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MATERNAL MORTALITY IN A MATERNITY WARD AT A REGIONAL HOSPITAL CENTER IN SOUTERN SENEGAL

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ABSTRACT

Objectives: •to determine the maternal mortality ratio at the Kolda Regional Hospital; •to describe the socio-demographic characteristics of the deceased patients; •to clarify the causes of maternal mortality and to identify the associated risk factors.

Materials and method: This was a prospective, descriptive and analytical study conducted between January 1st, 2012 and December 31st, 2016 at the Kolda Regional Hospital Center. We collected data from maternity records, resuscitation records, anesthesia records and the operating protocol register.

Results: During this study period, we recorded 120 maternal deaths out of 4116 living births, a maternal mortality ratio of 2915.4 per 100,000 living births. The average age of our patients was 27 years old. The average parity was 4 deliveries and multiparas accounted for half of the patients. In our series, 84% of patients were evacuated; high blood pressure (35.8%) and obstructed labor (18.8%) were the most common reasons for evacuation. More than half of the deaths (52.5%) occurred in the postpartum and 32.5% in the 3rd quarter. More than half of the deaths occurred within the first 24 hours after of admission (52%). Just over a third of patients (39%) had delivered by caesarean section and we had 58.8% of perinatal deaths. The conclusions of the audit were a delay in consultation (57%) followed by a delay in evacuation (28%) and a delay in the management of patients (25%).

Conclusion: The multiple factors influencing the high maternal mortality rate in this region of Senegal can be attributed to the community, the medical team, and / or the health system. Strategic interventions to reduce this mortality rate should be based on community education on safe motherhood, on the improvement of the level of education, on communication systems and better transportation, on access to quality reproductive health services and availability of emergency obstetric care.

Keywords: Audit, maternal mortality, Kolda.

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Introduction

Maternal mortality remains a major public health problem in the world. It is of considerable importance in many developing countries and is an indicator of the quality of care in obstetrics [1]. According to the World Health Organization (WHO), about 830 women die every day from preventable causes related to pregnancy and childbirth. 99% of all maternal deaths occur in developing countries, 62% of which are in sub-Saharan Africa. Maternal mortality is higher in rural areas and in the poorest communities. The risk of complications and deaths due to pregnancy is higher in young adolescent girls than in older women [2]. The assistance of qualified personnel before, during and after delivery can save the lives of women and newborns. Between 2016 and 2030, as part of the Sustainable Development Goals, the goal is to reduce the global maternal mortality rate to below 70 per 100,000 live births [1,2]. In Senegal, the maternal mortality ratio has fallen significantly, but remains high. In fact, it went from 510 to 315 deaths per 100,000 living births between 1992 and 2015. Every day, 4 women lose their lives by giving birth. There is an excess mortality of teenage mothers with 629 deaths per 100,000 living births. Kolda region is one of the most affected by this scourge. In fact, it has a maternal mortality rate of 417.6 per 100,000 living births [3].

Reducing maternal mortality is therefore a priority goal in our developing countries. To accompany this process and understand the reasons for this high maternal mortality rate in Kolda, we proposed to carry out this study whose specific objectives were as follows:

- to determine the maternal mortality ratio at the Kolda Regional Hospital;

- to describe the socio-demographic characteristics of the deceased patients;

- to clarify the causes of maternal mortality and to identify the associated risk factors.

Patients and method

This was a prospective, descriptive and analytical study conducted between January 1st, 2012 and December 31st, 2016 at the Kolda Regional Hospital Center. We included in our study all pregnant women who were monitored or who gave birth in this structure and who died during pregnancy, childbirth or the 42 days that followed. In this study we excluded pregnant women or women who delivered and whose death took place in a structure other than ours or at home.

We collected data from birth records, from resuscitation records, from anesthesia records and from the operating record book.

We have studied the following parameters:

- the socio-demographic characteristics of the patients: age, gestation, parity;

- the data of the delivery: the mode of delivery, the place of birth, the mode of admission, the place of admission;

- the observed complications, the place of death and the cause of death.

