. Women who died from
121 accidental or incidental causes such as Road Traffic Accidents (n=24) were excluded and 5 sets of
122 case notes were unavailable which resulted in 233 maternal death cases for assessment. Of the 233
123 maternal deaths, 177 (76%) were reviewed by the hospital where the majority of care had been
124 given or where the woman had died. However, there was no evidence of a review having been
125 undertaken in 56 deaths (24%) and no evidence of change in this proportion over time.
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127 **Timing, place and cause of maternal deaths**

128 The timing of maternal deaths was considered in relation to whether or not a review was completed.
129 Of the 92 women who died in pregnancy, 45 (49%) of these occurred at less than 20 weeks gestation
130 with 62% reviewed. After 20 weeks' gestation a higher proportion of the deaths were reviewed
131 (85%) (Table 1). Of the 141 maternal deaths that occurred in the postnatal period, 78 (55%) occurred
132 in the first week and of these 85% (n=66) were reviewed. Of the deaths between 28 and 42 days
133 after birth, just under half (n=9, 45%) were reviewed.
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134

135 **Table 1: Timing (gestation and days) of women who died in pregnancy or in the early postnatal** 136 **period**

136

Deaths of women (gestation or days)		Reviewed	Not reviewed	TOTAL
		Number (%)	Number (%)	
Deaths in Antenatal Period (gestation)	0 - 20/40	28 (62)	17 (38)	45
	21 - 35/40	26 (87)	4 (13)	30
	36 - 42/40	14 (82)	3 (18)	17
Antenatal Total		68 (74)	24 (26)	92
Deaths in Postnatal period	0-6 days	66 (85)	12 (15)	78
	7-13 days	15 (79)	4 (21)	19
	14-27 days	19 (79)	5 (21)	24
	28-42 days	9 (45)	11 (55)	20
Postnatal Total		109 (77)	32 (23)	141
TOTAL		177 (76%)	56 (24%)	233

Place of death

An intensive care unit (ICU) was the most common location where women died (n=88); the care of 75% of the women who died in ICU was reviewed although maternity services were not always involved. Of the 30 women who died while being cared for in maternity services such as delivery suite, theatre, and wards, 93% (n=28) were reviewed (Table 2). Women who died in Accident and Emergency departments however, were less likely to have their cases reviewed (28/42, 67%) along with those who died in specialist units such as neurological, liver, vascular or cardiac units, or in palliative care (9/13, 69%).

Table 2: Place of death:

Place of death	Reviewed	Not reviewed	TOTAL
	Number (%)	Number (%)	
Accident & Emergency	28 (67)	14 (33)	42
General hospital	12 (80)	3 (20)	15
Home	26 (70)	11 (30)	37
Intensive Care Unit	66 (75)	22 (25)	88
Maternity services	28 (93)	2 (9)	30
Outdoors	8 (100)	0 (0)	8
Specialist units	9 (69)	4 (31)	13
TOTAL	177 (76)	56 (24)	233

150 Causes of Death

151 Of the major causes of maternal death, both obstetric and medical related deaths had higher
152 proportions of reviews compared to deaths related to psychiatric causes (Table 3).

153

154 **Table 3: Cause of death**

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Cause of death	Antenatal		Postnatal		TOTAL (%)
	Reviewed Number (%)	Not reviewed Number (%)	Reviewed Number (%)	Not reviewed Number (%)	
Obstetric deaths	12 (27)	4 (9)	24 (55)	4 (9)	44 (19)
Mental health related deaths	8 (38)	4 (19)	6 (29)	3(14)	21 (9)
Medical deaths	48 (28)	16 (10)	79 (47)	25 (15)	168 (72)
TOTAL	68 (29)	24 (10)	109 (47)	32 (14)	233 (100)

156

157 The quality of the review

158 Of the women who died, 60% (n=140) had a documented local review of the care received. For a
159 further 16% (n=37) a review was mentioned but this was not included in the case notes and so the
160 quality could not be assessed, and 24% (n=56) had no review included in the case notes. The most
161 common type of review was entitled a Serious Incident Report (29%, n=68), with Root Cause Analysis
162 being the title of 18% (n=41), Hospital review of 12% (n=27) and 2% (n=4) having another title.

