

Maternal mortality trends, causes and delays in care in the Upper West Region of Ghana, 2021–2025: a retrospective observational study

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Abstract

Background

Contemporary regional evidence on maternal mortality trends, causes and care-related delays in northern Ghana remains limited. This study examined maternal mortality trends, causes of death, the Three Delays, and clinical, obstetric and health-system contributory factors in Ghana's Upper West Region from 2021 to 2025.

Methods

We conducted a retrospective observational study using routinely collected maternal death surveillance and audit records from health facilities in the Upper West Region. All 110 recorded maternal deaths were included in the mortality-trend analysis; 94 cases with sufficiently complete audit information were included in detailed analyses. Causes of death were classified using the WHO International Classification of Diseases–Maternal Mortality (ICD-MM) framework, and delays were assessed using the Three Delays Model. Classifications were derived from audit information and case narratives and finalised through multidisciplinary review and consensus. Annual institutional maternal mortality ratios (MMRs), causes of death, delays, referral characteristics and contributory factors were summarized descriptively, with cross-tabulations used to examine delays across ICD-MM cause groups.

Results

Overall, 110 maternal deaths occurred among 138,031 live births, corresponding to an institutional MMR of 80 per 100,000 live births. The MMR declined from 100 per 100,000 in 2021 to 59 in 2022, before progressively increasing to 93 in 2025. Among the 94 cases with detailed information, 61.7% were direct maternal deaths. Non-obstetric complications were the largest ICD-MM cause group (38.3%), followed by obstetric haemorrhage (27.7%) and other obstetric complications (25.5%); pulmonary embolism was the most frequently recorded specific diagnosis (21.3%). At least one delay occurred in 81.9% of cases, with Delay 3 most frequent (64.9%), followed by Delay 1 (43.6%) and Delay 2 (18.1%). Prominent contributory factors included delayed intervention (43.6%), inadequate equipment or consumables (38.3%), anaemia in pregnancy (35.1%), and inadequate clinical knowledge or skills (29.8%).

Conclusions

Maternal deaths in the Upper West Region involved substantial obstetric and non-obstetric morbidity and frequent delays across the care pathway, particularly after women reached health facilities. Strengthening emergency obstetric and medical readiness, timely clinical intervention, referral

coordination and management of high-risk pregnancies should be priorities for maternal health quality improvement.

Introduction

Maternal mortality remains a major global public health challenge and an important indicator of health-system performance and the quality of maternal healthcare. The World Health Organization (WHO) defines maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy from causes related to or aggravated by the pregnancy or its management, excluding accidental or incidental causes[1]. Despite substantial progress, an estimated 260,000 women died from pregnancy- and childbirth-related causes in 2023, with approximately 92% of these deaths occurring in low- and lower-middle-income countries[1]. Sub-Saharan Africa continues to bear a disproportionate burden, accounting for approximately 70% of global maternal deaths in 2023[1]. Progress therefore remains insufficient to achieve Sustainable Development Goal 3.1, which aims to reduce the global maternal mortality ratio (MMR) to fewer than 70 deaths per 100,000 live births by 2030. Recent peer-reviewed global analyses similarly demonstrate that progress towards this target remains inadequate [2].

Maternal deaths arise from both direct obstetric complications and indirect medical conditions. A recent WHO systematic analysis identified haemorrhage, hypertensive disorders, pregnancy-related infections, abortion and embolism among the major direct causes globally, while indirect obstetric causes accounted for a substantial proportion of deaths [2]. Similarly, a systematic review of evidence from sub-Saharan Africa identified obstetric haemorrhage, hypertensive disorders, non-obstetric complications and pregnancy-related infections as the leading cause groups[3]. Ghanaian evidence demonstrates a comparable burden of direct and indirect conditions, including hypertensive disorders, haemorrhage, sepsis, sickle cell disease and pulmonary embolism[4]. Many maternal deaths are potentially preventable through early recognition of complications, timely referral, skilled obstetric care and access to effective emergency and critical care[3, 5].

Maternal mortality estimates quantify the burden of maternal deaths but provide limited insight into where breakdowns in the pathway to effective care occur. Facility-based maternal death reviews can complement mortality estimates by identifying clinical and health-system deficiencies in the care pathway and opportunities for improving the timeliness and quality of emergency obstetric care[6]. The Three Delays Model provides a useful framework for examining these barriers, distinguishing delays in deciding to seek care (Delay 1), reaching an appropriate health facility (Delay 2), and receiving adequate and timely care after arrival (Delay 3) [7]. Evidence from low- and middle-income settings demonstrates that delays across this care pathway contribute to severe maternal outcomes[8]. In Ghana, facility-based studies have identified late referral, shortages of senior clinical staff, inadequate blood and blood products, limited critical-care capacity, and delays in receiving definitive treatment as important contributors to maternal deaths[9, 10]. These findings demonstrate that delays may occur sequentially or concurrently and that reaching a health facility does not necessarily ensure timely or effective care.

Ghana has implemented several interventions to improve maternal health, including the Free Maternal Health Services Policy, improvements in emergency obstetric care and strengthening of referral and maternal death review systems. The fee-exemption policy was introduced to improve financial access to antenatal and delivery care, although evidence indicates that indirect and residual costs may continue to limit access for some women[11]. Studies in Ghana have also demonstrated persistent health-system constraints, including inadequate logistics, equipment, blood availability, staffing and adherence to clinical protocols[10, 12]. Importantly, research from northern Ghana has identified gaps in the quality of antenatal and childbirth care despite service availability, reinforcing the need to consider quality as well as coverage[13].

