



Original Article

Maternal and Perinatal Death Surveillance and Response: An Evaluation of Practices Among Healthcare Workers in South-South, Nigeria

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Abstract

Background: Despite the formal launch of Nigeria's Maternal and Perinatal Death Surveillance and Response (MPDSR) national guideline in 2016, limited data exist on actual practice among healthcare workers. This study assessed MPDSR practice and its determinants among healthcare workers in three referral hospitals in Edo State, Nigeria.

Methodology: A cross-sectional study was conducted among 221 healthcare workers in Central Hospital, Benin, University of Benin Teaching Hospital, and Irrua Specialist Teaching Hospital. MPDSR practice was assessed using three indicators: having received MPDSR training, having ever reported maternal death, and having attended maternal death reviews. Respondents who engaged in at least two of these three practices were classified as having good practice. Data were analyzed using IBM SPSS version 25, with the chi-square test and binary logistic regression. Statistical significance was set at $p < 0.05$.

Results: Only 50 (22.6%) healthcare workers demonstrated good practice of MPDSR, while 171 (77.4%) had poor practice. Training coverage was critically low (8.6%), one-third (33.9%) had ever reported a maternal death, and 48.9% had attended maternal death reviews; of these, 91.7% were passive attendees only. Multivariate analysis identified older age, good knowledge, and positive attitude toward MPDSR as independent predictors of good practice, while female sex was independently associated with lower odds of good practice (all $p < 0.05$).

Conclusion: Poor MPDSR practice prevails in the selected hospitals, with critical deficits in training coverage, death reporting, and meaningful review participation. Improving practice requires scaled-up training, strengthened reporting systems, and targeted strategies addressing knowledge, attitudinal, and gender-related barriers.

Keywords: MPDSR practice, maternal death reporting, death review attendance, healthcare workers, Nigeria

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Introduction

Maternal and perinatal death surveillance and response (MPDSR) represent a critical public health intervention for reducing preventable deaths through systematic identification, notification, review, and response to maternal and perinatal deaths.[1] The World Health Organization (WHO) launched the Maternal Death Surveillance and Response (MDSR) policy in 2012, a framework focused specifically on maternal deaths. Nigeria subsequently adapted and expanded this framework to include perinatal deaths, resulting in the Maternal and Perinatal Death Surveillance and Response (MPDSR) national guideline, formally launched in 2016. Throughout this paper, ‘MPDSR’ refers to the Nigerian national framework; ‘MDSR’ is used only when directly citing the WHO maternal-specific policy or works that use that terminology.[2,3] While the existence of policies and guidelines is essential, their impact depends fundamentally on the extent to which healthcare workers actively engage in MPDSR practices.

Methods

Study Design and Setting

This was a descriptive cross-sectional study conducted in three purposively selected referral hospitals in Edo State, Nigeria: Central Hospital Benin (CHB), a secondary healthcare facility, and two tertiary institutions, University of Benin Teaching Hospital (UBTH) and Irrua Specialist Teaching Hospital (ISTH). These facilities were selected because they are the principal referral centres in Edo State, each with functional maternity and paediatric departments, high patient volumes, and sufficient staff to provide robust data. All three facilities had MPDSR systems in operation at the time of the study, having instituted maternal death review processes in accordance with the 2017 Federal Ministry of Health national guideline. Sampling was drawn from all relevant departments (maternity, neonatal, and paediatric units) using the nominal staff roll of each facility, ensuring that healthcare workers across these units were eligible for inclusion. Findings should be interpreted within this referral-hospital context and may not be directly generalisable to primary healthcare facilities or settings where MPDSR implementation is less established.

Study Population and Sampling

The study population comprised doctors, nurses, and midwives working in maternity, neonatal, and pediatric units of the selected hospitals—healthcare professionals directly involved in maternal and perinatal care and expected to participate in MPDSR activities. Sample size calculation using Cochran’s formula for a single proportion yielded 209 participants, adjusted to 230 with a 10% non-response allowance. A sampling frame was developed from the nominal staff roll of each facility, and participants were selected using simple random sampling with computer-generated random numbers.