163

164 *Composition of review panels*

165 Sixty-five percent (91/140) of reviews were conducted by a multidisciplinary team (MDT), although
166 this did not always include maternity services, and 18% (25/140) were conducted by a single
167 reviewer (Table 4). Of the reviews undertaken 60% (84/140) involved obstetricians or gynaecologists
168 and 59% (82/140) included midwives. Absence of maternity service representation was evident in
169 cases where the death occurred at a different hospital or non-maternity department of the same
170 hospital (for example, Accident and Emergency or Intensive Care Unit). For 16% (23/140) of reviews,
171 the job title(s) of the professional(s) who undertook them was not documented. The family was
172 documented as having specific questions or issues addressed by the panel in 14% (19/140) of
173 reviews and external reviewers were involved in 12% (17/140) reviews.

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177 **Table 4: Professional group of reviewers**

Professional group of reviewers	TOTAL n=140 (%)
Obstetrics/Gynaecology	84 (60)
Midwifery	82 (59)
Anaesthetics	41 (29)
Senior Management	48 (34)
Risk/Governance	69 (49)
Pathologist	4 (3)
External	17 (12)
Family	19 (14)
Other professional(s)	70 (50)
Not documented	23 (16)

178

179 The exact composition of the group was sometimes lacking and, while not explicitly recommended,
 180 the authors considered the optimum minimum composition of the MDT for review to be different
 181 for each of the three causes of death: Review of a maternal death from an obstetric cause should
 182 include an obstetrician, midwife and anaesthetist and yet this was only documented in 12/30 (40%)
 183 of local reviews examined. Review of a maternal death from a medical cause should include an
 184 obstetrician, midwife and specialist in whatever the medical condition, such as a cardiac specialist
 185 and yet this was documented in only 43/102 (42%) reviews examined. Review of a maternal death
 186 relating to a psychiatric cause should include an obstetrician, midwife and psychiatric specialist and
 187 yet none of those examined did (0/8). Only 55/140 (39%) of maternal deaths were considered to
 188 have been reviewed by an optimum MDT, with the composition being unclear for 71/140 (51%).

189 *Contributory factors*

190 Contributory factors were systematically assessed in only 13% (18/140) of local reviews using the
 191 headings listed in national guidance (see Table 5). A further 11% (15/140) used some of these
 192 factors: overall the most frequently reported factor was Communication (31/140, 22%). A small
 193 proportion of reviews (4%) utilised headings to assess care which differed to those listed in national
 194 guidance, such as Individual Knowledge and Skill, Clinical, External, Other Factors, Documentation,
 195 or Systems. In 32% (45/140) of reviews contributory factors were described in a summary paragraph
 196 only and there was no evidence that contributory factors had been examined in 36% (50/140) of
 197 local reviews examined.

198 **Table 5: Inclusion of contributory factors and follow-up in RCAs:**

Root Cause Analysis content	Number n=140 (%)
All individual contributory factors listed	18 (13)
Some factors using National Patient Safety Agency headings	15 (11)
Some factors using different headings	5 (4)
Mixed headings	7 (5)
Summary only	45 (32)
No contributory factors	50 (35)
Actions (or recommendations / learning points)	123 (88)
No actions	17 (12)
Systemic actions	111 (79)
Systemic and individual actions	12 (9)
Non-clinical actions only	9 (6)
Timeline and person responsible identified	77 (55)
Audit	19 (14)

199

200 The majority of local reviews examined (88%) included actions to improve ongoing care; most of
 201 which were systemic (79%). None of the reviews reported individual actions alone, whilst 9%
 202 (12/140) included both systemic and individual actions. A small number of reviews (9/140) only
 203 included non-clinical actions such as conducting the review, completing death notifications, or
 204 supporting hospital staff. Only 14% (19/140) of all reviews of the care of women who died
 205 recommended or undertook an audit to monitor implementation of changes.