Maternal mortality remains an important concern in the Upper West Region. An earlier review at the Wa Regional Hospital documented 73 maternal deaths among 14,027 live births between 2005 and 2010, corresponding to an overall MMR of approximately 520 per 100,000 live births[14]. However, contemporary regional evidence on maternal mortality trends, causes of death, care-related delays and the clinical and obstetric circumstances surrounding maternal deaths remains limited. Updated evidence from maternal death audits is therefore needed to identify potentially modifiable gaps in care and guide improvements in maternal health services. Against this background, this study examined maternal mortality trends in the Upper West Region of Ghana from 2021 to 2025, identified the leading causes of maternal death, assessed the contribution of the Three Delays, and described the clinical and obstetric contributory factors documented among maternal death cases.

Methods

Study design and setting

We conducted a retrospective observational study of routinely collected maternal death surveillance and audit records from health facilities in the Upper West Region of Ghana between January 2021 and December 2025. The study examined trends and causes of maternal death, care-related delays, referral characteristics, and clinical and obstetric factors documented among women who died. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[15].

The Upper West Region comprises 11 districts and municipalities, with Wa as the regional capital, and had a population of approximately 995,502 according to the 2021 Population and Housing Census. Maternal health services are delivered through a network of regional and district hospitals, polyclinics, health centres, clinics, maternity homes, and Community-based Health Planning and Services (CHPS) compounds.

Study population and data sources

The study included all 110 recorded and audited maternal deaths reported by health facilities in the region during the study period. All 110 deaths were included in the analysis of maternal mortality trends. Of these, 94 had sufficiently complete audit records and were included in the detailed analysis of maternal characteristics, causes of death, pregnancy outcomes, referral pathways, and delays in care (Fig. 1).

Maternal deaths were identified through the routine Ghana Health Service Maternal and Perinatal Death Surveillance and Response system using regional surveillance records and corresponding maternal death audit/review reports. Maternal death was defined according to the WHO definition as death during pregnancy or within 42 days of pregnancy termination from a pregnancy-related or pregnancy-aggravated cause, excluding accidental or incidental causes. Facility records were reconciled with the regional surveillance dataset using demographic, facility, date-of-death and clinical information to identify and remove duplicate records. Referral deaths were counted once, with referral pathway and place of death retained as case characteristics. As ascertainment was facility based and did not independently capture community deaths, mortality estimates are reported as institutional MMRs.

Data were extracted retrospectively from maternal death audit reports and routine maternal mortality surveillance records using a structured data extraction tool. Annual numbers of live births were obtained from regional routine health records for calculation of maternal mortality ratios.

Study variables and measures

Variables were selected based on information available in the maternal death audit records. Sociodemographic variables included age, marital status, educational level, occupation, religion, ethnicity, and place of residence (urban or rural). Obstetric variables included gravidity, parity, antenatal care (ANC) attendance, number of ANC visits, gestational age, previous caesarean section, previous postpartum haemorrhage, pregnancy outcome, and mode of delivery or pregnancy termination.

Clinical variables included hypertension or blood pressure problems during pregnancy, anaemia, diabetes, hepatitis B and C, HIV infection, and sickle cell disease. Mortality and health-system variables included year of maternal death, reporting district or municipality, cause of death, place and timing of death, referral status, referring facility, mode of transport, travel time, and documented delays in care. Clinical diagnoses and circumstances documented in the maternal death audit/review records were reviewed by the study team and mapped to the WHO International Classification of Diseases–Maternal Mortality (ICD-MM) framework[16], including classification as direct or indirect maternal deaths[17]. Specific recorded diagnoses were retained for descriptive analysis. Proposed classifications were reviewed alongside the case narratives by a multidisciplinary audit committee, with discrepancies resolved by consensus[18, 19].

Delays in care were classified using the Three Delays Model described by Thaddeus and Maine [7]. The Three Delays were retrospectively assigned by the study team from maternal death audit/review records

using documented care-seeking, referral and transport, presentation, clinical-management and health-system information, consistent with approaches used in previous maternal death reviews[18]. Delay 1 represented delay in deciding or seeking care; Delay 2, delay in reaching an appropriate facility, including transport or referral delays; and Delay 3, delay in receiving timely and adequate facility care, including delayed intervention and documented resource, staffing or clinical-capacity constraints. Multiple delays could be assigned to the same case. Classifications were reviewed against the case narratives by the multidisciplinary audit committee and finalised by consensus.

Data management and analysis

Data were cleaned in Microsoft Excel and analysed using Stata version 16.0. Data cleaning involved checking for duplicate records, missing or invalid values, inconsistent categorical entries, and inconsistencies between gestational age and pregnancy outcome. Categories were harmonized before analysis.

Annual institutional maternal mortality ratios (MMRs) were calculated by dividing the number of recorded maternal deaths by the corresponding number of live births recorded in regional routine health records and multiplying by 100,000. Categorical variables were summarized using frequencies and percentages. Continuous variables were summarized using means and standard deviations or medians and interquartile ranges, depending on their distribution.

Causes of death, clinical and obstetric characteristics, pregnancy outcomes, the Three Delays, health-system contributing factors, and referral and transport characteristics were summarized descriptively. Cross-tabulations were used to examine the distribution of the Three Delays across ICD-MM cause-of-death groups. Because the study included only maternal deaths and no comparison group of women who survived pregnancy, these analyses were interpreted as descriptive patterns among maternal death cases rather than estimates of risk or causal associations. Findings were presented using tables and figures.

Results

Maternal mortality trends, 2021–2025

A total of 110 maternal deaths were recorded among 138,031 live births between 2021 and 2025, corresponding to an overall institutional maternal mortality ratio (MMR) of 80 deaths per 100,000 live births. The annual MMR declined markedly from 100 per 100,000 live births in 2021 to 59 in 2022, followed by a progressive increase to 70 in 2023, 75 in 2024, and 93 in 2025 (Table 1 and Fig. 2). Thus, although the MMR remained below the 2021 level throughout the study period, the initial decline was not sustained, with a notable upward trend from 2022 to 2025.

