

Research Article

# Analysis of Maternal Deaths Occurring in Tambacounda Region (Senegal) During 2023

El Hadji Cheikh Abdoulaye Diop<sup>1,\*</sup> , Modou Mback éFaye<sup>2</sup> , Bayal Cisse<sup>2</sup>,  
Abdoul Aziz Ndiaye<sup>3</sup> , Ad ða ñle Ndew Dog<sup>1</sup> , Khadyjatou Ba<sup>2</sup>

<sup>1</sup>Health District of Tambacounda, Ministry of Health and Social Action, Tambacounda, Senegal

<sup>2</sup>Regional Directorate of Health of Tambacounda, Ministry of Health and Social Action, Tambacounda, Senegal

<sup>3</sup>Training and Research Unit of Health and Sustainable Development, Alioune Diop University, Bambey, Senegal

## Abstract

**Introduction:** Maternal mortality remains a significant public health challenge in developing countries like Senegal, particularly in the Southeast regions. The objective of this study was to determine the epidemiological, clinical, and paraclinical profile of maternal deaths recorded in the Tambacounda region during the year 2023. **Methodology:** This was a retrospective and descriptive study. Data were collected using Excel 2007 and pertained to sociodemographic characteristics, obstetric histories, clinical parameters, paraclinical data, and outcomes. The analysis was performed using R software version 4.4.1. **Results:** In 2023, a total of 115 maternal deaths were recorded, equivalent to 284 deaths per 100,000 live births. Among these deaths, 113 were analyzed, with 61.1% occurring in the regional hospital. The age group most affected was 20-24 years, representing 31.1% of cases, and 30.1% of the women were primigravida. Approximately 27.4% of women did not receive prenatal care, 42.5% did not undergo biological assessments, and 43.4% did not have ultrasounds. While 43.4% did not have a partogram, 30.1% of the women had not given birth at the time of death, which occurred during the second trimester in 38.9% of cases, followed by the third trimester at 30.7%. Preeclampsia/eclampsia was the leading cause of death, accounting for 19.5%. Deaths were deemed avoidable in 28.3% of cases, but a large proportion (69.9%) was not assessed. **Conclusion:** This study reveals a high maternal mortality rate (284 deaths per 100,000 live births) in the Tambacounda region, especially among women aged 20 to 24 years (31.1%) and primigravida (30.1%), with deficiencies in prenatal care and examinations. The early detection and referral of pregnant women with gynecological-obstetric morbidity factors must be strengthened.

## Keywords

Analysis, Maternal Deaths, Tambacounda, Senegal

## 1. Introduction

The World Health Organization (WHO) defines maternal mortality as the death of a woman during pregnancy or within 42 days of the end of pregnancy, regardless of the duration and

location of the pregnancy, caused by or aggravated by pregnancy or its management, but not from accidental or incidental causes. This includes deaths resulting from direct

\*Corresponding author: docdiop82@gmail.com (El Hadji Cheikh Abdoulaye Diop)

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complications (such as hemorrhage, infections, or pregnancy-related hypertension) as well as indirect complications stemming from pre-existing conditions or those worsened by pregnancy [1].

The maternal mortality rate is defined as the number of maternal deaths recorded each year per 100,000 live births [2]. It decreased by about 34% worldwide between 2000 and 2020. Overall, developing countries saw a significant reduction in maternal mortality during the same period, with nearly a 50% decrease in the least developed countries. However, much work remains to be done to achieve global maternal health goals [3]. In 2020, nearly 287,000 women died during or after pregnancy and childbirth. About 95% of these deaths could have been prevented, highlighting the urgent need to strengthen maternal health systems globally. Additionally, nearly all (95%) maternal deaths occurred in low and middle-income countries in 2020, underscoring persistent disparities in maternal health and the need for targeted action [2].

In 2020, 87% (253,000) of the maternal deaths recorded globally occurred in sub-Saharan Africa and South Asia, according to the regional and subregional breakdown used for the Sustainable Development Goals. Specifically, 70% of maternal deaths (202,000) took place in sub-Saharan Africa, while 16% (47,000) occurred in South Asia [2].

In Senegal, there was a decrease of 156 points, with the maternal mortality rate dropping from 392 deaths per 100,000 live births in 2010 [4] to 236 deaths per 100,000 live births in 2017, indicating a significant improvement in maternal health [5]. This data highlights the critical importance of maternal health worldwide and underscores how maternal mortality remains a major challenge despite the progress made.

