

Maternal Mortality at the Teaching Hospital of Mother and Child Lagoon (CHU-MEL) in Benin: A Preventable Drama?

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How to cite this paper: Aboubakar, M., Akodjenou, J., Echoudina, C., Ahounou, E., Biaou, C.O.A. and Zoumenou, E. (2021) Maternal Mortality at the Teaching Hospital of Mother and Child Lagoon (CHU-MEL) in Benin: A Preventable Drama? *Open Journal of Obstetrics and Gynecology*, 11, 315-325.

<https://doi.org/10.4236/ojog.2021.113032>

Received: January 27, 2021

Accepted: March 26, 2021

Published: March 29, 2021

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Abstract

Introduction: The maternal mortality ratio in developing countries is 239/100,000 live births (LV) in 2015, compared to 12/100,000 live births (LV) in developed countries. This study aims to analyze the avoidability of maternal deaths at the CHU-MEL from 2015 to 2019. **Patients and Method:** This was a descriptive analytical study with retrospective data collection from January 1st 2015 to August 31st 2019, *i.e.* 56 months. The data were collected from medical records, maternal death registers, anaesthesia registers. They were entered and analyzed using Epi info version 7 software. The associations between avoidability of death and aetiologies were tested using Chi² or Fisher's test as appropriate. The threshold for statistical significance was 5%. **Results:** The maternal mortality ratio over 5 years was 905 maternal deaths per 100,000 LV. The age of the deceased women ranged from 15 to 44 years, with an average of 29.09 ± 7.04 years. They were illiterate or primary educated (47.02%), married (64.50%) primigravida or paucigravidae (47.02%) and primiparous or pauciparous (59.52%). Of the 151 maternal deaths, (90.73%) were deemed preventable. Delay was the main reason for maternal death, and 82.11% had at least one type of delay. There was no significant difference between the avoidability of death and the main aetiologies of haemorrhage ($p = 0.865$), infections ($p = 0.208$) and hypertensive complications ($p = 0.438$). **Conclusion:** The maternal mortality ratio during the study period was 905 maternal deaths per 100,000 LV. Deaths were preventable in 90.73% of cases. The avoidability factors found were varied.

Keywords

Maternal Mortality, Avoidability, CHU-MEL, Benin

1. Introduction

The mortality rate is an indicator of the quality of a country's health system. Maternal mortality provides information on the risk incurred by women during pregnancy and childbirth. This risk is a reflection of the deficiency and strengths of the functioning of the health system.

The maternal mortality ratio in developing countries is 239/100,000 live births (LV) in 2015, compared to 12/100,000 live births in developed countries [1].

The probability that a young woman will one day die from a cause related to pregnancy or childbirth is 1 in 4900 in developed countries, compared to 1 in 180 in developing countries [1]. In Africa, the risk of maternal mortality is 1 in 16 women, a consequence of the collapse of health systems [2].

In Benin, maternal mortality is 410 deaths per 100,000 live births in 2011 [3] and 391 deaths per 100,000 live births in 2018 [4]. This decrease is not significant despite government efforts to provide free caesarean sections and improve the health system [3]. To reduce the maternal death rate, it is necessary to identify the barriers that limit access to quality maternal health care and to take action to address modifiable causes at all levels of the health system. The objective of this work is to study maternal deaths in order to assess their avoidability at a reference maternity in Cotonou.

2. Patients and Method

We carried out a descriptive analytical study with retrospective data collection from 1st January 2015 to 31 August 2019, *i.e.* a duration of 56 months. The study population consisted of maternal death records at the CHUMEL. Maternal death was considered to be "the death of a woman occurring during pregnancy or within 42 days of its termination, whatever the duration or location, for any cause determined or aggravated by the pregnancy or the care it caused, but neither accidental nor fortuitous". We have exhaustively included records of maternal deaths that occurred during the study period.

A maternal death is "preventable" or "possibly preventable" if one or more changes in the patient's care pathway could have changed the fatal outcome.