Maternal deaths were unevenly distributed across the region. Wa Municipal accounted for 61 of 110 recorded deaths (55.5%), followed by Sissala East (12; 10.9%) and Nadowli-Kaleo (11; 10.0%). Together, these three areas accounted for 76.4% of recorded maternal deaths. These figures represent counts of deaths and should not be interpreted as district-specific maternal mortality ratios because district-level live-birth denominators were not available.

Table 1			
Maternal deaths, live births, and maternal mortality ratio, 2021–2025			
Year	Maternal deaths	Live births	MMR per 100,000 live births
2021	28	27,872	100
2022	16	27,160	59
2023	19	27,335	70
2024	20	26,536	75
2025	27	29,128	93
Total	110	138,031	80

Characteristics of maternal death cases

Detailed audit information was available for 94 of the 110 maternal deaths (85.5%). The mean age of the women was 30.9 years (SD 6.7), with approximately two-thirds (67.0%) aged 20–34 years. Most were rural residents (66.0%) and married (88.3%), while 40.4% had no formal education (Table 2).

Most women had a history of previous pregnancy, with 86.2% having been pregnant at least twice and 22.3% having a parity of five or more. Antenatal care attendance was high (95.7%). However, only 26.6% had attended eight or more ANC visits. More than half of the deaths (55.3%) occurred in pregnancies of at least 28 weeks' gestation.

Table 2
Sociodemographic, obstetric, clinical, and pregnancy-related
characteristics of maternal death cases included in the detailed audit
analysis (N = 94)

Characteristic	n (%) or summary
Sociodemographic characteristics	
Age, years, Mean $\pm$ SD	30.9 $\pm$ 6.7
Age category	
< 20 years	5 (5.3)
20–34 years	63 (67.0)
$\geq$ 35 years	26 (27.7)
Residence	
Rural	62 (66.0)
Urban	32 (34.0)
Educational status	
No formal education	38 (40.4)
Primary education	18 (19.1)
Junior High School/Middle School	15 (16.0)
Senior High School/Technical/Vocational	9 (9.6)
Tertiary education	14 (14.9)
Marital status	
Married	83 (88.3)
Never married	8 (8.5)
Cohabiting	2 (2.1)
Widowed	1 (1.1)
Occupation	
Farming	28 (29.8)
Housewife	20 (21.3)
Trading	13 (13.8)
Artisan	13 (13.8)
Civil/public servant	11 (11.7)

Characteristic	n (%) or summary
Sociodemographic characteristics	
Unemployed	9 (9.6)
Obstetric and antenatal characteristics	
Gravidity	
Primigravida (1)	13 (13.8)
Gravida 2–4	47 (50.0)
Gravida ≥ 5	34 (36.2)
Parity	
Nullipara (0)	3 (3.2)
Para 1–4	70 (74.5)
Para ≥ 5	21 (22.3)
Antenatal care attendance	
Yes	90 (95.7)
Number of antenatal care visits	
0 visits	4 (4.3)
1–3 visits	16 (17.0)
4–7 visits	49 (52.1)
≥ 8 visits	25 (26.6)
Gestational age	
< 22 weeks	31 (33.0)
22–27 weeks	11 (11.7)
28–36 weeks	42 (44.7)
≥ 37 weeks	10 (10.6)
Previous caesarean section, yes	16 (17.0)
Previous postpartum haemorrhage, yes	2 (2.1)
Clinical characteristics	
Anaemia in pregnancy, yes	33 (35.1)
Sickle cell disease, yes	16 (17.0)

Characteristic	n (%) or summary
Sociodemographic characteristics	
Blood pressure problem during ANC, yes	10 (10.6)
Tested positive for Hepatitis B, yes	4 (4.3)
Tested positive for Hepatitis C, yes	1 (1.1)
Tested positive for HIV, yes	2 (2.1)
Diabetes, yes	0 (0.0)
Delivery, pregnancy outcome, and place of death	
Mode of delivery/pregnancy termination	
Caesarean section	47 (50.0)
Surgical evacuation	25 (26.6)
Vaginal delivery/ expulsion	22 (23.4)
Pregnancy outcome	
Foetal death/miscarriage	30 (31.9)
Fresh stillbirth	33 (35.1)
Macerated stillbirth	6 (6.4)
Live birth	23 (24.5)
Neonatal death	2 (2.1)
Place of death	
District hospital	47 (50.0)
Regional hospital	35 (37.2)
Health Centre/Clinic	8 (8.6)
Private maternity home	3 (3.2)
CHPS compound	1 (1.1)

Anaemia was the most frequently documented clinical condition during pregnancy (35.1%), followed by sickle cell disease and previous caesarean section (17.0% each). Caesarean section was the most common mode of delivery or pregnancy termination (50.0%). Adverse pregnancy outcomes were common: 41.5% were stillbirths and 31.9% were foetal deaths or miscarriages, while 24.5% resulted in live births. Half of the maternal deaths occurred in district hospitals and 37.2% in the regional hospital. The median interval from delivery or pregnancy termination to maternal death was 3 days (IQR 0–5).

Causes of maternal death

Direct maternal deaths accounted for 58 of the 94 deaths (61.7%), while 36 (38.3%) were classified as indirect deaths. Based on the WHO ICD-MM classification, non-obstetric complications were the largest cause group (38.3%), followed by obstetric haemorrhage (27.7%) and other obstetric complications (25.5%). Pregnancy-related infections accounted for 7.4%, while unanticipated complications of management accounted for 1.1% (Table 3).