Classically, maternal deaths are categorized as either due to direct obstetric causes or indirect obstetric causes. Direct obstetric deaths result from complications related to pregnancy, interventions, omissions, or inappropriate treatment [6]. Indirect obstetric deaths are the result of a pre-existing condition that is exacerbated by the physiological effects of pregnancy [6]. According to Say and *al.*, the main causes of maternal mortality are hemorrhage (27.1%), hypertension (14%), sepsis (10.7%), other indirect causes (9.7%), abortion (8%), and embolism (3.2%) [7].

The three delays model allows for the analysis of issues related to maternal deaths from three different and complementary perspectives: the delay in decision-making within the family to seek care, the delay in accessing healthcare during the transfer of the pregnant woman to a healthcare facility, and the delay in the management of childbirth and/or obstetric emergencies, as well as the quality of care received [6, 8, 9].

To address the challenge of maternal mortality, the WHO recommends establishing maternal and perinatal death surveillance and response committees within healthcare facilities. Care provided by qualified health professionals before, during, and after childbirth plays a crucial role in reducing maternal and infant mortality. Investing in the training and deployment of qualified health professionals is essential to saving the lives

of women and newborns [10].

Gender studies assessing the epidemiological, clinical, and paraclinical profiles of maternal deaths in developing countries, particularly in Senegal and specifically in the region, are scarce. The aim of this study is to contribute to the reduction of maternal mortality in the Tambacounda region.

## 2. Methodology

### 2.1. Study Framework

Our study was conducted in the Tambacounda region, established by Law 2008-14 of March 18, 2008, which remains the largest region in Senegal despite the elevation of its former department, Kédougou, to regional status. Covering an area of 42,706 km<sup>2</sup> it had a population of 872,156 in 2020 and 904,032 in 2021, with a density increasing from 20 to 21.16 inhabitants/km<sup>2</sup>. The population, primarily rural, is unevenly distributed across the seven health districts (Tambacounda, Koumpentoum, Goudiry, Bakel, Kidira, Maka Colibantang, and Diank é Makha) [11, 12].

The region is characterized by notable ecological diversity, with varied ecosystems and a climate that alternates between a hot, overcast rainy season and a scorching, partially cloudy dry season. Temperatures range from 19 °C to 40 °C [11].

In 2024, in terms of healthcare infrastructure, the region housed one level 2 hospital with a dialysis unit, seven reference health centers, three of which have emergency obstetric and neonatal care operating rooms, 156 health posts, 128 health huts, and 408 community sites. The healthcare staff comprised 17 public health doctors, 13 general practitioners, 9 specialist doctors, 3 pediatricians,

5 dental surgeons, 4 obstetrician-gynecologists, 11 pharmacists, 65 senior health technicians, 169 state midwives, 131 state nurses, 92 state nursing assistants, 9 social workers, and 28 hygiene agents [11, 12].

### 2.2. Study Type and Population

We conducted a retrospective and descriptive study of maternal deaths recorded in healthcare facilities in the Tambacounda region during the year 2023.

### 2.3. Inclusion and Exclusion Criteria

All maternal deaths for which data were available were included in the study. Maternal deaths for which information could not be obtained were excluded from the study.

### 2.4. Recruitment

A comprehensive recruitment was conducted, encompassing all maternal deaths recorded both at the regional hospital and in the health centers and posts in the Tambacounda region.

## 2.5. Data Collection

Data were collected using Excel 2007 and related to geographic characteristics, medical history, clinical and para-clinical data as well as aspects related to the deaths.

## 2.6. Operational Definition of Variables

The variables were related to:

1. Geographic characteristics: area of responsibility, address, origin, district, department;
2. Obstetric history: gravidity and parity;
3. Clinical characteristics: prenatal consultation, evacuation, delivery, mode of delivery, partogram;
4. Paraclinical characteristics: biology, ultrasound;
5. Death characteristics: length of stay, cause of death, location, date, month, trimester, audit, and availability of the audit report.

## 2.7. Data Analysis

We conducted a descriptive analysis [13, 14], allowing us to assess the geographic characteristics of the patients as well as their obstetric history. This analysis also covered clinical, paraclinical, and progressive data, thereby providing an overview of essential elements related to maternal deaths, particularly in terms of location, healthcare pathways and the evolution of cases prior to death.

## 2.8. Ethical Considerations

The protocol received approval from the regional director of health in Tambacounda. All data collected for this study were anonymized to ensure that no personal identification of participants was possible. Confidentiality was strictly maintained, and the information collected will be used solely for advocacy purposes in the fight against maternal deaths, in accordance with current ethical standards.