Data Collection and Measurement

Data were collected using a pre-tested, structured, interviewer-administered questionnaire adapted from previous maternal death surveillance studies. The instrument was pretested on 25 healthcare workers at Central Hospital, Auchi, and refined based on feedback to ensure clarity and cultural appropriateness. Six trained nurse research assistants administered questionnaires over a nine-month period.

MPDSR practice was assessed using three key indicators reflecting essential and observable components of the surveillance cycle: (1) having received MPDSR training, (2) having ever reported a maternal death, and (3) having attended maternal death reviews. Although training receipt is often conceptualised as a determinant of practice, it is also an operationally required activity within the MPDSR system — healthcare workers are expected to undergo training as an integral part of their role in MPDSR implementation.[3,11] Its inclusion as an indicator is consistent with approaches used in prior implementation studies that treat training participation as an obligatory practice component rather than merely an exposure variable.[6,12] Nonetheless, we acknowledge this conceptual tension and conducted sensitivity analyses treating training as a predictor variable rather than a practice indicator; results were consistent with the main findings. Each

indicator was scored as 1 if present and 0 if absent, yielding a maximum score of 3. Respondents scoring 2 or 3 were classified as having good practice, while those scoring 0 or 1 were classified as having poor practice, reflecting the minimum engagement necessary for meaningful participation in MPDSR.

For respondents who had attended maternal death reviews, additional information was collected on their level of involvement using three categories: attending clinical meetings, asking questions during reviews, and providing feedback on review outcomes. Knowledge and attitude toward MPDSR were also assessed as potential predictors of practice, using validated instruments described in previous publications from this study.

Data Analysis

Data were analyzed using IBM SPSS version 25. Descriptive statistics, including frequencies, percentages, and means, were computed. Bivariate analysis using chi-square test (or Fisher's exact test where appropriate) examined relationships between healthcare worker characteristics and MPDSR practice. Variables showing significant associations ($p < 0.05$) in bivariate analysis were entered into a binary logistic regression model to identify independent predictors of good practice. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated. Model fit was assessed using Hosmer-Lemeshow test and Nagelkerke R^2 . Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Ethics and Research Committee of the College of Medical Sciences, University of Benin (Protocol No. CMS/REC/2021/244). Administrative permissions were secured from the management of participating facilities. The ethics committee approved the use of verbal informed consent in lieu of written consent, on the grounds that the study involved no clinical intervention, all participants were qualified healthcare professionals capable of making an informed decision, and the questionnaire-based design posed minimal risk to participants. All participants were provided with a written participant information sheet and provided verbal informed consent before enrolment. Confidentiality was maintained throughout data collection, analysis, and reporting, and no identifying information was recorded on questionnaires.

Results

Socio-Demographic Characteristics

A total of 221 healthcare workers participated in the study (96% response rate). The majority were female (71.9%), with a mean age of 33.58 ± 7.53 years. Most respondents (70.1%) were aged 22–36 years. By professional category, doctors comprised 57.0%, nurses 28.1%, and midwives 11.8%. By designation, nurses/midwives represented 42.5%, house officers 30.8%, residents/medical officers 22.2%, and consultants 4.5%. Most participants (70.6%) had worked in their facilities for less than three years. Facility distribution showed 30.3% from Central Hospital Benin, 45.7% from UBTH, and 24.0% from ISTH.

MPDSR Practice Among Healthcare Workers

Table 1 presents the assessment of MPDSR practice across three key indicators. Only 19 (8.6%) healthcare workers had received MPDSR training, representing a critical gap in capacity building. Regarding death reporting, 75 (33.9%) had ever reported a maternal death, indicating that approximately two-thirds of healthcare workers had never engaged in this fundamental surveillance activity. Nearly half of respondents (48.9%, $n=108$) had attended maternal death reviews, showing relatively better engagement in this practice domain. Overall, only 50 (22.6%) healthcare workers demonstrated good practice of MPDSR (engaging in at least two of the three assessed activities), while the vast majority (77.4%, $n=171$) had poor practice.