206

207 **DISCUSSION**

208 This is the first study to systematically examine the number and quality of local reviews of the care
 209 of women who died during or after pregnancy in the UK and Ireland. It shows that only three
 210 quarters of maternal deaths are reviewed and has highlighted that the care of women who died at
 211 less than 20 weeks gestation and between 28-42 days after birth was less likely to be reviewed. The
 212 care of women who died outside maternity services (for example at home) and women who died
 213 from mental health-related causes was also less likely to be reviewed. The study also suggests that a
 214 substantial proportion of these local reviews of care were not optimal, in that they were not
 215 undertaken by a multidisciplinary group, did not include root cause analysis and made relatively
 216 weak recommendations and actions.

217 This study systematically examined the quantity and quality of local reviews of maternal deaths
 218 within the UK and Ireland over a three year period. As such, this may not be representative of local

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3 219 reviews over a wider time period or in different countries. Assessment was made on the basis of
4 220 what was contained within the anonymised case notes provided to MBRRACE-UK, and therefore may
5 221 not reflect the full procedure of review in some cases.
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9 222 The study findings appear to be consistent within a wider context of reviews of care related to both
10 223 maternal morbidity and perinatal death in maternity services. Shah et al¹⁸ examined severe maternal
11 224 morbidity reviews from six UK hospitals and identified that the care of some women who had severe
12 225 morbidities was not reviewed and in those that were, key issues affecting the outcome were not
13 226 always identified, nor were lessons evidenced as being learned. A comparison of American local and
14 227 statewide reviews of 31 maternal deaths found that state reviews found more preventable system
15 228 rather than patient factors when the cases were anonymised and investigated by an external review
16 229 team.¹⁹ National CEs into the care of women who had term, normally formed antepartum stillbirths
17 230 found that 23% had a local review carried out and only 10% were undertaken according to Royal
18 231 College of Obstetrics and Gynaecology guidance.²⁰ While some of these CEs were not focused on
19 232 maternal deaths, it appears that there is a lack of effective investigation of care within a hospital
20 233 after a significant adverse outcome.
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30 234 There is increasing evidence that the use of root cause analysis within healthcare is problematic with
31 235 variable use of the investigation tools in reviews of serious incidents.²¹ This is further compounded
32 236 by the complexity of reviews being undertaken within tight deadlines and by a local team who may
33 237 have provided care or work alongside those who have, which may reduce objectivity. Indeed, this
34 238 may explain why such reviews commonly result in weak corrective actions and poor dissemination of
35 239 findings and that repetition of similar events continues^{22 23} suggesting that lessons were not being
36 240 learned and that action to address issues was inadequate. There also appears to be tension between
37 241 a 'no blame' culture and a 'just culture'²⁴ with the emotional tensions felt by those undertaking the
38 242 review of care. A balance needs to be maintained between system and individual accountability;
39 243 reviews should not be a scapegoat exercise while any professional failure must focus on learning and
40 244 quality improvement. Suggested solutions to support quality balanced reviews include the need for
41 245 professionalisation of incident investigation (including appropriate training), a need for the
42 246 involvement of patient's relatives to be recognised and valued²⁵ and for a better understanding of
43 247 the role of blame²⁴. It is clear that the quality of reviews should be properly monitored and evaluated
44 248 by an enhanced surveillance system, such as those not only in the UK but also elsewhere in Europe,
45 249 ^{26 27} North America²⁸ and Australasia.²⁹
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57 250 The purpose of review is to learn from events and this should involve reporting, investigation,
58 251 learning and action planning, implementation and closure¹⁵ and yet of the reviews examined, not all
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3 252 had action plans, and just over half had a nominated person responsible for the action, with audit
4 253 only recommended to check change in practice in 14%. While not systematically assessed many of
5 254 the recommendations were for guidelines to be updated, training to be undertaken or dissemination
6 255 of the findings. There is some evidence that easily achieved actions do not work as effectively as
7 256 system changes but these are most commonly found in reviews, due to the comparatively lower
8 257 financial and time costs, as well as the reduced pressure to change the culture of organisations²⁰.
9 258 These 'weaker' types of actions may not prevent the event from happening again.³⁰ Further research
10 259 is needed to explore the follow-up to local review including the short and long term impact of
11 260 actions.
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263 Conclusions

264 This study is the first to show that not all women who die in pregnancy or in the first 42 days post-
265 birth in the UK and Ireland have their care reviewed by the local hospital. It also identified variation
266 across hospitals concerning who was involved in reviews as well as the quality.

