

Assessment of the Quality of Maternal Death Audits at the Departmental University Hospital Center of Borgou and Alibori, Benin, from 2020 to 2023

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Abstract

Introduction: Maternal death audits were implemented in hospitals across Benin to reduce maternal mortality. This study aimed to assess the quality of these audits at the Departmental University Hospital Center of Borgou and Alibori (CHUD-B/A) between 2020 and 2023. **Methods:** This was an observational, cross-sectional, descriptive, and analytical study based on retrospective data collection conducted from May 20 to July 4, 2024. All maternal death audits carried out between January 1, 2020, and December 31, 2023, were included. **Results:** Out of 241 reported maternal deaths, 113 were audited (46.89%; 95% CI: 40.45 - 53.40), corresponding to 84 audit reports. Only 44.30% of the recommendations were implemented. The overall quality of the audits was rated as good in 70.24% of cases, moderate in 26.19%, and poor in 3.57%. The multidisciplinary composition of the audit team was significantly associated with audit quality ($p = 0.007$; 95% CI: 1.72 - 5.24). **Conclusion:** Efforts should be strengthened to increase the proportion of audited maternal deaths and ensure the effective implementation of audit recommendations.

Keywords

Maternal Death, Audit, CHUD-B/A, Quality

1. Introduction

Maternal mortality remains high and is largely driven by preventable causes and delays in care, such as hemorrhage, hypertension, infection, and severe anemia—issues consistently documented in institutional and national reviews [1] [2]. Existing audit systems exhibit several weaknesses, including inconsistencies in case counting and review quality, as well as unreliable coverage indicators [3] [4]. Field studies have also highlighted delays in notification, underreporting of community deaths, and insufficient follow-up of recommendations [5] [6].

Ideally, every maternal death occurring in a health facility—or identified in the community—should undergo a comprehensive, timely, and standardized review leading to targeted, measurable recommendations. The tools used must be reliable, classifications must comply with the ICD-MM framework, coverage should approach 100%, and the review process must be integrated within a clear accountability mechanism [6] [7]. Active governance (by ministries or coordination bodies), a “no-blame” culture, and operational follow-up are essential to ensure the translation of recommendations into concrete action [6] [7].

In practice, many countries report incomplete audit cycles, delayed reviews, underreporting, and limited implementation of recommendations. Common challenges include non-systematic audits, lack of follow-up mechanisms, methodological gaps, and discrepancies in classification [5] [8] [9]. Several studies have documented substantial in-hospital delays and a high proportion of deaths deemed preventable due to the absence of concrete corrective measures [2].

A weak audit system leads to poor understanding of the true causes of maternal deaths, underestimation or misclassification of cases, missed opportunities for improvement, and persistently high rates of preventable mortality. The consequences are clinical (repetition of avoidable errors), programmatic (misguided priorities), and political (unreliable indicators for policy decision-making). Evidence also shows that discrepancies between post-mortem and clinical diagnoses can substantially alter the understanding of causes and the corresponding public health priorities [2] [10].

In this context, the central question arises: What is the quality of maternal death audits at the Departmental University Hospital Center of Borgou and Alibori (CHUD-B/A) between 2020 and 2023, and which factors influence their completeness, reliability, and the effective implementation of recommendations? This study was initiated to address that question.

2. Methods

It was an observational, cross-sectional, descriptive, and analytical study based on the retrospective review of maternal death audit records that occurred at the Departmental University Hospital Center of Borgou and Alibori (CHUD-B/A) between January 1, 2020, and December 31, 2023, using exhaustive sampling. The quality of the audits was defined as the ability to identify, analyze, and prevent avoidable maternal deaths, taking into account available resources and stake-