Table 1: Healthcare Workers' Practice of MPDSR (N=221)

Practice Variable	Response	Frequency	Percent (%)
Trained on MPDSR	Yes	19	8.6
	No	202	91.4
Ever reported maternal death	Yes	75	33.9
	No	146	66.1
Attended maternal death review	Yes	108	48.9
	No	113	51.1
Overall Practice Score	Good	50	22.6
	Poor	171	77.4

Level of Involvement in Maternal Death Reviews

Among the 108 healthcare workers who had attended maternal death reviews, analysis of their level of involvement revealed limited depth of engagement. The vast majority (91.7%, n=99) participated only by attending clinical meetings, representing passive attendance rather than active engagement. Only 6 participants (5.6%) reported asking questions during reviews, indicating minimal active participation in critical analysis and discussion. An even smaller number, 3 participants (2.8%), provided feedback on review outcomes, suggesting very limited engagement in the action and response phases of MPDSR.

Factors Associated with MPDSR Practice

Bivariate analysis (Table 2) revealed multiple healthcare worker characteristics significantly associated with MPDSR practice. Hospital location showed a significant relationship ($\chi^2=6.645$, $p=0.036$), with Central Hospital Benin having the highest proportion of good practice (32.8%), followed by ISTH (22.6%) and UBTH (15.8%). Age demonstrated a strong association ($\chi^2=14.620$, $p=0.001$), with older healthcare workers showing progressively better practice: 17.4% among those aged 22–36 years, 28.3% among 37–46 years, and 61.5% among 47–56 years. Sex was significantly associated with practice ($\chi^2=4.569$, $p=0.033$), with male healthcare workers (32.3%) more likely to have good practice than females (18.9%). Healthcare workers' designation showed a significant association ($\chi^2=9.002$, $p=0.029$), with residents/medical officers (34.7%) and consultants (30.0%) demonstrating better practice than house officers (11.8%) and nurses/midwives (23.4%). Duration of employment was strongly associated with practice ($\chi^2=13.929$, $p=0.002$), with those employed 7–10 years showing the highest proportion of good practice (66.7%). Knowledge of MPDSR showed the strongest association ($\chi^2=29.575$, $p<0.001$), with 56.8% of those with good knowledge demonstrating good practice compared to only 15.8% of those with poor knowledge. Attitude toward MPDSR was also significantly associated ($\chi^2=5.936$, $p=0.015$), with 25.1% of those with positive attitudes having good practice compared to 3.8% of those with negative attitudes.

Table 2: Relationship Between Healthcare Worker Characteristics and MPDSR Practice (N = 221)

Variable	Good Practice n (%)	Poor Practice n (%)	χ^2	p-value
Hospital				
Central Hospital Benin	22 (32.8)	45 (67.2)	6.645	0.036
UBTH	16 (15.8)	85 (84.2)		
ISTH	12 (22.6)	41 (77.4)		
Age (years)				
22–36	27 (17.4)	128 (82.6)	14.620	0.001
37–46	15 (28.3)	38 (71.7)		
47–56	8 (61.5)	5 (38.5)		
Sex				
Male	20 (32.3)	42 (67.7)	4.569	0.033
Female	30 (18.9)	129 (81.1)		
Designation				
Consultants	3 (30.0)	7 (70.0)	9.002	0.029
Residents/Medical Officers	17 (34.7)	32 (65.3)		
House Officers	8 (11.8)	60 (88.2)		
Nurses/Midwives	22 (23.4)	72 (76.6)		
Duration of Employment				
<3 years	29 (18.6)	127 (81.4)	13.929	0.002
4–6 years	10 (30.3)	23 (69.7)		
7–10 years	8 (66.7)	4 (33.3)		
>10 years	3 (15.0)	17 (85.0)		

Knowledge of MPDSR				
Good	21 (56.8)	16 (43.2)	29.575	<0.001
Poor	29 (15.8)	155 (84.2)		
Attitude Towards MPDSR				
Positive	49 (25.1)	146 (74.9)	5.936	0.015
Negative	1 (3.8)	25 (96.2)		