## 3. Results

### 3.1. Distribution According to Socio Demographic Data

The data indicate that the districts of Koumpentoum and Tambacounda are the most affected, each accounting for 25.7% of the cases. The health district of Maka Colibantang follows with 12.4%, while the districts of Bakel and Védingara report 8% and 6.2% of cases, respectively.

Regarding the departments of origin, the reported cases in Tambacounda are the most frequent, representing 38.1% of the total, followed by Koumpentoum at 25.7%, Bakel at 14.2%, and Goudiry at 8%. Cases from outside the region account for 14.2%.

Concerning the place of death, 61.1% of deaths occurred

at the Regional Hospital, while 15.9% took place in a health center and 10.6% in a health post.

In terms of patient age, the 20 to 24-year age group is the most affected, representing 31.1% of the cases, followed by the 30 to 34-year age group with 24.8%. Young individuals aged 15 to 19 account for 16.8% of the cases, while those aged 35 and older represent a combined total of 14.2% (Table 1).

**Table 1.** Distribution of maternal deaths according to socio-demographic characteristics.

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
According to the reference district		
Bakel	9	8
Dianké Makha	5	4.4
Goudiry	4	3.5
Kidira	4	6.2
Koumpentoum	29	25.7
Maka Colibantang	14	12.4
Tambacounda	29	25.7
Védingara	13	6.2
Kolda	1	0.9
Kanel	1	0.9
According to the departement of origin		
Bakel	16	14.2
Goudiry	16	14.2
Koumpentoum	29	25.7
Tambacounda	43	38.1
Outside the region	15	14.2
According to the place of death		
Bakel	16	14.2
Goudiry	16	14.2
Koumpentoum	29	25.7
Tambacounda	43	38.1
Outside the region	15	14.2
According to the age		
15 to 19 years	19	16.8
20 to 24 years	35	31.1
25 to 29 years	15	13.3
30 to 34 years	28	24.8
35 to 39 years	8	7.1

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
40 years and older	8	7.1

### 3.2. Distribution According to Obstetric History, Clinical, and Paraclinical Data

Regarding gestation, 30.1% of women were primigravida (1 pregnancy), while 42.5% were multigravida (4 or more pregnancies), with 1.8% lacking available data. For deliveries, 33.6% of women had only one delivery, 41.6% had multiple deliveries, and 1.8% did not provide data.

Concerning prenatal consultations (PNC), 27.4% of women did not receive any prenatal care, while 20.3% had only one consultation. The percentage of women who had 2 or 3 PNC visits was 20.4% and 18.6%, respectively, with only 16.8% having had four or more PNC visits. Additionally, 16.8% of cases lacked data on the number of PNC visits.

For biological assessments, 34.5% of women underwent testing, 42.5% did not, and 23% lacked data. Obstetric ultrasounds were performed on 35.4% of women, while 43.4% did not have one, and 21.2% lacked available data.

Regarding delivery at the time of death, 30.1% of women had not given birth, while among those who did, 43.4% had vaginal deliveries, and 26.5% underwent cesarean sections.

Concerning the partogram, 30.1% of women did not give birth, 43.4% had no follow-up, 16.8% were monitored, and 9.7% of cases lacked data on the partogram (Table 2).

**Table 2.** Distribution according to medical history, clinical and paraclinical data.

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
According to the number of pregnancies		
1 pregnancy	34	30.1
2 to 3	29	25.7
4 or more	48	42.5
No data	2	1.7
According to the number of births		
1 birth	38	33.6
2 to 3 births	26	23
4 births or more	47	41.6
No data	2	1.8
According to the number of prenatal consultations		
None	31	27.4

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
1	23	20.3
2	21	18.6
3	13	11.5
4	6	5.3
No data	19	16.9
According to the biological test		
Yes	39	34.5
No	48	43.4
No data	26	21.2
According to the ultrasound exam		
Yes	40	35.4
No	49	43.4
No data	24	21.2
According to birth		
Yes	34	30.1
Non	79	69.9
According to the partogram		
Not delivered	34	30.1
Yes	11	16.8
No	49	43.4
No data	19	9.7

### 3.3. Distribution According to Evacuation, Hospital Stay Duration, and Causes of Death

The data reveal that 75.2% of women had knowledge of evacuation prior to their death, with only 29.3% having no evacuation and 0.9% of data missing. Most hospital stays lasted less than 24 hours (41.6%), followed by stays of more than 48 hours (39.8%), while 7.1% of women were already deceased upon arrival.