holder expectations. It was assessed using an evaluation grid specifically developed for this study, inspired by the World Health Organization's recommendations and the methodological framework proposed by Cahyanti *et al.* (2021) [4]. The internal consistency of the grid was verified using Cronbach's alpha coefficient, which showed good reliability ($\alpha = 0.82$). This grid included five key criteria—coverage (case identification), relevance (causes and contributing factors), reliability (quality and consistency of information), effectiveness (cost-benefit ratio), and acceptability (commitment of professionals, authorities, and families). Each criterion was scored out of 20 points, yielding a total score of 100, which classified audits as poor (<50), moderate (50 - 79), or good (≥ 80) in quality. The tool was pretested and validated by a panel of three public health experts to ensure its clarity, internal consistency, and reproducibility before use. Each criterion was worth 20 points, for a total of 100, classifying audits as poor (<50), moderate (50 - 79), or good (≥ 80) quality. Data were collected through a structured documentary review grid and exported to EpiData 3.2 for verification. Statistical analysis was performed using MedCalc v.19.4.1 and R. Descriptive analysis calculated frequencies, means, standard deviations, medians, and quartiles, presented in tables and graphs. Bivariate analysis tested the associations between the dependent and independent variables (Chi-square, Fisher, ANOVA), with PR and 95% CI, and significance set at 5%. The study complied with ethical principles in Benin. Data were anonymized and secured in accordance with Law No. 2009-09 of May 22, 2009.

3. Results (Figure 1)

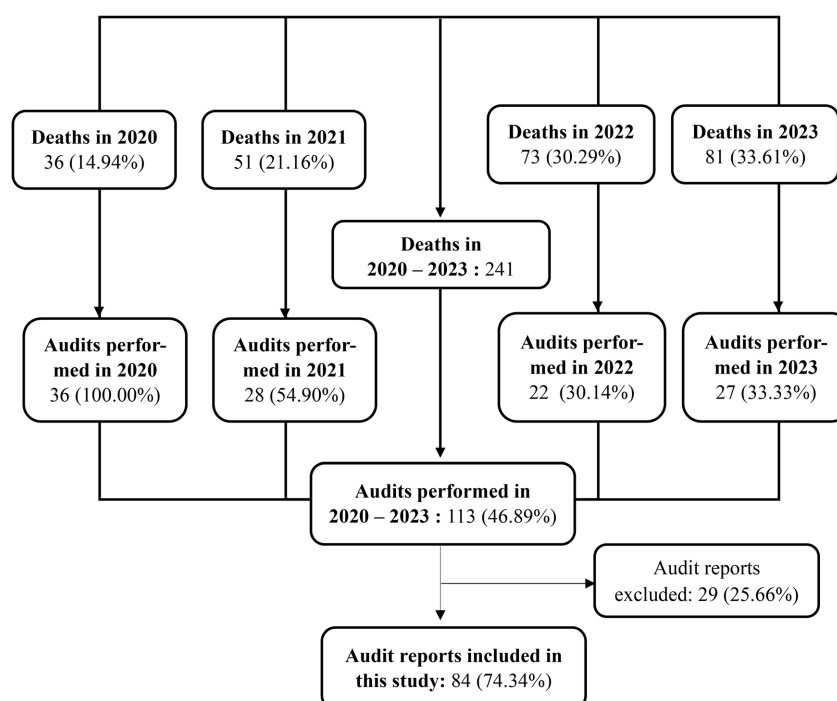


Figure 1. Flow diagram of deceased cases and audit outcomes (CHUD; 2020-2023).

➤ Hospital Maternal Mortality Rate

The hospital maternal mortality rate at CHUD-B/A from 2020 to 2023 was 2,476 maternal deaths per 100,000 live births (The CHUD-B/A is one of the largest referral centers in northern Benin, receiving the most severe obstetric cases from several departments).

➤ Audit Coverage of Maternal Death Cases at CHUD-B/A

During the study period, 113 maternal deaths were audited out of 241 reported deaths, corresponding to a maternal death audit completion rate of 46.89% (95% CI: 40.45% - 53.40%).

➤ Sociodemographic Characteristics of Deceased Women

A total of 84 maternal death records with complete audit reports were included. Although 113 audits were conducted during the study period, only 84 reports were available and usable; the remaining ones were either missing, damaged, or incomplete, making them inaccessible or unsuitable for analysis. Patients' ages ranged from 14 to 42 years, with a mean of 27.81 ± 6.93 years and a modal age group of 20 - 29 years. More than half (54.76%, 46/84) resided in urban areas, and the majority (66.67%, 56/84) were married (**Table 1**).

Table 1. Distribution of audited maternal deaths according to area of residence, marital status, and religion of the deceased women (CHUD-B/A, 2020-2023).