At the level of specific recorded diagnoses, pulmonary embolism was the most frequently documented diagnosis, accounting for 20 deaths (21.3%), followed by haemorrhagic shock (16 deaths, 17.0%). Other recorded diagnoses occurred less frequently (Fig. 3).

Table 3
Causes of maternal death according to WHO ICD-MM
classification (N = 94)

Classification / diagnosis	n	%
WHO ICD-MM group		
Non-obstetric complications	36	38.3
Obstetric haemorrhage	26	27.7
Other obstetric complications	24	25.5
Pregnancy-related infection	7	7.4
Unanticipated complications of management	1	1.1
Maternal death type		
Direct maternal death	58	61.7
Indirect maternal death	36	38.3

Three delays and documented contributory factors

Delays in accessing or receiving appropriate maternal care were common. At least one of the Three Delays was documented in 77 of 94 deaths (81.9%), while 32 (34.0%) had multiple delay types. Delay 3, representing delay in receiving adequate and timely care after reaching a health facility, was the most frequently documented delay (64.9%). Delay 1, related to deciding or seeking care, was documented in 43.6%, while Delay 2, involving reaching an appropriate health facility, was documented in 18.1%.

The most frequently documented specific contributory factor was delay in instituting interventions (43.6%), followed by delay in seeking care (41.5%) and lack of equipment or consumables (38.3%). Inadequate knowledge or skills (29.8%) and inadequate human resources (26.6%) were also commonly

documented. These findings indicate that both pre-facility and facility-level factors contributed to delays, although facility-level challenges were prominent (Table 4).

Table 4
Documented contributory factors to delays among maternal death cases (N = 94)

Specific documented contributory factors	n	%
Delay in seeking care	39	41.5
Declined treatment/admission	8	8.5
Lack of transport	8	8.5
Delay reaching referral facility	13	13.8
Communication breakdown between services	15	16.0
Lack of equipment/consumables	36	38.3
Inadequate human resources	25	26.6
Delay in instituting interventions	41	43.6
Inadequate knowledge/skills	28	29.8
<i>Because multiple delay types and contributory factors could be documented for the same maternal death, percentages are not mutually exclusive</i>		

Referral pathways and transport

More than half of the women who died (55/94, 58.5%) had been referred from another health facility. Among referred cases, health centres were the most common referring facilities (43.6%), followed by district hospitals (32.7%) and CHPS compounds (18.2%). Ambulances were the most frequently documented mode of transport (37.2%); however, nearly one-third of women (29.8%) travelled by tricycle or motorcycle, while others used private or public transport.

The median recorded travel time to a health facility or referral destination was 145 minutes (IQR 108.3–189.1), with travel times ranging from 20 to 600 minutes (Table 5).

Table 5
Referral and transport characteristics among maternal death cases
(N = 94)

Characteristic	Category summary
Referral status, N (%)	
Referred	55 (58.5)
Not referred	39 (41.5)
Referring facility among referred (n = 55)	
Health Centre	24 (43.6)
District hospital	18 (32.7)
CHPS	10 (18.2)
Clinic	2 (3.6)
Private maternity home	1 (1.8)
Transport to facility/referral	
Ambulance	35 (37.2)
Tricycle/Motor bike	28 (29.8)
Private transport	16 (17.0)
Public transport	15 (16.0)
Travel time, minutes	
Median (IQR)	145 (108.3–189.1)
Range	20–600

Distribution of delays by cause of maternal death

The distribution of delays differed across the WHO ICD-MM cause-of-death groups (Table 6). Delay 3 was particularly prominent among deaths due to obstetric haemorrhage, occurring in 21 of 26 cases (80.8%). It was also documented in 63.9% of deaths from non-obstetric complications and 54.2% of deaths from other obstetric complications.

Overall, at least one delay was documented in 92.3% of obstetric haemorrhage deaths, 85.7% of pregnancy-related infection deaths, and 83.3% of deaths due to non-obstetric complications. Delay 1 was relatively frequent among pregnancy-related infection deaths (71.4%) and non-obstetric complications (52.8%), although the small number of infection-related deaths warrants cautious interpretation.

These comparisons describe the distribution of delays among women who died and should not be interpreted as evidence that a particular delay increased the risk of maternal death, since the study did not include a comparison group of women who survived pregnancy.

Table 6
Distribution of the Three Delays by WHO ICD-MM cause-of-death group (N = 94)

WHO ICD-MM group	n	Delay 1 n (%)	Delay 2 n (%)	Delay 3 n (%)	Any delay n (%)
Overall	94	41 (43.6)	17 (18.1)	61 (64.9)	77 (81.9)
Non-obstetric complications	36	19 (52.8)	9 (25.0)	23 (63.9)	30 (83.3)
Obstetric haemorrhage	26	10 (38.5)	4 (15.4)	21 (80.8)	24 (92.3)
Other obstetric complications	24	6 (25.0)	2 (8.3)	13 (54.2)	16 (66.7)
Pregnancy-related infection	7	5 (71.4)	2 (28.6)	4 (57.1)	6 (85.7)
Unanticipated complications of management	1	1 (100.0)	0 (0.0)	0 (0.0)	1 (100.0)
Values are n (% within WHO ICD-MM cause-of-death group). Delay 1 = delay in deciding/seeking care; Delay 2 = delay in reaching an appropriate facility; Delay 3 = delay in receiving adequate and timely care after reaching a facility.					

Discussion

This study provides updated evidence on maternal mortality in the Upper West Region of Ghana and highlights an important gap between contact with maternal health services and receipt of timely, effective care. Although most women had attended antenatal care and many had been referred through the health system, delays were documented in the majority of maternal deaths, with Delay 3 predominating. The substantial contribution of non-obstetric complications further indicates that maternal mortality prevention requires both effective emergency obstetric care and stronger capacity to manage medical complications of pregnancy.