Multivariate logistic regression analysis (Table 3) identified independent predictors of good MPDSR practice after controlling for potential confounders. Age emerged as a strong independent predictor, with healthcare workers aged 37–46 years (n=53) having significantly higher odds of good practice (AOR=4.050, 95% CI=1.227–13.365, p = 0.022) compared to those aged 22–36 years (n=155). The association was even stronger for those aged 47–56 years (n=13; AOR=37.787, 95% CI=3.296–433.194, p = 0.004); however, the very wide confidence interval for this category reflects the small subgroup size and should be interpreted with caution. Good knowledge of MPDSR (n=37 with good knowledge) independently predicted good practice (AOR=4.042, 95% CI=1.423–11.482, p = 0.009), supporting the knowledge-practice link. Positive attitude toward MPDSR (n=195 positive, n=26 negative) showed a strong independent association with good practice (AOR=58.638, 95% CI=3.748–917.328, p = 0.004); this large estimate with a wide confidence interval likely reflects sparse data in the negative attitude category and should be interpreted as indicating a strong positive direction of association rather than a precise effect size. Healthcare workers from UBTH had significantly lower odds of good practice compared to those from Central Hospital Benin (AOR=0.170, 95% CI=0.056–0.517, p = 0.002). Female sex was independently associated with lower odds of good practice (AOR=0.253, 95% CI=0.088–0.726, p = 0.011).

Table 3: Multivariate Analysis – Independent Predictors of Good MPDSR Practice (N = 221)

Variable	AOR	95% CI	p-value
Hospital			
Central Hospital Benin (ref)	1.000	-	-
UBTH	0.170	0.056–0.517	0.002
ISTH	0.487	0.146–1.626	0.242
Age (years)			
22–36 (ref)	1.000	-	-
37–46	4.050	1.227–13.365	0.022

47–56	37.787	3.296–433.194	0.004
Sex			
Male (ref)	1.000	-	-
Female	0.253	0.088–0.726	0.011
Knowledge of MPDSR			
Poor (ref)	1.000	-	-
Good	4.042	1.423–11.482	0.009
Attitude Towards MPDSR			
Negative (ref)	1.000	-	-
Positive	58.638	3.748–917.328	0.004

Note: $R^2 = 0.296–0.451$, $\chi^2 = 77.605$, $df = 21$, $p < 0.001$

Discussion

This study reveals profoundly poor MPDSR practice among healthcare workers in the selected referral hospitals in Edo State, with only 22.6% demonstrating good practice. This finding is particularly concerning given that these are referral-level facilities expected to have relatively better implementation of quality improvement initiatives compared to lower-level facilities. The poor practice documented in this study is consistent with reports from other Nigerian settings, including Lagos and Northern Nigeria, where substantial implementation gaps have been documented despite policy frameworks being in place.[15,16]

The extraordinarily low training coverage (8.6%) represents perhaps the most critical finding of this study. Training is the foundation upon which effective MPDSR implementation is built, providing healthcare workers with essential knowledge, skills, and confidence to engage in surveillance and review activities.[17] The fact that over 91% of healthcare workers had never received any MPDSR training suggests a fundamental weakness in capacity-building efforts. This training gap helps explain the poor knowledge levels documented in the first paper from this study and likely contributes significantly to the poor practice patterns observed.

Low death reporting (33.9%) is equally concerning. Death notification is the entry point for the entire MPDSR system — unnotified deaths cannot be reviewed, and prevention opportunities are lost.[18] Underreporting is a recognised challenge globally, driven by fear of blame, medico-legal concerns, workload pressures, and poor knowledge of reporting procedures.[19,20][18] Underreporting has been documented as a persistent challenge in maternal death surveillance systems globally, driven by factors including lack of knowledge about reporting procedures, fear of blame, concerns about medico-legal implications, workload pressures, and inadequate information systems.[19,20]

Review attendance (48.9%) was comparatively higher but predominantly passive — 91.7% of attendees only attended clinical meetings, with 5.6% asking questions and 2.8% providing outcome feedback.

Attendance, therefore, does not equate to meaningful engagement, and the quality of participation requires as much attention as coverage rates.

The age-related gradient in practice is consistent with the accumulation of experiential exposure over a career, seniority in roles that involve review activities, and greater confidence to participate actively. Targeted strategies to engage younger and junior healthcare workers in MPDSR are therefore warranted.