	Count (N = 84)	Frequency (%)
Age (years)		
• <20	10	11.90
• [20; 30[	41	48.81
• [30; 40[	30	35.71
• ≥40	03	03.57
Area of residence		
• Rural	38	45.24
• Urban	46	54.76
Marital status		
• Single	11	13.10
• Married	56	66.67
• Not specified	10	11.90
• Cohabiting	07	08.33

Patient History

A total of 86.90% (73/84) of the patients had no pre-existing medical conditions, with hypertension being the most frequent (7.14%, 6/84). A previous cesarean section was reported in 17.50% (14/84) of cases, of which 78.57% (11/14) had only one prior cesarean. Regarding complications, 86.59% (71/84) had none, with

pre-eclampsia being the most common (8.54%) (**Table 2**).

Table 2. Distribution of maternal deaths according to patient history (CHUD-B/A, 2020–2023, N = 84).

	Count (N = 84)	Frequency (%)
Previous cesarean section		
• Yes	14	17.50
• No	70	83.33
Number of cesareans (n = 14)		
• One	11	78.57
• [2; 4[	02	14.29
• ≥4	01	07.14
Previous medical or obstetric complications		
• Pre-eclampsia	07	08.54
• None	71	86.59
• Other ¹	06	07.32

Maternal Death Data

This study showed that 75% (63/84) of maternal deaths were due to direct causes, while 25% (21/84) were from indirect causes. Among the specific causes, severe pregnancy-related anemia (21.43%) was the most frequent (**Table 3**).

Table 3. Classification and distribution of maternal death causes (CHUD-B/A, 2020–2023, N = 84).

	Count (N = 84)	Frequency (%)
Type of death cause		
• Direct	63	75.00
• Indirect	21	25.00
Specific causes of maternal death		
• Postpartum hemorrhage	06	07.14
• Pre-eclampsia	07	08.33
• Complication of abortion	08	09.52
• Acute pulmonary edema	11	13.10
• Septic shock	11	13.10
• Coagulation disorder	08	09.52
• Severe pregnancy-related anemia	18	21.43
• Postpartum sepsis	08	09.52
• Other ²	31	36.90

¹Severe anemia (1), probable urinary tract infection during pregnancy (1), premature rupture of membranes (1), previous hemorrhages (1), placenta previa/abruptio placentae (HRP) (1), threatened pre-term labor (MAP) (1).

²Uterine rupture (2), genital tract infection (2), dystocia (1), amniotic fluid embolism (2), ectopic pregnancy (1), antepartum hemorrhage (4), eclampsia (5), gestational hypertension (4), disseminated intravascular coagulation (DIC) (5), failure of fetal engagement (5).

The majority of maternal deaths (61.90%) occurred after delivery. Among postpartum deaths, the mode of delivery was distributed between vaginal deliveries (53.85%) and cesarean sections (46.15%). Of the cesarean deliveries, 75.00% (18/24) were performed as emergencies (**Table 4**).

Table 4. Distribution of maternal deaths by timing, gestational age, and mode of delivery (CHUD-B/A, 2020-2023, N = 84).

	Count (N = 84)	Frequency (%)
Timing of death		
• During pregnancy	26	30.95
• During delivery	06	07.14
• Postpartum	52	61.90
Mode of delivery (n = 52)		
• Vagina	28	53.85
• Cesarean	24	46.15
Type of cesarean (n = 24)		
• Emergency	18	75.00
• Elective	06	25.00

Maternal Death Audit Data

The majority of maternal death audits were conducted more than two weeks after the death (73.81%). Regarding the number of participants, 59.52% (50/84) of audits involved 15 or more participants (**Table 5**).

Table 5. Distribution of maternal deaths according to audit data (CHUD-B/A, 2020-2023, N = 84).

	Count (N = 84)	Frequency (%)
Time between death and audit		
• ≤2 weeks	22	26.19
• >2 weeks	62	73.81
Nombre de participants		
• <15 participants	34	40.48
• ≥15 participants	50	59.52

Quality of Maternal Death Audits

Coverage: All stakeholders were included in 83.33% (70/84) of audits, and 92.86% (78/84) collected pregnancy history from the family.

Relevance: The cause of death was correctly targeted in 94.05% (79/84) of cases. Contributory factors were identified in 38.10% (32/84) and absent in 61.90% (52/84). The type of death was mentioned in 95.24% of audits.

