

Committee-based Certification of Causes of Maternal Death in Three Referral Hospitals in Senegal: A Prospective Multicenter Pilot Study in 2022

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ABSTRACT

Background: Reliable cause-of-death data are essential for designing effective maternal mortality prevention strategies. This study aimed to assess the implementation of committee-based certification and to describe the underlying and immediate causes of maternal deaths in three referral hospitals in Senegal.

Methods: We conducted a prospective, multicentre, descriptive pilot study from 1 January to 31 December 2022 at Pikine National Hospital and the regional hospitals of Matam and Tambacounda. All deaths meeting the World Health Organization definition of a maternal death were reviewed by a local committee. The causal sequence was reconstructed from the available records and coded according to ICD-11.

Results: Overall, 47 maternal deaths occurred among 9,262 live births, corresponding to a pooled hospital maternal mortality ratio of 507 deaths per 100,000 live births. Site-specific ratios were 325 per 100,000 in Pikine, 303 in Matam, and 962 in Tambacounda. The leading underlying causes were severe pre-eclampsia (17/47; 36.2%), immediate postpartum haemorrhage (7/47; 14.9%), and placental abruption (7/47; 14.9%). Direct obstetric causes accounted for 89.4% of deaths. Haemorrhagic shock was the most frequent immediate cause (20/47; 42.6%), followed by septic shock (7/47; 14.9%).

Conclusion: Committee-based certification documented a predominance of hypertensive disorders and obstetric haemorrhage among the underlying causes of maternal death. Standardising certification, improving clinical documentation, and linking certification with maternal death reviews may strengthen data quality and guide preventive action.

Keywords: Maternal Mortality, Cause of Death, Medical Certification, ICD-11, Maternal Death Review, Senegal.

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Introduction

A maternal death is the death of a woman while pregnant or within 42 days of the termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes [1]. ICD-11

distinguishes direct maternal deaths, resulting from obstetric complications of pregnancy, childbirth, or the postpartum period, from indirect maternal deaths, resulting from a pre-existing condition or a condition that developed during pregnancy and was aggravated by the physiological effects of pregnancy [1,2].

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Despite substantial progress, maternal mortality remains particularly high in sub-Saharan Africa [3]. In Senegal, the maternal mortality ratio was estimated at 236 deaths per 100,000 live births in 2017, whereas Sustainable Development Goal target 3.1 calls for reducing the global ratio to below 70 per 100,000 live births by 2030 [4].

Accurate identification of the causal sequence leading to death is essential for epidemiological surveillance, maternal death reviews, and the development of corrective measures. However, incomplete clinical documentation and heterogeneous certification practices may compromise data quality. Committee-based certification, drawing on multiple information sources and standardised coding, may improve the consistency of cause-of-death attribution.

The primary objective of this study was to describe the underlying and immediate causes of maternal deaths certified by committees in three referral hospitals in Senegal in 2022. Secondary objectives were to describe the implementation of the committees and to compare the distribution of causes across sites descriptively.

Methods

Study Design, Period, and Sites

This prospective, multicentre, descriptive pilot study was conducted from 1 January to 31 December 2022 at Pikine National Hospital (PNH), Matam Regional Hospital (MRH), and Tambacounda Regional Hospital (TRH). These public hospitals manage high-risk pregnancies and receive women referred from other health facilities.

Study Population and Eligibility Criteria

We included all deaths that met the WHO definition of a maternal death and occurred in one of the three hospitals during the study period. Late maternal deaths, deaths occurring in intensive care units or other departments, and deaths following interfacility transfer were actively sought and included when eligible. Accidental or incidental deaths and deaths not meeting the definition were excluded.

Organisation of the Certification Committees

An ad hoc certification committee was established in each hospital. Each committee included no more than five members (Table 1) and could seek advice from an external expert. At least three members were required to validate a certification. A four-hour orientation session was held at each hospital to explain the objectives, duration, conduct of certification meetings, and validation of the cause of maternal death. When consensus could not be reached, the cause supported by the majority was retained. The committee met whenever a maternal death was reported. For deaths following transfer, the obstetrician obtained a counter-referral form and a clinical summary whenever possible.

Data Sources and Certification Procedure

After each death, a physician completed a certification form and submitted it to the committee. The committee review was scheduled within 48 hours. Sources included the medical

record, referral or liaison forms, antenatal care record, operating theatre registers, operative reports, anaesthesia and intensive care records, and the death certificate. When necessary, additional information was obtained from the care team or the family, particularly for referred patients.

Table 1: Composition of the certification committees

Site	Composition
PNH	Two obstetrician-gynaecologists, one anaesthesiologist-intensivist, one emergency physician, and one forensic physician
MRH	One obstetrician-gynaecologist, one anaesthesiologist-intensivist, one nephrologist, one emergency physician, and one general practitioner
TRH	Two obstetrician-gynaecologists, one paediatrician, one anaesthesiologist-intensivist, and one occupational physician

Definitions and Coding

The underlying cause of death was defined as the disease or condition that initiated the chain of morbid events leading directly to death. The immediate cause was the terminal disease, condition, or complication directly responsible for death. Intermediate and contributing conditions were considered when reconstructing the causal sequence. Causes were coded according to the World Health Organization ICD-11 [1,2].

Statistical Analysis

The analysis was descriptive. Data were entered into Microsoft Excel. Categorical variables were summarised as counts and percentages. Hospital maternal mortality ratios were calculated by dividing the number of maternal deaths by the number of live births recorded during the same period and were expressed per 100,000 live births. No association analyses were performed.

Ethical Considerations

Medical information was handled confidentially and the analytical dataset was anonymised.