The avoidability factors involved were classified into three categories:

- related to the adequacy of care, (adapted therapy, adapted but insufficient therapy, unsuitable therapy, therapeutic errors)
- related to the organization of care, (delay in care, reception, poor supervision)
- related to the patient's interaction with the health care system (refusal of treatment, notion of discharge against medical advice etc.).
- Death was avoidable when at least one of the criteria exists.

The death was deemed preventable if at least one of the criteria was met.

The independent variables were socio-demographic, relating to gynaecological-obstetrical history, medical and surgical history, clinical data, and therapeutic management.

The data was collected using pre-tested forms, by reviewing medical records, maternal death records, anaesthesia records, operating protocols and maternal death reports.

The completeness and consistency of the data collected was checked at the end of the day to ensure the quality of the data collected. The data was then entered and analysed using Epi info version 7 software. The associations between the avoidability of death and aetiologies were tested using Chi² or Fisher's test as appropriate. The strength of the associations was measured through raw Odds Ratios (OR) and their 95% confidence interval [95% CI]. The threshold for statistical significance was 5%.

3. Results

Frequency

During the period of study, there were 161 cases of maternal deaths, of which we excluded 10 cases from this study (5 cases of unrecovered records, 3 cases of death before admission and 2 cases of death on admission). During the same period, CHU-MEL registered 18,611 deliveries and 17,781 live births. The Maternal Mortality Ratio over this period is 905 maternal deaths per 100,000 NV.

Evolution of maternal deaths from 2015 to 2019

There was an increasing trend in the maternal mortality ratio in CHU-MEL from 2015 to 2019 (**Table 1**).

Socio-demographic characteristics of deceased patients

The ages of the deceased patients ranged from 15 to 44 years. The mean age was 29.09 ± 7.04 years and the median age was 29 years (IIQ: 23 - 36). Patients under 35 years of age represented 65.23% of the population (**Table 2**).

Of the 151 women, 71 (47.02%) had not reached secondary school or were illiterate.

Gynaecological-obstetrical history

Deceased patients were primigravida or paucigravidain 47.02% of cases; primiparous or pauciparous in 59.52% of cases.

Previous pregnancies medical History

The main medical history found in previous pregnancies were caesarean section

Table 1. Parameters for the study of maternal deaths at CHUMEL from 2015 to 2019.

Year	Deliveries	Live birth	Maternal death	Mortality Ratio**
2015	3609	3368	20	594
2016	4060	3706	30	809
2017	3296	3103	25	806
2018	4377	4095	45	1099
2019*	3269	3509	41	1168
2015-2019	18,611	17,781	161	905

*From January to August; **Per 100,000 Live births.

Table 2. Socio-demographic characteristics of the patients.

Number (151)	Percentage	
	Age (years)	
≤15	01	0.66
[16 - 20[10	06.62
[20 - 35[86	56.95
[35 - 40]	46	27.81
[41 - 44]	4	02.65
Unspecified	8	05.30
	Educational level	
illiterate	53	35.10
Primary educated	18	11.92
Secondary educated	09	05.96
Higher studies	12	07.95
Unspecified	59	39.07
	Matrimonial Status	
Married	40	26.49
Not married	22	14.57
Unspecified	89	58.94

(22.76%), hypertension and its complications (4.18%), ectopic pregnancy (1.38%) and placenta praevia (0.69%).

Pregnancy monitoring

Information on the number of prenatal visit (PV) was only available in 18.54% of the cases and showed that 10 women did not attend any PV

In the majority of the deceased women (92.02%) the pregnancy had not been followed or had been poorly followed. In 60.93% of the women, the minimum required prenatal check-up* had not been carried out.

*Blood grouping + rhesus factor (GSRH); blood count (CBC), albuminuria, hemoglobin electrophoresis, obstetrical ultrasound.

Analysis of Avoidability

Origin of deceased women

The women came from private (38.41%) and public (30.46%) health care and 22.51% came from traditional healers or from their homes.

Reasons for referral

A total of 125 women were admitted per referral. The main reason for referral was postpartum haemorrhage.