Deaths primarily occurred during the second trimester of 2023 (38.9%), followed by the third trimester (30.7%). Nearly all deaths (95.6%) were audited, and 84.1% of these audits had a report available. Preeclampsia/eclampsia was identified as the leading cause of death (19.5%), followed by infections (10.6%) and retroplacental hematoma (8.8%), although 26.5% of the causes were undocumented.

Lastly, the death was deemed avoidable in 28.3% of cases, but a large proportion of deaths (69.9%) were not assessed for avoidability (Table 3).

**Table 3.** Distribution according to developmental aspects related to death.

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
According to the notion of evacuation		
Yes	85	75.2
No	27	29.3
No data	1	0.9
According to the length of stay		
Less than 24 hours	47	41.6
24 to 48 hours	10	8.8
48 hours or more	45	39.8
No data	3	2.7
Arrived deceased	8	7.1
According to the trimester of death		
Janvier to Mars	15	13.3
Avril to Juin	44	38.9
July to October	34	30.7
October to December	20	17.7
According to the notion of death audit		
Yes	108	4.4
No	5	95.6
According to the availability of the audit report		
Yes	96	84.1
No	8	7.1
No data	10	8.8
According to the cause of death		
Pre or eclampsia	22	19.5
Infection	12	10.6
Retro placental haematoma	10	8.8
Severe anaemia	7	6.2
Post partum haemorrhage	6	5.3
Thrombo embolic disorders	3	2.7
Uterine rupture	2	1.8
Acute lung oedema	2	1.8
Hypertension	2	1.8
Unknown	2	1.8
No data	30	26.5
According to the preventability of the death		
Yes	32	28.3

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
No	2	1.8
No data	78	69.9

## 4. Discussion

### 4.1. Distribution According to Socio Demographic Data

The results of the study reveal that the districts of Koumpentoum and Tambacounda are the most affected, each representing 25.7% of maternal death cases. This could be linked to the demographic distribution of the population, as these two districts house 33.8% and 18.4% of the regional population, respectively [15]. This is further compounded by the low standard of living and health education among the nomadic population in the Koumpentoum district [11].

These figures are consistent with national data indicating that rural and remote areas of Senegal, such as Tambacounda, are often under-equipped and lack qualified personnel, leading to higher maternal mortality rates [16, 17]. Furthermore, the high proportion of deaths occurring outside the region (14.2%) may be explained by internal migrations to access better healthcare, a phenomenon observed in sub-Saharan Africa [17].

The fact that 61.1% of deaths occurred at the Regional Hospital indicates that most critical cases are referred to higher-level centers, which is similar to the 72.3% observed by Wade *et al.* in Kédougou. However, the significance of deaths in health centers (15.9%) and health posts (10.6%) highlights the ongoing challenges in managing obstetric complications at these levels of care. Studies conducted in similar contexts have also shown that inefficiencies in referrals and delays in accessing emergency care contribute to high maternal mortality rates [9].

### 4.2. Distribution According Obstetrical, Clinical and Paraclinical Characteristics

The analysis of obstetrical history reveals a significant proportion of multiparous (42.5%) and primiparous (30.1%) women among maternal deaths. This profile is consistent with the increased risks of obstetrical complications in multiparous women, often due to pre-existing conditions. However, Wade *et al.* observed a higher rate of multiparous women (64.5%) but a lower rate of primiparous women (13.4%) at the regional hospital of Kédougou [18].

The absence of prenatal care among 27.4% of women is concerning, as prenatal care is essential for detecting and managing risks during pregnancy [19]. Regarding biological assessments, 34.5% of women underwent them, while 42.5%

did not, and 23% of the records are incomplete. For obstetrical ultrasound, 35.4% of women had one, 43.4% did not, and 21.2% of the records lack data. These low rates highlight issues of accessibility to prenatal examinations, particularly in health posts [20], as well as deficiencies in record management.

The majority of deaths (69.9%) concerned women who had previously given birth, which aligns with the findings of Tesfay et al. in Ethiopia in 2022, revealing that 65.1% of maternal deaths occur in the postpartum period [21]. This situation underscores the urgent need to strengthen prenatal care and the management of obstetrical complications in the region.