Good knowledge was independently associated with good practice (AOR=4.042), validating the knowledge-practice pathway of the KAP framework and supporting investment in training as a mechanism for improving practice.[21]

Positive attitude toward MPDSR was the strongest independent predictor of good practice in this study (AOR=58.6). While this estimate has a very wide confidence interval (95% CI: 3.7–917.3), likely reflecting the small number of participants with negative attitudes (n=26) and possible sparse data in this cell, the direction and statistical significance of the association are consistent with the KAP framework and corroborated by the bivariate findings. The wide interval precludes precise quantification of the effect, and the point estimate should be interpreted with caution; nonetheless, the finding affirms that attitudes — encompassing beliefs about MPDSR’s value and perceived organisational support — are important drivers of engagement.[22] Similarly, the AOR for age 47–56 years (AOR=37.8, 95% CI: 3.3–433.2) should be interpreted cautiously given the small subgroup size (n=13), though the age gradient is strongly supported by bivariate analysis ($p < 0.001$) and is biologically plausible.[22]

The finding that female healthcare workers had significantly lower odds of good practice (AOR=0.253) is concerning and warrants careful interpretation.[23] Given that females constitute the majority of the healthcare workforce in maternal and perinatal care settings, this gender gap in practice has substantial implications for MPDSR implementation. The mechanisms underlying this association were not directly examined in this study and require further investigation. Possible hypotheses that warrant empirical testing include differential assignment to review committees, structural hierarchies that limit junior female staff participation, and scheduling factors — though none of these explanations can be substantiated from the present data.

The facility-level variation in practice, with UBTH healthcare workers showing significantly poorer practice compared to Central Hospital Benin, suggests that organizational factors substantially influence implementation.[24] This pattern is somewhat counterintuitive, as tertiary facilities typically have more resources and trained staff than secondary facilities. The poorer practice at UBTH may reflect several organizational factors: larger facility size, making coordination more challenging, heavier clinical workloads limiting time for MPDSR activities, more hierarchical organizational structures inhibiting participation, or possibly less effective MPDSR leadership and management.

Comparison with international literature reveals that the practice patterns documented in this study are not unique to Nigeria but reflect broader implementation challenges in low- and middle-income countries. Studies from Ethiopia, Kenya, and Malawi have documented similar patterns of low training coverage, underreporting, and limited meaningful participation in reviews.[25,26,27] However, success stories exist. Countries like Morocco, Rwanda, and Sri Lanka achieved substantial improvements in MPDSR practice through systematic capacity building, strong political commitment, adequate resource allocation, integration with broader quality improvement initiatives, and sustained supportive supervision.[28,29]

This study has several limitations that should be considered when interpreting findings. The cross-sectional design limits causal inference. While we identified associations between knowledge, attitude, and practice, the directionality of these relationships cannot be definitively established. Practice was assessed through self-report rather than direct observation, which introduces three specific biases. First, recall bias may affect accuracy, particularly for death reporting among workers with long tenures or high patient volumes who may not recall individual reporting episodes. Second, the interviewer-administered format may amplify

social desirability bias, with respondents over-reporting participation in activities perceived as professionally desirable (training, reporting, attendance), potentially leading to overestimation of good practice. Third, reporting bias may arise if respondents conflated informal clinical discussions of deaths with formal MPDSR reporting. These biases are likely to result in overestimation of practice, meaning true practice rates may be even lower than those documented. The study was conducted in purposively selected referral-level facilities with operational MPDSR systems; findings may not generalise to lower-level facilities or to settings where surveillance systems are nascent or non-functional.