Results

Maternal Deaths and Hospital Maternal Mortality Ratios

Overall, 47 maternal deaths were identified among 9,262 live births, yielding a pooled hospital maternal mortality ratio of 507 deaths per 100,000 live births. The highest ratio was observed in Tambacounda (Table 2).

Table 2: Maternal deaths and hospital maternal mortality ratios by facility

Hospital	Maternal deaths, n	Live births, n	Ratio per 100,000
PNH	17	5,238	325
MRH	4	1,321	303
TRH	26	2,703	962
Total	47	9,262	507

Underlying Causes of Maternal Death

Severe pre-eclampsia was the leading underlying cause (17/47; 36.2%), followed by immediate postpartum haemorrhage and placental abruption, each accounting for seven deaths (14.9%). Direct obstetric causes accounted for 42 deaths (89.4%), whereas indirect causes accounted for five deaths (10.6%) (Table 3).

Table 3: Underlying causes of maternal death across the three hospitals

Underlying cause	ICD-11 code	n	%
Severe pre-eclampsia	JA24.1	17	36.2
Immediate postpartum haemorrhage	JA43.2	7	14.9
Placental abruption with coagulopathy	JA8C.0	7	14.9
Haemorrhage due to uterine rupture	JA43.4	5	10.6
Puerperal infection	JB40.Z	4	8.5
Severe anaemia	3A03.Y	3	6.4
Anaesthetic complication	JB0C.1	1	2.1
Intestinal obstruction	DB30.Y	1	2.1
Haemorrhagic placenta praevia	JA8B.1	1	2.1
Peripartum cardiomyopathy	JB44.3	1	2.1
Total		47	100.0

Immediate Causes of Maternal Death

Haemorrhagic shock was the most frequent immediate cause of death (20/47; 42.6%), followed by septic shock (7/47; 14.9%). Acute kidney injury, acute pulmonary oedema, and multiorgan failure occurred less frequently (Table 4).

Table 4: Immediate causes of maternal death

Immediate cause	ICD-11 code	n	%
Haemorrhagic shock	MG40.1	20	42.6
Septic shock	1G41	7	14.9
Acute kidney injury	JB44.4	5	10.6
Acute pulmonary oedema	CB01	4	8.5
Multiorgan failure	MH16	4	8.5
Heart failure	BA52.Z	3	6.4
HELLP syndrome	JA24.2	2	4.3
Cardiorespiratory arrest, unspecified	MC82.Z	1	2.1
Haemorrhagic stroke	8B00	1	2.1
Total		47	100.0

Discussion

Main Findings

This multicentre study identified 47 maternal deaths in three referral hospitals in Senegal in 2022. Direct obstetric causes predominated. Hypertensive disorders and obstetric haemorrhage were the leading underlying causes, while haemorrhagic shock was the most frequent immediate cause.

These findings highlight the persistent burden of acute obstetric complications in hospital-based maternal mortality in sub-Saharan Africa [3,5-8].

Underlying Causes

Severe pre-eclampsia accounted for more than one-third of underlying causes. Although placental abruption may be associated with hypertensive disease, it should remain classified according to the certified causal sequence rather than being automatically grouped with pre-eclampsia. Postpartum haemorrhage and uterine rupture also accounted for a substantial proportion of deaths. This distribution is consistent with several African series reporting haemorrhage, hypertensive disorders, and infection as leading direct causes [5-8].

The absence of deaths attributed to ectopic pregnancy or abortion complications during the study period should be interpreted cautiously. The small sample, limited observation period, and exclusively hospital-based recruitment do not support conclusions regarding a decline in these causes or its possible explanations.

Immediate Causes and Clinical Implications

The predominance of haemorrhagic shock underscores the importance of early recognition of obstetric haemorrhage, standardised protocols, immediate availability of uterotonics, and access to blood products. However, this study did not measure treatment delays or actual blood availability and therefore cannot directly attribute deaths to shortcomings in the blood transfusion system.

Septic shock, renal, cardiac, or multiorgan failure, and acute pulmonary oedema illustrate the need for multidisciplinary care involving obstetrics, anaesthesia and critical care, transfusion medicine, and internal medicine. Certification should be linked to confidential maternal death reviews to identify preventable factors and organisational failures.

Differences between Hospitals

The ratio observed in Tambacounda was approximately three times those recorded in Pikine and Matam. This difference may reflect the profile of referred patients, severity on admission, transfer distances, delivery volume, or resource availability. These hypotheses were not investigated and cannot be confirmed. Furthermore, the small number of deaths in Matam makes its ratio particularly sensitive to random variation.

Contribution of Committee-based Certification

Committee review of multiple documentary sources may improve the consistency of causal reconstruction and coding. Nevertheless, the study did not compare causes assigned before and after committee deliberation or measure inter-rater agreement. It therefore describes implementation of the approach without formally demonstrating improved diagnostic accuracy.

Limitations

This study has several limitations: the small sample size, inclusion of only three hospitals, exclusively hospital-based recruitment,

exclusion of community deaths, variable record quality, absence of autopsy data, and lack of inter-rater agreement assessment. Ratios were based on a single year and should not be interpreted as regional estimates. Finally, the available data did not allow assessment of delays in care or preventability.

Conclusion

This pilot study implemented committee-based certification for 47 maternal deaths occurring in three referral hospitals in Senegal in 2022. Direct obstetric causes predominated, particularly hypertensive disorders and obstetric haemorrhage, while haemorrhagic shock was the leading immediate mechanism of death. Standardising certification according to ICD-11, improving clinical documentation, and integrating certification with maternal death reviews may strengthen data quality. Larger studies incorporating feasibility indicators, diagnostic agreement, and preventability assessment are needed to determine the added value of this approach.

Declarations

Funding

This study received no specific funding.

Competing Interests

The authors declare that they have no competing interests related to this article.

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