The institutional maternal mortality ratio declined markedly in 2022 but increased progressively thereafter, indicating that the initial improvement was not sustained. Given the relatively small annual number of deaths, some year-to-year fluctuation is expected; nevertheless, the sustained increase from 2022 to 2025 warrants attention. This pattern reinforces the need to examine changes in causes of death, referral pathways and health-system performance alongside annual MMR. Sustaining reductions remains a wider challenge, with recent global evidence showing that progress in maternal mortality reduction remains insufficient to achieve the Sustainable Development Goal target[2].

The cause-of-death profile differed somewhat from earlier Ghanaian reports. Although direct maternal deaths predominated overall, non-obstetric complications constituted the largest individual ICD-MM

group. At Korle Bu Teaching Hospital, Boafor et al. identified hypertensive disorders and haemorrhage as the two leading causes of maternal death[4], while a maternal death audit at the Eastern Regional Hospital similarly identified pregnancy-induced hypertension among the major causes[10]. More recent African evidence, however, demonstrates considerable variation in cause-of-death patterns. In an analysis of 18,321 reviewed maternal deaths from 22 African countries, non-obstetric complications accounted for an average of 20% of deaths and were the leading ICD-MM group in several countries[20]. Globally, indirect causes account for approximately 23% of maternal deaths[2]. Differences between studies may reflect variation in case mix, referral patterns, diagnostic capacity and classification practices rather than a true epidemiological transition. Nonetheless, the findings indicate that maternity services must be equipped to manage medical complications alongside traditional obstetric emergencies.

Pulmonary embolism was the most frequently recorded specific diagnosis in this study, a notable departure from previous Ghanaian reports in which haemorrhage and hypertensive disorders have generally predominated. At Korle Bu, pulmonary embolism accounted for 8.0% of maternal deaths compared with 37.3% for hypertensive disorders and 20.6% for haemorrhage[4]. The prominence of pulmonary embolism in the present study supports closer attention to thromboembolism risk assessment, appropriate prophylaxis, early recognition and timely management. However, this finding should be interpreted cautiously because retrospective audit records may not consistently establish whether pulmonary embolism was confirmed by definitive diagnostic investigations. Differences in diagnostic and cause-of-death classification practices could therefore partly explain its prominence.

The most important health-system finding was the predominance of Delay 3, suggesting that reaching a health facility did not consistently translate into timely and adequate treatment. This finding closely mirrors recent African evidence. Muriithi et al. found Delay 3 to be the predominant delay in 16 of the 17 African countries with available delay data, with an average contribution of 61%, compared with 26% for Delay 1 and 15% for Delay 2 [20]. Similarly, Mohammed et al. reported Delay 3 in 88.9% of maternal deaths in a ten-year hospital-based analysis, highlighting deficiencies in timely and adequate care after women reached health facilities[18]. Ghanaian maternal death audits have similarly identified late treatment, inadequate blood availability, shortages of senior clinical staff and limited critical-care capacity as important contributors to maternal deaths[10] [21]. The consistency of these findings across settings suggests that improving maternal survival requires greater attention to what happens after women reach care, rather than focusing on service utilization alone.

The specific contributory factors identified in this audit reinforce this interpretation, particularly delayed institution of interventions, inadequate equipment and consumables, human-resource constraints and gaps in clinical knowledge or skills. Similar facility-based evidence from Tanzania has highlighted the importance of timely recognition and appropriate management of severe obstetric complications in preventing progression to maternal death[6]. These deficiencies are particularly consequential for time-critical conditions such as obstetric haemorrhage. Recent global estimates identify haemorrhage as the leading cause of maternal death, accounting for approximately 27% of maternal deaths worldwide[2].

Effective management requires rapid recognition and resuscitation, access to blood and blood products, timely medical or surgical intervention and appropriate escalation of care. The concentration of Delay 3 among haemorrhage deaths in the present study does not establish causality, but it identifies emergency obstetric readiness as an important target for quality improvement.

The referral findings further demonstrate that the Three Delays operate as a continuum rather than isolated events. More than half of the women had been referred, and recorded travel times were substantial despite Delay 2 being documented less frequently than Delay 3. This may reflect under-recognition of referral delays during maternal death reviews, differences in classification, or genuinely greater bottlenecks after arrival. In a prospective study of 1,082 obstetric referrals to a regional hospital in Ghana, Goodman et al. demonstrated important delays between arrival and receipt of appropriate obstetric care[9]. Subsequent implementation research at the same hospital showed that systematic obstetric triage and quality-improvement interventions could reduce facility-based delays[22]. Strengthening referral systems should therefore encompass pre-referral stabilization, communication and transport as well as rapid triage and definitive treatment at the receiving facility.

High antenatal care attendance among women who died reinforces the broader distinction between service coverage and effective care. ANC provides an important platform for screening, early identification and management of pregnancy-related conditions and preparation for appropriate delivery and referral. However, high attendance does not necessarily indicate that women received all recommended components of quality care. Evidence from Ghana and Kenya demonstrated important gaps in the quality and content of ANC despite high service utilization, with poorer-quality ANC associated with adverse pregnancy outcomes[13, 23, 24]. The high ANC attendance observed in this study should therefore not be interpreted as evidence that ANC was ineffective. Rather, it underscores the need to strengthen the content, continuity and responsiveness of care, particularly for women with high-risk pregnancies.