Conclusion

Poor practice of MPDSR prevails among healthcare workers in the selected referral hospitals in Edo State, with profound deficits across all assessed dimensions—training, death reporting, and review participation. Only about one in five healthcare workers demonstrates good practice, and even among those who attend reviews, meaningful engagement is minimal. The extremely low training coverage (8.6%) represents a critical gap that undermines the entire MPDSR system. The strong independent associations between practice and both knowledge and attitude validate the knowledge-attitude-practice framework and highlight the interconnected nature of these domains. Age, sex, and facility location emerge as important determinants of practice, suggesting that individual, gender-related, and organizational factors all influence implementation. Improving MPDSR practice requires comprehensive, multilevel interventions including dramatically scaled-up training programs, strengthened death notification systems, enhanced quality of review processes, targeted strategies to address gender-related barriers, and attention to organizational enablers of practice.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Launch a comprehensive, scaled-up MPDSR training program targeting at least 80% coverage of healthcare workers in maternal and perinatal care units within two years, with particular emphasis on younger healthcare workers and female staff.
2. Strengthen death notification systems through simplified reporting procedures, clear guidelines, regular feedback mechanisms, and explicit policies protecting healthcare workers from punitive consequences of honest reporting.
3. Transform death review meetings from passive clinical presentations to interactive learning sessions through facilitator training, structured review methodologies, psychological safety protocols, and dedicated time allocation.
4. Conduct gender analysis of barriers to MPDSR participation and implement targeted interventions such as flexible scheduling of review meetings, provision of child care support, active promotion of women's voices, and addressing workplace gender dynamics.
5. Strengthen facility-level MPDSR leadership through identification and training of MPDSR champions, clear role definitions, protected time for MPDSR activities, and integration of MPDSR into facility performance management systems.
6. Establish regular supportive supervision mechanisms that provide feedback, mentorship, and problem-solving support to facilities, with particular attention to large tertiary institutions where implementation challenges appear greatest.
7. Develop and implement strategies to demonstrate the tangible value of MPDSR participation, including systematic feedback on how reviews lead to improvements, recognition of healthcare worker contributions, and visible management support for MPDSR activities.

8. Integrate MPDSR into broader quality improvement initiatives rather than maintaining it as a standalone activity, leveraging existing quality improvement structures and creating synergies with other patient safety programs.

References

1. World Health Organization. Maternal death surveillance and response: technical guidance information for action to prevent maternal death. Geneva: WHO; 2013.
2. World Health Organization. Strategies toward ending preventable maternal mortality (EPMM). Geneva: WHO; 2015.
3. Federal Ministry of Health, Nigeria. National guidelines for maternal and perinatal death surveillance and response. Abuja: Federal Ministry of Health; 2017.
4. Bandali S, Thomas C, Hukin E, Matthews Z, Mathai M, Ramachandran Dilip T, et al. Maternal death surveillance and response systems in driving accountability and influencing change. *Int J Gynaecol Obstet.* 2016;135(3):365–71.
5. Pattinson RC, Say L, Makin JD, Bastos MH. Critical incident audit and feedback to improve perinatal and maternal mortality and morbidity. *Cochrane Database Syst Rev.* 2005;(4): CD002961.
6. Ayele B, Gebretnsae H, Hadgu T, Negash D, G/silassie F, Alemu T, et al. Maternal and perinatal death surveillance and response in Ethiopia: achievements, challenges and prospects. *PLoS One.* 2019;14(10):e0223540.
7. Nyamtema AS, Urassa DP, Pembe AB, Kisanga F, van Roosmalen J. Factors for change in maternal and perinatal audit systems in Dar es Salaam hospitals, Tanzania. *BMC Pregnancy Childbirth.* 2010;10:29.
8. Kongnyuy EJ, Mlava G, van den Broek N. Facility-based maternal death review in three districts in the central region of Malawi: an analysis of causes and characteristics of maternal deaths. *Womens Health Issues.* 2009;19(1):14–20.
9. Glanz K, Rimer BK, Viswanath K. Health behavior and health education: theory, research, and practice. 4th ed. San Francisco: Jossey-Bass; 2008.
10. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process.* 1991;50(2):179–211.
11. Smith H, Ameh C, Roos N, Mathai M, van den Broek N. Implementing maternal death surveillance and response: a review of lessons from country case studies. *BMC Pregnancy Childbirth.* 2017;17(1):233.
12. Kinney MV, Ajayi G, de Graft-Johnson J, Hill K, Khadka N, Om'Iniabohs A, et al. An assessment of facility-level maternal and perinatal death surveillance and response systems in four sub-Saharan African countries. *PLoS One.* 2020;15(12):e0243722.
13. Okonofua F, Imosemi D, Igboin B, Adeyemi A, Chibuko C, Idowu A, et al. Maternal death review and outcomes: an assessment in Lagos State, Nigeria. *PLoS One.* 2017;12(12):e0188392.
14. Aikpitanyi J, Ohenhen V, Ugbodaga P, Ojemhen B, Omo-Omorodion BI, Ntoimo LF, et al. Maternal death review and surveillance: the case of Central Hospital, Benin City, Nigeria. *PLoS One.* 2019;14(12):e0226075.
15. Okonofua F, Ntoimo LF, Ogu R, Galadanci H, Gana M, Okike ON, et al. Assessing the knowledge and skills on emergency obstetric care among health providers: implications for health systems strengthening in Nigeria. *PLoS One.* 2019;14(4):e0213719.
16. Mohammed A, Bajowa O, Alayande A, Elisha M, Goldson E, Mueller U, et al. Facility based maternal and perinatal mortality: evidence from maternal and perinatal death surveillance and response, Gombe State, Nigeria. *Eur J Med Health Sci.* 2022;4(5):114–9.
17. Mgawadere F, Unkels R, Kazembe A, van den Broek N. Factors associated with maternal mortality in Malawi: application of the three delays model. *BMC Pregnancy Childbirth.* 2017;17(1):219.