We entered data using the Epi Info6 software. We also did the exploitation and analysis using the same software and SPSS. For bivariate analysis, we used chi2 tests according to their applicability and the significance of the association was verified using the chi2 test; and the threshold value for the p was 0.05.

Results

Descriptive results

Maternal Mortality Ratio

During the five years, we recorded 120 maternal deaths out of 4,116 live births, a maternal mortality ratio of 2915.4 per 100,000 living births (Table 1).

Sociodemographic characteristics

Age

In our series, the average age of our patients was 27 years with extremes of 16 and 40 years. The most representative age group was 25 to 34 years (60%) (Figure 1).

In our series, 118 patients were married, that is 99%.

Gesture and parity

The average pregnancy was 6 pregnancies with extremes of 1 and 13 pregnancies. Multigestes accounted for almost half of the patients (47.1%).

The average parity was 4 deliveries with extremes of 0 and 9 deliveries. Multiparas accounted for half of the patients (50%).

Clinical data

Antecedents

In this study we found four cases of women in labor with high blood pressure (3.3%), two cases of diabetes (1.6%) and 2 cases of HIV infections (1.6%) and the same rate was found in our patients with sickle cell.

Eleven patients had a scarred uterus (9.2%) and 06 had a history of abortion (5%) (Table 2).

Table 1: Maternal Mortality Ratio at the Kolda Regional Hospital Center between January 1, 2012 and December 31, 2016 (N = 120).

Year	Number of deliveries	Number of living births	Number of maternal deaths	Maternal motality ratio / 100000 NV
2012	964	744	23	3091.4
2013	885	707	22	3111.7
2014	975	746	23	3083.1
2015	1124	942	25	2653.9
2016	1266	977	27	2763.5
Total	5214	4116	120	2915.4

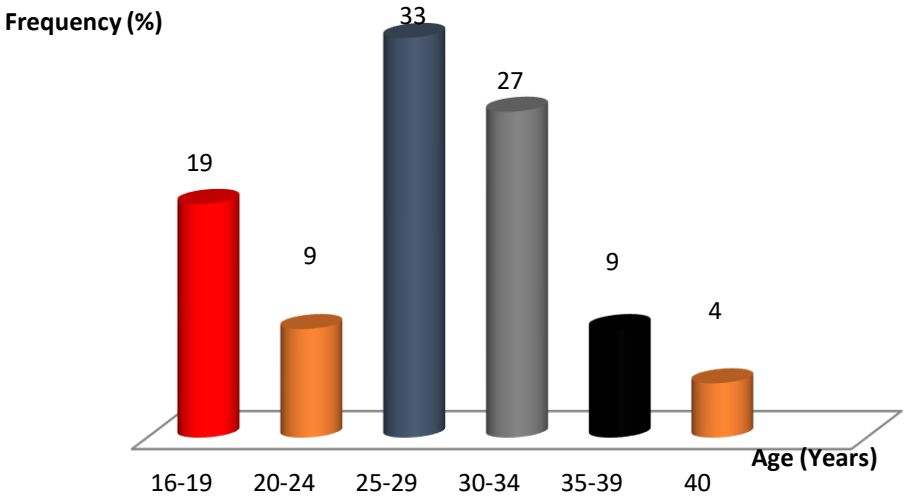

Figure 1: Age distribution (n = 120).

Table 2: Breakdown by History

Health history	Number	Frequency
health history		
High blood pressure	**04**	**3.3%**
Diabetes	**02**	**1.6%**
Sickle cell	**02**	**1.6%**
Obstetric history		
Scarred uterus	**11**	**9.2%**
Abortion	**06**	**5%**

Pregnancy history

In our series, only 6 patients (8.8%) had received at least prenatal consultations, while 28 (23.5%) had no follow-up during pregnancy.

All of our patients had at least one pathology and anemia was found in half of the patients (Table 3).

Table 3: Distribution according to pathologies encountered during pregnancy

Diagnosed Pathologies during pregnancy	Number	frequency (%)
Anemia	61	50.5
High blood pressure	49	40.5
Scarred uterus	11	13.2
HRP	4	3.3
Diabetes	2	1.6
HIV infections	2	1.6
Sickle cell	2	1.6

Mode of admission and origin of patients

In our series, 84% of patients were evacuated compared to only 16% who came by themselves. Among the evacuated patients, 64 (63.2%) were from the Kolda District and 19 (18.8%) were from the Sedhiou area (**Table 4**).