Reliability: Epidemiological (96.43%), clinical (100%), and therapeutic (98.81%) aspects were almost always detailed. Patient journey and relational testimonies were included in 85.71% but missing in 14.29% (12/84). Consistency between results and recommendations was found in 89.29% (75/84) versus 10.71% (9/84).

Effectiveness: The benefit–cost ratio encouraged implementation of recommendations in 92.86% of audits, versus 7.14% (6/84). Recommendations were deemed sufficient in 90.48% (76/84) and insufficient in 9.52% (8/84).

Acceptability: Family participation was reported in 80.95% of audits and absent in 19.05% (16/84). Recommendations were unanimously accepted in 95.24% (80/84), and not approved in 4.76% (4/84). The administration acted promptly in 92.86% (78/84) and delayed in 7.14% (6/84); however, effective implementation occurred in only 44.30% (35/84), leaving 55.70% (44/84) unimplemented.

The majority of audits were conducted by multidisciplinary teams (90.48%) with the necessary resources (88.10%). The duration did not exceed two hours in 84.52%. Nearly all audits used international guidelines (98.81%), an effective data management/analysis system (96.43%), and appropriate tools (96.43%).

Overall Quality of Maternal Death Audits

Audit results showed that 70.24% of maternal death audits were of good quality, 26.19% were of moderate quality, and 3.57% were of poor quality. Audits conducted by non-multidisciplinary teams had a threefold higher risk of poor quality compared with audits conducted by multidisciplinary teams (**Table 6**).

Table 6. Impact of multi disciplinarity on maternal death audit quality at CHUD-B/A (2020-2023).

	N	Audit quality		PR	95% CI	P-Value
		Poor	Goodd			
Multidisciplinary audit team						
• Oui	76	19 (25.00)	57 (75.00)	1	-	-
• Non	08	6 (75.00)	2 (25.00)	3	[1.72; 5.24]	0.007

4. Discussion

Hospital Maternal Mortality Rate

The hospital maternal mortality rate observed at CHUD-B/A between 2020 and 2023 was 2,476 deaths per 100,000 live births, an alarming level reflecting a persistent burden of preventable deaths. Scientifically, such a rate highlights challenges related to both the quality of obstetric care and the structural and organizational determinants of the health system. Lower rates have been reported elsewhere: Shiferaw *et al.* (2021) reported a ratio of 228.3/100,000 at Saint Paul's Hospital in Addis Ababa [1], while Namagembe *et al.* (2022) [2] observed 350 deaths over three years in Kampala, with a lower rate but still well above global standards. These discrepancies can be explained by differences in health system context, access to care, and the capacity of hospitals to respond.

Audit Coverage of Maternal Deaths

Only 46.89% of reported deaths were audited at CHUD-B/A, far below the WHO target of near-complete coverage. This result reflects challenges in implementing the audit cycle, particularly regarding follow-up, human resources, and institutional ownership. Similar findings were reported by Gausman *et al.* (2024) [3], who noted that in India, less than half of maternal deaths audited met WHO quality standards. Likewise, Congo *et al.* (2022) [8] in Burkina Faso showed that the audit cycle was incomplete in most facilities due to non-implementation of recommendations. These convergences highlight a systemic weakness in operationalizing the “surveillance and response” concept.

Sociodemographic Profile of Deceased Women

The mean age of deceased women was 27.8 years, with a modal age group of 20–30 years, underscoring the particular vulnerability of young adults in their reproductive years. This confirms that maternal mortality primarily affects women at the peak of their reproductive and socio-economic potential. Similar observations were made by Kodan *et al.* (2021) [6] in Suriname, reporting a median age of 29 years, and by Heemelaar *et al.* (2023) [7] in Namibia, where most deaths involved women aged 20 - 35 years. That more than half of cases originated from urban areas contrasts with the usual assumption of rural predominance but aligns with the findings of Namagembe *et al.* (2022) [2] in Kampala, where rapid urbanization does not necessarily equate to equitable access to quality obstetric care.