Adequacy of treatment prior to referral

Of the 125 women referred, 32 (25.60%) had received care deemed appropriate before referral, *i.e.* in accordance with the protocols in force.

Referral conditions

Of the cases informed, 48.83% did not have a reliable intravenous catheter;

45.61% did not have a referral form, 82.29% had not benefited from medical transport and in 73.25% there was a delay between referral and arrival at the CHUMEL.

Diagnostic and therapeutic errors

Diagnostic errors were found in 8 women *i.e.* 5.30% of deceased women. Therapeutics were harmful in 5.30% (n = 8/151) of these cases, we found 03 cases of acute pulmonary oedema (APO) due to iatrogenic overload.

Inadequate and insufficient therapy

Of the 151 women, 14 (9.27%) were considered to be inadequately cared for, and 14 (9.27%) were considered to be suitable, but 55.63% (n = 84/151) were considered to be unsuitable (n = 84/151).

Poor follow-up

Poor mother and foetal follow-up was noted in 58 women, *i.e.* 38.41% of the women who died.

Types of delay

A total of 124 women (82.11%) had at least one type of delay. The third delay was the most frequent (63.58%) (Table 3).

Factors causing delay

Several factors have been identified. The three main factors were, in order: lack of financial means (n = 78/124; 62.90%), lack of blood products (n = 59/124; or 47.58%) and the unavailability of the operating room (n = 24; or 19.35%) (Table 4).

Avoidance of death

Of the 151 maternal deaths, 137 (90.73%) were deemed preventable (Figure 1).

Relationship between avoidability of death and main aetiologies

The analyses did not find a significant difference between the avoidability of death and the main aetiologies (Table 5).

Table 3. Distribution of maternal death by type of delay.

	Effectif	%*
First delay		
Yes	53	35.10
No	80	52.98
Not specified	18	11.92
Second delay		
Yes	51	33.77
No	82	54.30
Not specified	18	11.92
Third delay		
Yes	96	63.58
No	37	24.50
Not specified	18	11.92

*one woman could presents many delays.

Table 4. Distribution of maternal deaths by delay factors*.

	number	%
Lack of financial means	79	63.70
Lack of blood products	59	47.58
Unavailablity of operating room	24	19.35
Unavailablity of transport means for reference	6	4.84
multiple Reference**	3	2.42
Childbirth at home	2	1.61
Lack of surgery materials	1	0.81
Lack of oxygen	1	0.81

*Several delay factors could be recorded for the same woman; **Cases where patients are redirected between several health cares before the reference center.

Table 5. Relationship between avoidability of death and major aetiologies.

	Avoidability		OR [IC95%]	p-value
	Yes (%)	No (%)		
haemorrhage				
Yes	74 (92.50)	6 (07.50)	1.10 [0.34 - 3.60]	0.865
No	63 (91.30)	6 (08.70)	1	
Infections				
Yes	15 (100.00)	0 (00.00)	-	0.208
No	120 (90.91)	12 (09.09)		
Hypertension complication				
Yes	32 (88.89)	4 (11.11)	0.60 [0.17 - 2.15]	0.438
No	105 (92.92)	8 (07.08)	1	

Unavoidable
n=14 (9.27%)

**Figure 1.** Distribution of deceased women according to avoidability of death.

4. Discussion

Our aim was to study the avoidability of maternal deaths at the CHU-MEL, to trace the relationships between maternal deaths and the different aetiologies. We therefore found that death was preventable in 90.37% (n = 137/151) of cases and

the reasons were both multiple and varied.

Socio-demographic characteristics

Age

The mean age of the deceased patients was 29.09 ± 7.04 years. The most affected age group was women between 20 and 35 years of age. Our results are comparable to those of Denakpo *et al.* at the same hospital who found in 2008 that the majority of women who died were between 20 and 29 years old [5]. Kane, in Mali, in 2016, also found in his study on audits of maternal deaths that the majority of women who died were in the age group of 20 - 35 years [6]. This can be explained by the fact that this age range matches with the age of optimal female fertility, with significant sexual activity. In Benin, according to DHS V, the highest fertility rates are observed among women aged 20 - 29 years [7].