Table 4: Distribution according to the origin of evacuated patients

Origin	Number	Frequency (%)
Kolda Region		
District of Kolda	64	63.2
District of Velingara	14	14
District of Medina Yoro Foulah	4	4
Sedhiou Region	**19**	**18.8**
Total	**101**	**100**

Reasons and conditions of evacuation

The most common reasons for evacuation were high blood pressure (35.8%) and obstructed labor (18.8%) (Table 5).

All patients who were brought in the regional hospital, were evacuated by unskilled personnel, most often into a medical ambulance (79%). The rest of the sample (21%), were transported either by private vehicle (15%) or by taxi (6%).

Table 5: distribution according to the reason for evacuation

Reasons for evacuation	Number	Frequency (%)
Preeclampsia/Eclampsia	36	35.8
Prolonged labor /dystocic labor	19	18.8
Post-partum heamorrhagia	11	10.9
RPH	8	7.9
Anémie severe anemia	11	10.9
Severe malaria Paludisme	7	6.9
Post-partum Septicemia	4	3.9
Icterus and pregnancy	4	3.9
Sickled cell type SS and pregnancy	1	1
Total	101	100

Clinical examination at admission

More than half of the patients (66%) had a clear conscience and 96 patients or 80% had a stable hemodynamic state. More than half of the deaths (52.5%) occurred in the postpartum and 32.5% in the 3rd quarter (Table 6).

Table 6: Distribution according to the Term of Pregnancy

Term of pregnancy	Number	Frequency (%)
Second trimester	18	15
Third trimester	39	32.5
Post-partum	63	52.5
Total	**120**	**100**

Place and method of delivery

Half of the patients had given birth at the Kolda Regional Hospital (Table 7).

Just over one third of patients (39%) had delivered by caesarean section. Only 22% of them gave birth vaginally. In addition, we recorded 10 uterine rupture (8%) which required a laparotomy.

Time between admission and maternal death

The delay between admission and maternal death ranged from 5 minutes to 19 days. More than half of the deaths occurred within the first 24 hours after admission (52%), 27% between 24 and 48 hours and 21% beyond 48 hours (Table 8).

Table 7: Distribution according to place of delivery

Place of delivery	Number	Frequency (%)
Kolda Regional Hospital	60	50
At Home	13	10.8
Health Post	5	4.2
Kolda health centrer	5	4.2
Pregnancy in progress	37	30.8
Total	**120**	**100**

Table 8: Distribution by Time between Admission and Time of Death

Time required for admission-maternal death	Number	Frequency (%)
Less than 24 hours	63	52
24 hours to 48 hours	32	27
48 hours to 5 days	13	11
More than 5 dayss	12	10
Total	**120**	**100**

Causes of maternal deaths

More than two-thirds (67.5%) of maternal deaths were due to direct obstetric causes. Hemorrhage of delivery and syndromes and vascular-renal syndromes accounted for almost half of the cases (Table 9).

Table 9: Distribution according to the cause of death

Pathologies maternels	Effectif	Frequency (%)
Causes directes		
Hemorrhage of the delivery	30	25
Preeclampsia/Eclampsia	29	24.2
Retroplacental hematoma	12	10
Uterine rupture	10	8.3
Indirect Causes		
Postpartum endometritis	12	10
Severe anemia	12	10
Severe malaria	7	5.8
HIV/IADS Infection	3	2.5
Others	5	4.2
Total	**120**	**100**

Fetal prognosis

In our series, we recorded 58.8% of perinatal deaths, including 49.5% of fresh born deaths and 9.3% of macerated stillbirths.

Medical assistance

All the patients admitted to the structure had received immediate treatment.

Medical treatment

Blood transfusion (38.5%), and medical management of hypertensive conditions and their complications were the most commonly performed treatments

Obstetric-surgical treatment

More than a third of the patients had benefited from cesarean section (39.2%), laparotomy for uterine rupture was performed in 10 patients or 8% of cases.