Policy and practice implications

Taken together, the findings have important implications for maternal health policy and service delivery in Ghana. First, the predominance of facility-level delays suggests that improving access alone is insufficient without ensuring timely, high-quality care after women reach health facilities; regional and national strategies should therefore prioritize emergency readiness at district and referral hospitals through adequate skilled personnel, reliable blood services, essential supplies, surgical and anaesthetic capacity, and rapid escalation of care. Furthermore, the substantial contribution of non-obstetric complications highlights the need for stronger integration of obstetric, medical, anaesthetic and critical-care services, including early identification of high-risk women, timely specialist referral, and multidisciplinary management during pregnancy and the postpartum period[2]. Alongside these measures, strengthening the referral continuum should extend beyond transport to include early recognition of deterioration, pre-referral stabilization, effective communication between facilities, and rapid triage and definitive treatment on arrival, particularly for time-critical conditions such as

haemorrhage, sepsis and thromboembolic complications. Finally, maternal death surveillance and response should function as an accountability and continuous quality-improvement mechanism rather than primarily as a reporting exercise; audit findings should be translated into specific corrective actions with assigned responsibilities, timelines and follow-up indicators, supported by monitoring and re-audit[21]. Linking recurrent audit findings to resource allocation, workforce planning, emergency preparedness and supportive supervision could ultimately help translate maternal death reviews into sustained improvements in maternal care and survival.

Strengths and limitations

This study has several strengths. It provides recent five-year evidence on maternal mortality in the Upper West Region, using routinely conducted maternal death audits across the region rather than data from a single facility. The inclusion of all 110 recorded maternal deaths in the trend analysis allowed assessment of temporal changes in institutional maternal mortality, while the detailed review of 94 cases enabled examination of causes of death, referral pathways, clinical and obstetric characteristics, and the Three Delays. The use of the WHO ICD-MM framework[16] and the Three Delays Model also provides a standardized approach that facilitates comparison with other maternal death audit studies employing structured multidisciplinary case review[18, 19]. Importantly, the study integrates clinical causes with health-system and referral factors, providing actionable evidence for maternal health quality improvement.

These strengths should be considered alongside several limitations. The retrospective analysis relied on the completeness and accuracy of maternal death audit records, and 16 deaths lacked sufficient information for detailed analysis, potentially introducing selection bias. Documentation of delays may have varied across facilities and audit teams, while specific diagnoses, particularly pulmonary embolism, may have been subject to diagnostic or classification error. In addition, the reported MMR is institutional rather than population-based and should therefore not be interpreted as the maternal mortality ratio for the general population of the Upper West Region. Although ICD-MM and Three Delays classifications were finalised through multidisciplinary review and consensus, their accuracy depended on the completeness and quality of the underlying retrospective audit documentation, with potential for residual misclassification or under-ascertainment of contributory factors. Finally, because the detailed analysis was restricted to women who died and did not include a comparison group of women who survived pregnancy, observed clinical characteristics and delays represent contributory patterns among maternal deaths rather than independent risk factors, and causal associations cannot be established.

Conclusion

In conclusion, the central challenge identified by this study is not simply whether women reach maternal health services, but whether timely and effective care is delivered once they do. Reducing maternal mortality in the Upper West Region will require stronger emergency readiness, improved capacity to manage both obstetric and medical complications, better coordination across referral pathways, and greater accountability for correcting recurrent deficiencies identified through maternal death review.

Abbreviations

ANC

Antenatal care

CHPS

Community-based Health Planning and Services

GHS

Ghana Health Service

ICD-MM

International Classification of Diseases–Maternal Mortality

MMR

Maternal mortality ratio

MPDSR

Maternal and Perinatal Death Surveillance and Response

SDG

Sustainable Development Goal

STROBE

Strengthening the Reporting of Observational Studies in Epidemiology

WHO

World Health Organization.

Declarations

Ethics approval and consent to participate:

Ethical approval was obtained from the Ghana Health Service Ethical Review Committee, Upper West Regional Health Directorate (GHS-ERC-UWR; approval reference: GHS-ERC-UWR 004/08/25). Permission to access and use the maternal death surveillance and audit records was obtained from the Upper West Regional Health Directorate. The study involved the retrospective analysis of routinely collected maternal death surveillance and audit data, with no direct contact with patients or their relatives. No personal identifiers were extracted, and all data were anonymised and handled confidentially. The requirement for individual informed consent to participate was waived by the Ghana Health Service Ethical Review Committee, Upper West Regional Health Directorate, because the study used anonymised routinely collected secondary data and involved no direct participant contact.

Consent for publication:

Not applicable. The manuscript contains no identifiable individual-level information requiring consent for publication.

Competing Interest:

The authors declare that they have no competing interests.

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Author Contribution

Authors' contributions: JAN, CBD and GC conceived the study. SN, SA and JB contributed to study design and data extraction. SN, GBA, DN and BB conducted the data analysis and interpretation. SN, SA, JB and BB drafted the initial manuscript. JAN, CBD, GC, NA and BB critically reviewed and revised the manuscript for important intellectual content. JAN, CBD, SA, NA and BB provided supervision and contributed to the final review. All authors reviewed and approved the final manuscript and agree to be accountable for the work.

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Data Availability

The datasets used and/or analysed during the current study are not publicly available because they contain sensitive maternal mortality surveillance and audit information. De-identified data are available from the corresponding author on reasonable request, subject to approval by the Upper West Regional Health Directorate and compliance with applicable ethical and data-protection requirements.