18. Pattinson R, Kerber K, Waiswa P, Day LT, Mussell F, Asiruddin SK, et al. Perinatal mortality audit: counting, accountability, and overcoming challenges in scaling up in low- and middle-income countries. *Int J Gynaecol Obstet.* 2009;107 Suppl 1:S113–21.
19. Tura AK, Fage SG, Ibrahim AM, Mohamed I, Ahmed R, Gure T, et al. Beyond no blame: practical challenges of conducting maternal and perinatal death reviews in eastern Ethiopia. *Glob Health Sci Pract.* 2020;8(2):150–4.
20. Lewis G. Beyond the numbers: reviewing maternal deaths and complications to make pregnancy safer. *Br Med Bull.* 2003;67:27–37.
21. Green LW, Kreuter MW. *Health program planning: an educational and ecological approach.* 4th ed. New York: McGraw-Hill; 2005.
22. Moodley J, Pattinson RC, Fawcus S, Schoon MG, Moran N, Shweni PM. The confidential enquiry into maternal deaths in South Africa: a case study. *BJOG.* 2014;121 Suppl 4:53–60.
23. Newman C, Ng C, Paqué-Margolis S, Frymus D. Integration of gender-transformative interventions into health professional education reform for the 21st century: implications of an expert review. *Hum Resour Health.* 2021;19(1):44.
24. Hadush AZ, Dagnaw FT, Getachew T, Bailey PE, Lawley R, Ruano AL. Triangulating data sources for further learning from and about the MDSR in Ethiopia: a cross-sectional review of facility-based maternal death data from EmONC assessment and MDSR system. *BMC Pregnancy Childbirth.* 2020;20:206.
25. Gebrehiwot Y, Tewolde BT. Improving maternity care in Ethiopia through facility based review of maternal deaths and near misses. *Int J Gynaecol Obstet.* 2014;127 Suppl 1:S29–34.
26. Owolabi OO, Riley T, Juma K, Mutua M, Pleasure ZH, Amo-Adjei J, et al. Incidence of maternal near-miss in Kenya in 2018: findings from a nationally representative cross-sectional study in 54 referral hospitals. *Sci Rep.* 2020;10(1):15181.
27. Geelhoed D, Lafort Y, Chissale S, Candrinho B, Degomme O. Integrated maternal and child health services in Mozambique: structural health system limitations overshadow its effect on follow-up of HIV-exposed infants. *BMC Health Serv Res.* 2013;13:207.
28. De Brouwere V, Zinnen V, Duale S. Improving the quality of maternal health services: the Moroccan initiative for preventing maternal deaths. *Trop Med Int Health.* 2014;19(8):1024–31.
29. Sayinzoga F, Bijlmakers L, van Dillen J, Mivumbi V, Ngabo F, van der Velden K. Maternal death audit in Rwanda 2009–2013: a nationwide facility-based retrospective cohort study. *BMJ Open.* 2016;6(1):e009734.