The Confidential National Survey on Maternal Deaths (ENCMM) in France between 2010 and 2012 found that the majority of women who died were between 35 and 39 years of age [8]. This can be explained, on the one hand, by the preponderance of late pregnancies in Western societies and, on the other hand, by the existence of conditions such as diabetes and high blood pressure in old age which increase the risk of complications during pregnancy.

Level of education

Illiterate women and those with primary education were most represented, accounting for 47.02% of the population studied. This could be explained by the low enrolment rate for girls in developing countries and particularly in Benin [9]. Like us, Kane found in 2016 in his work at Referral Hospital IV (CSRIV) in the district of Bamako that illiterate women made up the majority of the population with a rate of 47% [6].

Marital status

Married women made up 64.5% of the deceased women in our study. Much higher figures were found by Kane at the CSRIV in the Bamako district, where 91% were married women [6]. This can be explained by the influence of the Muslim religion in this Muslim-majority country. Conversely, Foumane *et al.* found only 34.5% of the women who died at the Gynaeco-Obstetric and Paediatric Hospital in Yaoundé in 2010 to be married [10].

Gynaecological-obstetrical history

The pauciparous were the most represented in the population of women who died during the period (37.30%). The same observation was made by Lefèvre in 2014 in a study in the public hospitals of Reunion Island with a rate of 44.4% of deceased pauciparous [11]. Fomulu *et al.* found in their study at the Teaching hospital of Yaoundé in 2006 noted that the majority of women who died were nulliparous (841 maternal deaths per 100,000 live births) and multiparous (600 maternal deaths per 100,000 live births). Both nulliparous and big multiparous women are populations at risk of developing complications during pregnancy [12]. Indeed, nulliparity is a pejorative factor through pregnancy toxemia and its major complication, eclampsia. Multiparity is responsible for the laxity of the

uterine muscle, which favours vicious presentations, with a high risk of uterine rupture and postpartum haemorrhages.

Avoidability analysis

Pregnancy monitoring

The antenatal visit is the ideal time to ensure preventive measures such as screening for risk factors, tetanus vaccination, initiation of treatment and education of the woman about the course of pregnancy and childbirth [13]. In our study, 60.93% of the women had no pregnancy follow-up and 31.13% of the women had poor pregnancy follow-up. Kane in Bamako in 2014 found a much lower rate of 35% [6]. This situation is compatible with the low socio-economic and intellectual level of the population. Indeed, ignorance of the importance of antenatal care, the poor distribution and shortage of qualified human resources and the financial barrier are reasons for the low rate of prenatal visit in our developing countries.

Terms of patients transferring

The existence of a reliable intravenous catheter is an important element in the management of vital distress. It was absent in 48.83% of cases. Tshabu Aguemon *et al.* found a similar rate in a study carried out at maternity of Menontin hospital in Cotonou from 2007 to 2011 which showed that 46.86% of women who died had been referred without a intravenous catheter [14].

The transfer form, an important communication tool between the referring hospital and the referral hospital to ensure the continuum of care, was absent in 45.61% of cases. Other authors in Benin found rates ranging from 35% to 75% [5] [14]. In 82.29% of cases, the transport was not medicalised (use of personal means, non-equipped ambulances, etc.), exposing the woman to a deterioration in her already very precarious condition during the journey. Other authors have found similar figures ranging from 78.6% to 80% [5] [14]. Many hospitals do not have ambulances. When they do exist, they are generally devoid of any resuscitation equipment and are only used to move the patient.