Maternal Death Audit Committee Findings

Of the 120 maternal deaths recorded in five years, only 41 cases were audited (34%). The audit revealed that 70% of deaths were preventable concluding that there was a delay in the consultation (57%) followed by a delay in the evacuation procedures (28%) and a delay in the medical management of cases (25%).

Analytical results

Risk Factors for Maternal Mortality

Linked to the modality of childbirth

Deaths due to haemorrhagic causes were higher in women who gave birth vaginally (59%) than by caesarean section.

Table 10: Distribution of maternal deaths by risk of death due to delivery route

Death causes	Vaginally	Other ways	Total	p
Hemorrhagic causes	16(59%)	10(38%)	26	<0.0000
Blood pressure and complications causes	11(41%)	16(62%)	27	
Total	**27(100%)**	**26(100%)**	**53**	

Factors linked to age, parity and number of ANC

In fact, mean parity (4.3) and mean number of ANCs (2.1) were higher in mothers who died of

haemorrhage (p <0.05); while for age no association was observed.

Prognostic factors for children

Age-related factors, parity and number of prenatal consultations

The analysis showed that maternal age influenced fetal prognosis. This association was statistically significant and confirmed by a p = 0.0382. Parity and number of ANCs had no influence on the fate of the child with p = 0.2350 and p = 0.0835 respectively (Table 11).

Table 11: Distribution of maternal deaths by age, parity, number of ANCs and cause of death

Causes of death		Number	Mean	p
Age	Hemorrhagies	40	26.3	0.7184
	HBP and complications	41	28	
Parity	Hemorrhagies	40	4	0.0420
	HBP and complications	41	4.3	
Number ANC	Hemorrhagies	76	2,1	0.0216
	HBP and complications	75	1.8	

Table 11: Distribution of maternal deaths by cause of death and fate of children.

Parameters		Number	Mean	p
Causes of death				
Age	Living children	72	26.4	0.0382
	Dead children	48	29.8	
Parity	Living children	72	4,1	0.2350
	Dead children	48	3	
Number of ANC	Living children	31	1.7	0.0835
	dead	47	0.9	

Related to the delivery route

Of the children born vaginally, 46.1% were alive compared to 48.2% among those who were born by caesarean. The correlation was statistically significant with p = 0.0435 (Table 12).

Table 12: Distribution of children's prognosis according to the delivery route.

Parameters	vaginally	Other ways	Total	p
Living children	12(46.1%)	27(48.2%)	39	P=0.0435
Dead children	14(53.9%)	29(51.8%)	43	
Total	26	56	82	

Discussion

Epidemiology

Incidence of maternal mortality

In our series, from 2012 to 2016 at Kolda Regional Hospital Center, the maternal mortality rate was 2915.4 per 100,000 live births. This rate would be more than ten times the national average (315 per 100,000 NV in 2015)[3.4]. However, this is an intra-hospital rate. The national rate is an estimate of maternal mortality as a proportion of population.

Our result was closer to that found by Saizonou [5] in Benin where the intra-hospital maternal mortality rate at the Zou-Collines hospital center was 4769 per 100,000 live births (Table 13).

Table 13: Maternal Mortality Ratio by Country

Survey	Country	Year	Maternal Mortality Ratio
Formulu [6]	Cameroun	2006	365/100000 LB
Saizonou [5]	Benin	2006	4769 /100000 LB
Saucedo [7]	France	2010	9.6/100000 LB
Thiam [8]	Sénégal	2010	615.8/100000 LB
Mayi-Tsonga [9]	Gabon	2010	270/100000 LB
Our survey	Sénégal	2016	2915.4/100000 LB

LB: living birth

However, in developed countries the maternal ratio is much lower, notably in France 9.6 per 100,000 live births, in the United Kingdom 11.4 per 100,000 live births and in Finland 5.7 per 100,000 live births [1,7] .