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Figures

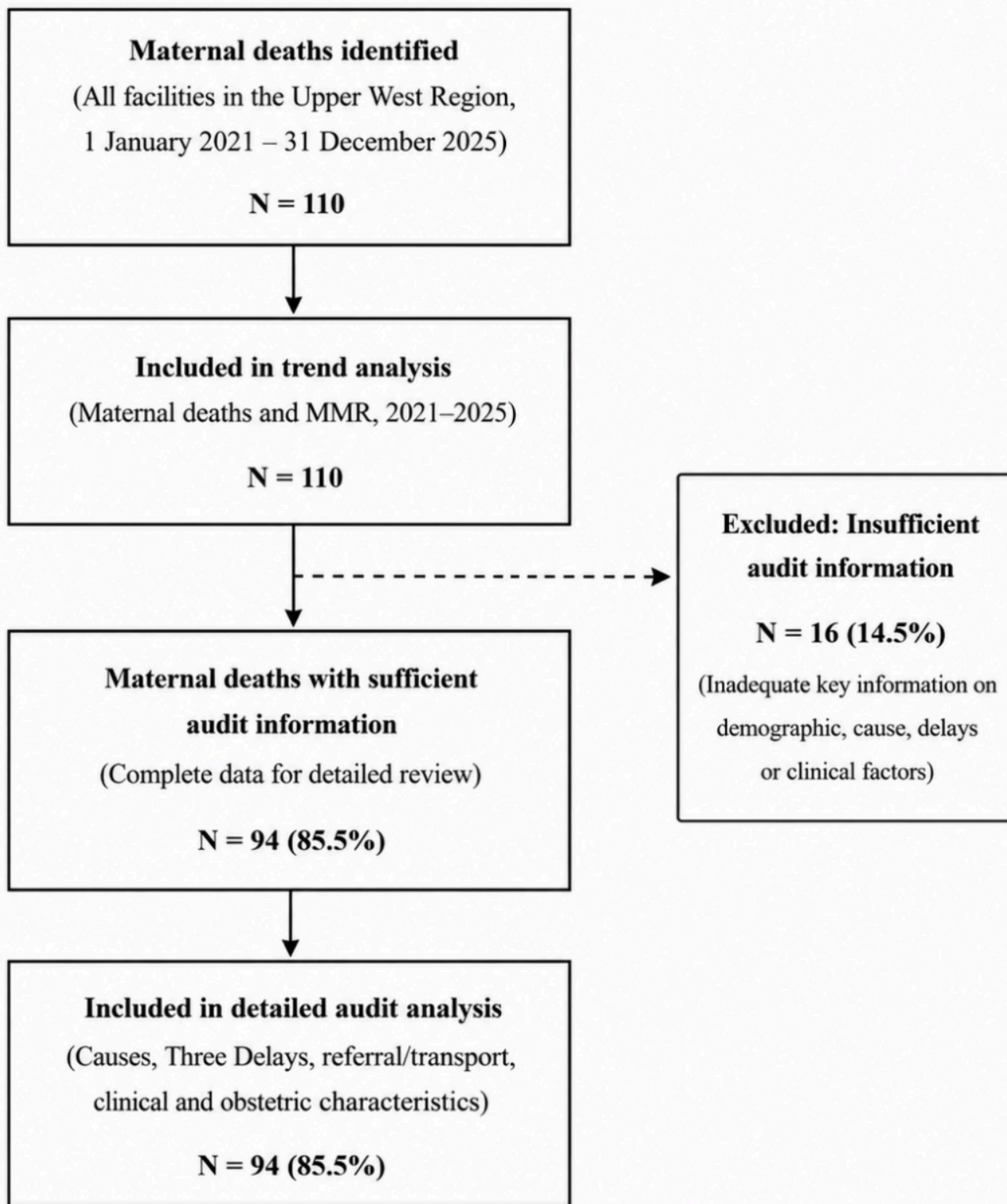


Figure 1

Study flow diagram of maternal deaths included in the analyses, Upper West region, Ghana (2021-2025)