Type of delay and factors of delay

The first delay relates to late recourse to emergency care attributed to the family and the community: ignorance of danger signs, delay in taking a decision on the appeal, choice of type of care

The second delay relates to the problems of access to care facilities and reference, to the functioning of the referral system but also to the state of communication routes and means of transport: geographical access, means of transport, financial access, cultural acceptability of health services

The third delay relates to availability of quality services. It depends of the organisation and availability of health structures: availability of staff, availability of the technical platform, community perception of the quality of services provided

In our study, the majority of the deceased women (82.11%) had experienced at least one type of delay. The most frequent type of delay was the third delay representing 63.58% of the cases. Baldé *et al.* also found in Guinea-Conakry in

2012 that the 3rd delay was the most frequent, but with higher figures than ours. Indeed, they found that 87.5% of the women who died were victims of the third delay [15]. The main factors of loss of time identified in our study were lack of financial means (63.7%), lack of blood products (47.58%) and unavailability of the operating room (19.35%). In Menontin hospital, Tshabu Aguemon *et al.* found no cases of lack of financial resources [14]. This can be explained by the fact that Menontin Hospital is a “first contact” referral hospital; patients go there with a good part of the available financial resources. However, they found a rate of unavailability of blood products comparable to that of our study. The same authors indicated that the unavailability of the operating room was noted in 39.53% of cases. This hospital has only one operating room shared between the obstetrics department and the other surgical specialties.

Follow-up

Poor follow-up of the mother and/or foetus may be due to poor organisation of care. Insufficient staff in the referral centers to cope with the various demands, but also under-equipment, are also factors that can explain this situation. We noted poor follow-up among 38.41% of the women. Tshabu Aguemon *et al.* found a lower rate in Menontin hospital (21%) [14].

Adequacy of therapy

At the referring center

The quality of care before referral plays an important role in the prognosis of referred patients. However, many authors in Benin [14] and DRC [16] have found that more than 30% of patients did not receive adequate treatment at the referring centre. We noted a higher rate with 74.4% of patients not having received adequate treatment before referral.

The poor quality of care in the referring centers has multifactorial origins; one of the factors being the anarchic installation of many substandard health facilities that practice childbirth.

At the referral center

Among the inadequacies observed in the conduct here, appropriate but insufficient therapy (55.63%) was the most frequent, far ahead of diagnostic errors (5.30%), therapeutic errors (5.30%) and inappropriate therapy (9.27%). Tshabu Aguemon *et al.* found no diagnostic errors at Menontin Hospital. They reported that 25.83% of the patients were treated inadequately and in 20.93% the therapy was adequate but insufficient [14]. Denakpo *et al.* found at the CHUMEL in 2008 that the therapy was either inappropriate (20% of cases) or insufficient (80% of cases) [5]. Bouvier-Colle found from 2010 to 2012 that 10% of maternal deaths in West Africa were due to therapeutic errors [17]. These inadequacies can be explained by the inadequacy of the technical platform, the insufficient number of health workers recruited for the task, and insufficient training and retraining on the new protocols in force.

Avoidability itself

While maternal mortality is an important indicator of the quality of a coun-

try's health system, the preventability of these deaths is even more important. In our study, we found that the majority of recorded maternal deaths were preventable (90.73%). Already in 2008 in the same hospital, Denakpo *et al.* reported that 100% of the deaths assessed were preventable [5]. These rates can be explained by the failure of the organisation of care and also of the content of care, which is often insufficient when it is adapted. The situation is similar in many developing countries. For example, the avoidability rates found by Baldé *et al.* in Guinea Conakry, Lefèvre in Reunion Island, and Ahbib in Marrakech were 87.5%, 85% and 70% respectively [13] [17]. In all these studies, as in our own, deaths from direct causes were the most preventable. Although the maternal mortality ratio is significantly lower in France, deaths from direct causes remain the most preventable. Deneux-thanaux found a rate of 66% in France from 2010 to 2012 [18].

Limitation of the study

An essential limitation of our study is the absence of certain essential information in medical records, which constitutes an information bias. However our objectives have been reached.

5. Conclusion

Our avoidability study found that deaths were preventable in 90.73% of cases. The avoidability factors were dysfunctions related to the organisation of care and the content of care. At CHU-MEL, we noted diagnostic errors, therapeutic errors, inappropriate therapy, poor monitoring and delays in care.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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