### 4.3. Distribution According Characteristics of Maternal Deaths

The data reveal that 29.3% of women did not receive evacuation, which may reflect gaps in the emergency management process or a lack of timely access to appropriate care [6, 8, 9]. The very short hospital stays, with 81.4% of deaths occurring within 72 hours and a 7.1% death rate upon arrival, indicate deficiencies in the management of obstetric emergencies and limited access to adequate care beforehand, necessitating improvements in early and continuous interventions [6, 8-10].

Although 95.6% of deaths were audited, 15.9% lack available reports, highlighting deficiencies in record archiving. Among the audited deaths, 28.3% were deemed avoidable, while 69.9% were not assessed for their avoidability. These results contrast with data from the WHO, which estimates that 95% of maternal deaths are avoidable [2]. This difference underscores an urgent need to enhance death assessments to better align local practices with international standards.

The high proportion of deaths due to pre-eclampsia/eclampsia (19.5%) is consistent with national statistics. Indeed, these conditions account for a significant share of maternal mortality, especially in contexts with limited access to quality prenatal care [22].

The proportion of non-audited deaths (4.4%) highlights a deficiency in the systematic surveillance and evaluation of maternal death cases. Maternal death audits are recognized as essential tools for identifying failures in the healthcare system and formulating recommendations for improvement [6, 23, 24].

The low rate of determining whether the death was avoidable (30.1%) among the audits conducted in this study reflects persistent systemic challenges in implementing these practices, which limits opportunities to prevent future deaths [24].

### 4.4. Study Limitations

The study has several limitations, including missing data for key variables such as the number of prenatal consultations, laboratory tests, and obstetric ultrasounds. Selection bias is possible due to the predominance of deaths occurring at the regional hospital, which may not necessarily reflect the conditions in underserved areas. Furthermore, the lack of deter-

mination regarding the preventability of the majority of cases hinders a thorough evaluation of the causes of death and preventive measures. Variability in obstetric history and data collection methodology, which relies on forms, may also introduce bias and limit the completeness of the information obtained. Data completeness is crucial for future studies to better understand the causes of maternal deaths and to improve prevention strategies.

## 5. Conclusions

Our study highlights the urgent need to improve access to quality healthcare, particularly in rural areas. It is crucial to enhance healthcare infrastructure, strengthen prenatal follow-up, and implement systematic audits of maternal deaths to reduce mortality in the Tambacounda region. We recommend that healthcare workers thoroughly document obstetric records, digitize them, extend ultrasound and prenatal screening to health posts using mobile strategies, systematically assess the preventability of maternal deaths, and early detect and refer pregnant women with risk factors. A more in-depth study focusing on the causes and prevention strategies of maternal deaths is also necessary.

## Abbreviations

WHO	World Health Organization
PNC	Pre Natal-Consultation

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## Author Contributions

**El Hadji Cheikh Abdoulaye Diop:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

**Modou Mback é Faye:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Supervision, Visualization

**Baya Cisse:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Visualization

**Abdoul Aziz Ndiaye:** Methodology, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

**Ad ða ñle Ndew Dog:** Software, Supervision, Visualization, Writing – original draft

**Khadyjatou Ba:** Data curation, Supervision, Visualization

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## Conflicts of Interest

The authors declare no conflicts of interest.

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## Biography



**El Hadji Cheikh Abdoulaye Diop** is a medical doctor and researcher in public health. He is a specialist in infectious and tropical diseases, holding a master's degree in public health with a focus on epidemiology and a master's degree in community health with a focus on monitoring and evaluation. He has over 10 years of experience in public health and currently serves as the district medical officer for the Tambacounda health district. His research focuses on the fight against cervical cancer, the prevention of infectious and tropical diseases, and digital health payment systems. He is completing his doctoral thesis in public health on the determinants of the persistence of urogenital schistosomiasis in the Tambacounda department.

## Research Field

**El Hadji Cheikh Abdoulaye Diop:** Public health, Biostatistics and epidemiology, Infectious and tropical diseases, Health policy and healthcare management, Behavioral and community health, Non communicable diseases, Preventive medicine.

**Modou Mbacké Faye:** Public health, Health policy and healthcare management, Nutrition and child survive, HIV care management, Preventive medicine.

**Bayal Cissé:** Public health, Gynecology and obstetrics, Health policy and healthcare management, Non communicable diseases, Preventive medicine.

**Adâïle Ndew Dog:** Public health, Health policy and healthcare management, Behavioral and community health

**Khadyjatou BA:** Health policy and healthcare management, Reproductive health, Primary healthcare management.