267 The care of all women who die during or after pregnancy needs to be reviewed using a standardised
268 robust process by an appropriate multidisciplinary team. If care that can be improved is identified
269 through the review, strong actions that will change practice are necessary with audit to monitor
270 implementation to improve practice.

271 Hospitals need to allocate sufficient time for preparation, participation and appropriate follow-up
272 for the review of care. Training is required for those involved in reviews to ensure adequate
273 assessment of maternity service systems, culture and care, not just at the time of death, in order to
274 come to a clear understanding of the mother's care and what if anything, could be done to prevent
275 the same outcome happening again.

276 **Word count:** 3368 / 4000

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278 What is already known about this topic:

- 279 • National confidential enquiries have identified that many maternal deaths are preventable
- 280 • Local hospital improvements in care are needed in order to further reduce the number of
281 maternal deaths

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3 282 • Maternal deaths should prompt a multidisciplinary review with root cause analysis within
4 283 the hospital providing care with actions to address any identified issues
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8 285 **What this study adds:**
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- 10
11 286 • Systematic exploration of the reviews showed three quarters of women who died in
12 287 pregnancy or within six weeks of giving birth had their care reviewed and when done rarely
13 288 by an appropriate multidisciplinary team
14
15 289 • When maternal deaths were reviewed, the quality of reviews could be improved suggesting
16 290 that improvements in training, support and adequate time are required together with using
17 291 a standardised robust process
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23 293 **Acknowledgments:** We would like to acknowledge the contribution of the many healthcare
24 294 professionals and staff from the health service and other organisations who were involved in the
25 295 notification of cases, the provision of data and the assessment of individual cases in both the UK and
26 296 Ireland.
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32 298 **Data sharing:** Data are available for sharing on request from HQIP at

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34 299 <https://www.hqip.org.uk/national-programmes/accessing-ncapop-data/#.XAFiOi10do4>
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38 301 **Competing interests:** All authors have completed the ICMJE uniform disclosure form at
39 302 www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted
40 303 work; no financial relationships with any organisations that might have an interest in the submitted
41 304 work in the previous three years; no other relationships or activities that could appear to have
42 305 influenced the submitted work.
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47 306 **Funding:** This paper presents independent research arising from a Research Professorship award to
48 307 Prof Marian Knight, NIHR-RP-011-032, supported by the National Institute for Health Research. The
49 308 views expressed in this publication are those of the author(s) and not necessarily those of the NHS,
50 309 the National Institute for Health Research or the Department of Health. This work was also
51 310 supported by the Collaborations for Leadership in Applied Health Research and Care in the West
52 311 Midlands (Grant number IS-CLA-0113-10018).
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58 312 **Authorship:** The study was designed by SK and MK. Data extraction was undertaken by FCS, LG and
59 313 SK. FCS wrote the first draft of the paper which was commented on by all authors, who have

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3 314 approved the submitted version. All authors had access to the data in the study and can take
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5 315 responsibility for the integrity of the data and the accuracy of the data analysis.
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8 316 **Transparency declaration:** The lead author affirms that this manuscript is an honest, accurate, and
9
10 317 transparent account of the study being reported; that no important aspects of the study have been
11
12 318 omitted; and that any discrepancies from the study as planned have been explained.
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14 319 **Ethical approval:** Permission was obtained from the Healthcare Quality Improvement Partnership as
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16 320 data controllers to enable access to the anonymised case notes for this secondary case note review
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18 321 study. Research Ethics Committee approval was not required for this secondary analysis of
19
20 322 anonymous data.
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