Causes of Death

Direct causes accounted for 75% of deaths, with severe anemia (21.4%) being the most frequent. This illustrates the major burden of immediate obstetric complications and the persistent gaps in rapid prevention and management of hemorrhage and anemia. In other contexts, direct causes also predominate: Shiferaw *et al.* (2021) [1] in Ethiopia reported 90% direct deaths, dominated by hypertensive disorders and hemorrhage; Namagembe *et al.* (2022) [2] in Uganda found hemorrhage (45%) and hypertension (25%) as the leading causes. Variations in cause ranking reflect local differences in healthcare provision and disease prevalence.

The low rate of identified contributory factors (38.1%) reflects methodological weaknesses in the audit process. This may be due to incomplete medical records, delayed review sessions, or limited training of committees in root cause analysis. Similar findings by Congo *et al.* (2022) [8] and Rumbeli *et al.* (2024) [11] have shown that inadequate analysis of underlying factors reduces the corrective potential of maternal death audits.

Audit Timing and Participation

Most audits were conducted more than two weeks after death (73.81%), indicating reduced responsiveness and limiting the system’s ability for rapid learning. Ideally, audits should be conducted promptly to generate timely corrective actions. Rumbeli *et al.* (2024) [11] in Tanzania emphasized the importance of a participatory and rapid process to enhance collective learning and prevent repeated

errors. Regarding participation, more than half of audits involved at least 15 participants, reflecting an effort toward inclusivity. Similar observations were made by Namagembe *et al.* (2022) [2] in Uganda, where multi-professional involvement was a key factor for improving the quality of analysis and relevance of recommendations.

Overall Audit Quality

Overall, 70.2% of audits were of good quality, 26.2% of moderate quality, and 3.6% of poor quality. Non-multidisciplinary audits presented a threefold higher risk of poor quality, confirming the importance of a collaborative and integrated approach. These findings are consistent with Compaoré *et al.* (2022) [12] in Ghana, who highlighted the critical role of governance and collective leadership in ensuring high-quality surveillance and response processes.

Limited Implementation of Recommendations

The limited implementation of recommendations (44.3%) indicates a lack of systematic follow-up and accountability mechanisms. This may result from human and financial resource constraints, the absence of a structured action plan, or weak administrative oversight. Previous studies [12] have demonstrated that without a permanent monitoring committee, audit recommendations often remain theoretical.

Factors Influencing Audit Quality

The vast majority of audits were conducted by multidisciplinary teams (90.5%), with adequate resources and tools, representing a key quality determinant. The near-universal use of international guidelines (98.8%) confirms alignment with WHO standards. Multidisciplinarity has been identified as a major lever in several studies: Gausman *et al.* (2024) [3] showed that the diversity of involved competencies enhanced audit coherence and completeness, Congo *et al.* (2022) [8] noted that a lack of actor diversity exposed audits to bias and reduced effectiveness.

5. Limitations of the Study

This study has several limitations that should be acknowledged when interpreting the findings.

First, although 113 maternal death audits were conducted during the study period, only 84 complete audit reports were available and analyzable. The remaining reports were either missing, damaged, or incomplete, making them unsuitable for inclusion. This selective availability of records may have introduced a selection bias, particularly if the missing or unusable reports differed systematically in quality from those retained.

Second, the retrospective design relies on existing documentation and audit records, which may be subject to inaccuracies, incomplete information, and variability in how cases were recorded. Such information bias could have affected the assessment of audit quality and the identification of contributory factors.

Third, most audits were conducted more than two weeks after the maternal death, which may have increased the risk of recall bias among participants and

reduced the precision of qualitative elements such as testimonies and reconstruction of clinical pathways. Delayed reviews may also limit the accuracy of root-cause analysis and weaken the reliability of conclusions drawn from the audit process.

Despite these limitations, the study provides valuable insight into the performance of maternal death audits at the CHUD-B/A and highlights critical areas for strengthening the audit and response system.

6. Conclusion

In conclusion, although the quality of maternal death audits at CHUD-B/A was generally satisfactory, significant gaps persist in the completeness of reviews and the translation of recommendations into action. Strengthening institutional accountability requires the establishment of a permanent multidisciplinary audit and monitoring committee, supported by a digital tracking dashboard to ensure systematic follow-up of recommendations, regular feedback to clinical teams, and real-time evaluation of corrective measures. Such a structured governance approach would enhance the learning function of audits and foster continuous improvement in maternal care quality.

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Conflict of Interests

The authors declare no conflicts of interest related to the conduct of this study, the data analysis, or the writing of this manuscript.

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