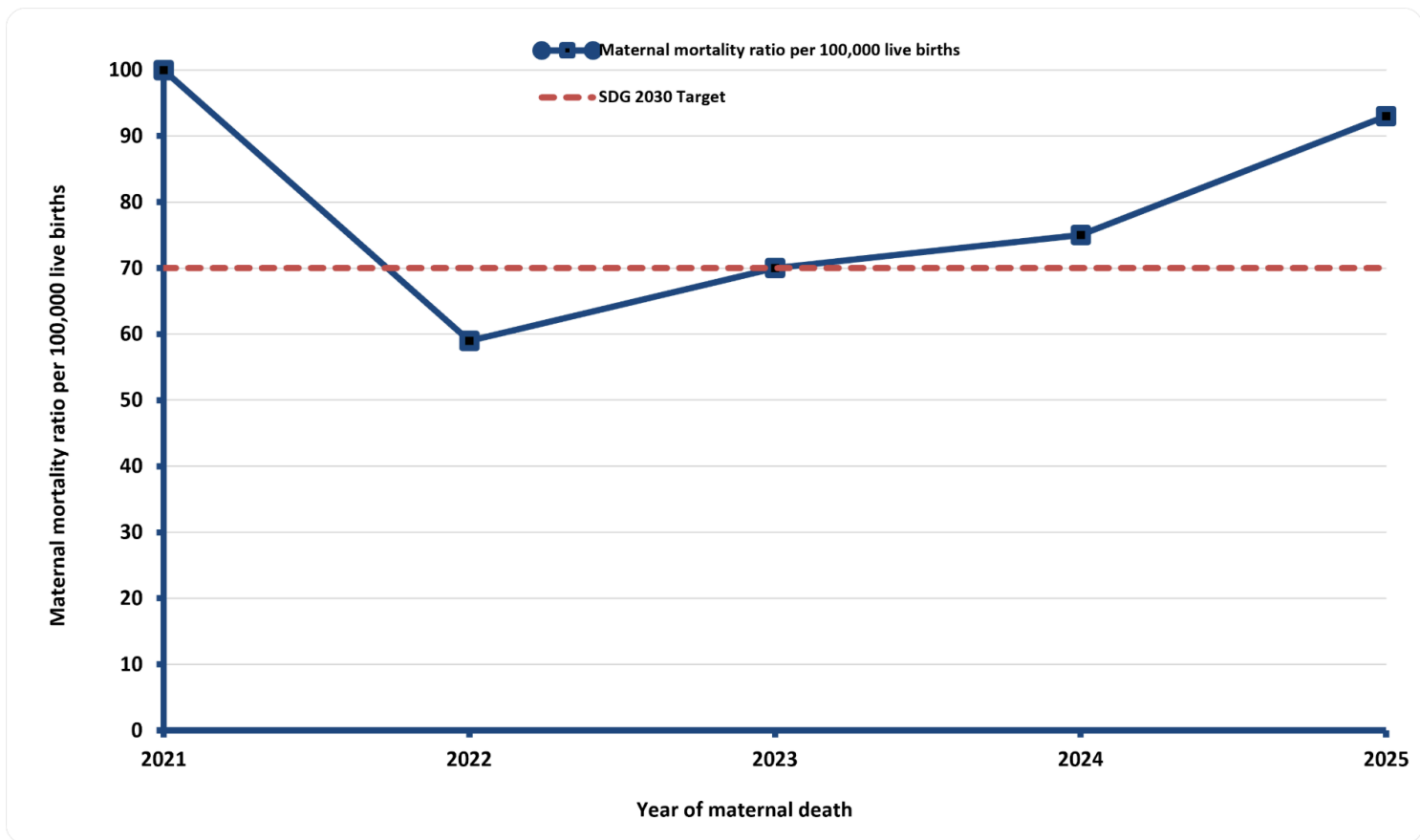


Figure 2

Maternal mortality ratio in the Upper West Region, 2021–2025.

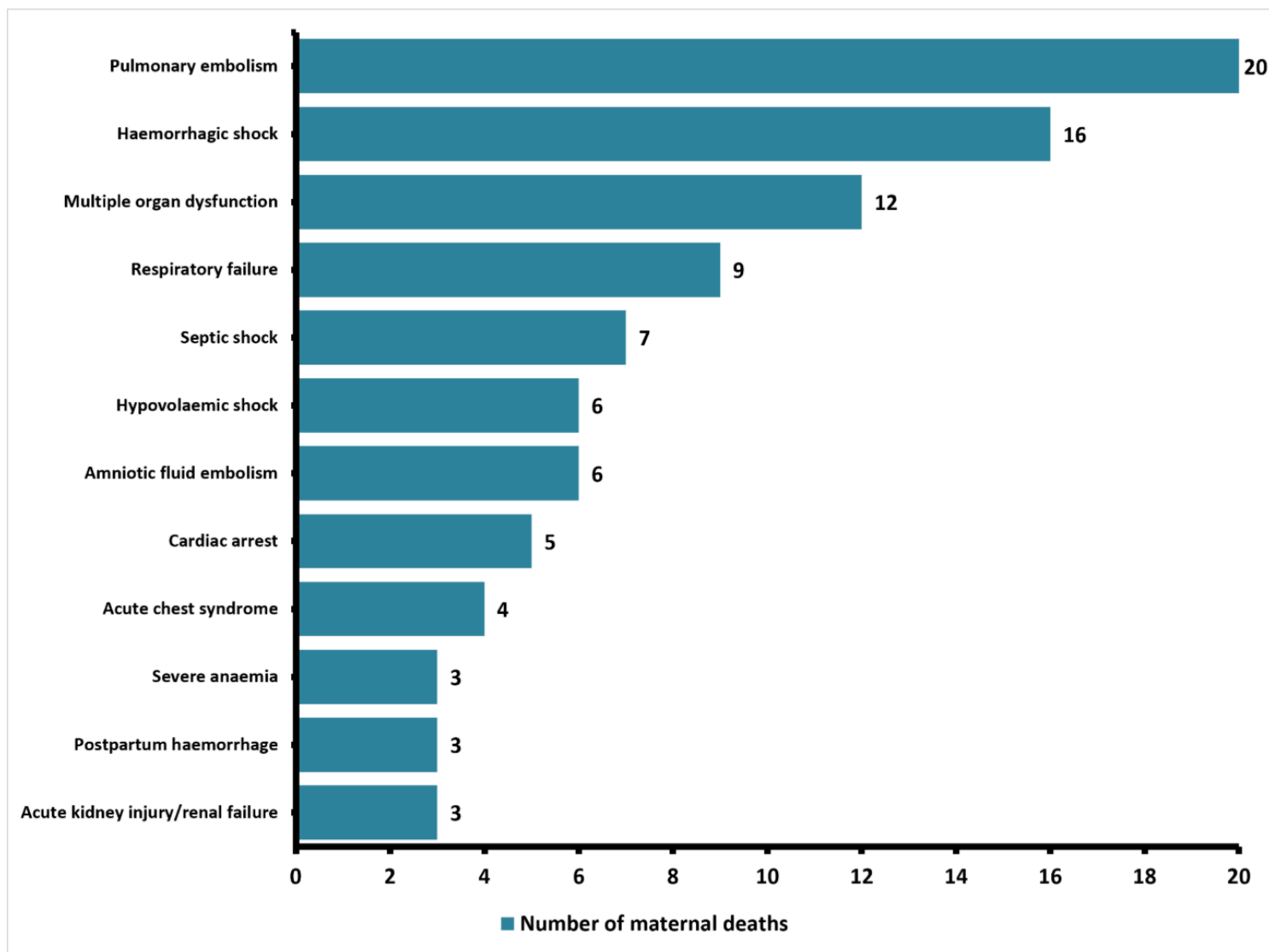


Figure 3

Leading recorded specific diagnoses among maternal deaths (N=94).