Socio-demographic characteristics

Age

The most affected age group was 25-34 years old with 60%. The young age found in our series is classic. The average age was 27 years old with extremes of 16 and 40 years. Age was not a risk factor for maternal mortality (p = 0.7184) but had an influence on fetal prognosis (p = 0.0382). These results are comparable to those found in Gabon by Mayi-Tsonga [11] where the average age was 25 years with extremes of 16 and 41 years. Similarly, in Cameroon, Foumane [12] found a higher incidence of maternal mortality for the 25-34 age group. In Madagascar, the average age was higher with 31 years with extremes of 15 and 63 years [13].

The incidence of maternal mortality was low among women aged 35 and over with a frequency of 13%. These contrasts with the results of Formulu et al [6], which states that women aged 40 and over are 3 to 4 times more likely to experience maternal mortality than women under 20 years of age. Similarly, Saucedo [7] showed that in France, women over 45 years of age had a mortality eight times higher than those aged 25 and under.

Parity

In our series, pauciparous and multiparous were the most affected with respectively 32.5% and 50%. However, there is a decrease in the incidence of maternal mortality to 8.2% in nulliparas. Our results are close to those of Mayi-Tsonga [9] which asserted the frequency of maternal mortality was higher among the pauciparas 46% and multiparas 20%. Similarly, Thiam [8] demonstrated to Baudouin that multipares were the most affected with an incidence of 48%.

These results are contrary to those found by Formulu [6] where the ratio of maternal mortality was higher among nulliparas with 841 per 100,000 live births than among large multiparas with 600 per 100,000 live births.

Marital status

In our study, the majority of deceased women were married with a rate of 99% against 1% of single women. This is due to the frequency of early marriages in our country especially in the Kolda region. It was the same in Thiam's study [8], which found 60.4% of married women and 1.9% of unmarried women.

Unlike certain authors, Foumane [12] in Cameroon and Mayi-Tsonga [9] in Gabon, found respectively 65.5% and 75% of single unmarried patients, which he explained by the high frequency of clandestine induced abortions and the lack of prenatal care.

Clinical data

Prenatal consultations

For good monitoring of pregnancy, WHO recommends at least four prenatal consultations [1,2]. In our series, we found that 91.2% of the deceased women had less than four ANCs, including 23.5% who had no ANC. Our results were similar to those of Cissé [14] who stated that 91% of the dead women had less than 4 ANCs, 30% of which had not received any prenatal care.

Our results were more important than those of Formulu et al. [6] in Yaoundé who stated that 66.6% of deaths were recorded in patients who had less than 04 prenatal consultations with 28.2% of female deaths who had not done any prenatal consultation. It was the same in the Thiam study [8] which concluded that 75% of women had less than 4 ANCs, 13.6% of whom had never made prenatal visits.

Several authors agree that high quality antenatal care reduces the rate of women dying during pregnancy and childbirth [6,15]. [6,15,16].

Admission data

Admission mode

In our series, 84% of the patients were evacuated into or referred to our service. These results are similar to those of formulu [6] in Cameroon who found that the majority of the patients in her study were referred to / evacuated, that is 82.05% of cases.

Our results were superior to those of Mayi-Tsonga [11], and Rafanomezantsoa [13] who found a lower incidence of evacuation respectively 17% and 46%.

Thiam [8] in his series found that more than 50% of women were evacuated. These same findings have been reported by the studies conducted by Dumont [17]. The same observation was made at the UHC of Trecheville [18] for it is a sub-regional reference center; moreover patients are admitted there under bad conditions.

Evacuation reasons

In our work, preeclampsia / eclampsia, prolonged labor / dystocia and postpartum haemorrhage were the most important reasons for evacuation with 35.8%, 18.8% and 10.9%, respectively. These results were different from those of Chelli [19] who showed that haemorrhages were the first reason for evacuation with 27%. Similarly for Thiam [20], hemorrhages were the first reason for evacuation with 42.4% followed by preeclampsia / eclampsia 11.5% and dystocia 10.3%.

Transportation Means

Seventy-nine percent of the patients were evacuated with unequipped ambulance. Contrary to Thiam [8], only 18.8% of patients were evacuated by ambulance. These same figures were found in the series of Aboubakary [21] at KARA CHU where only 13.8% of patients were evacuated in equipped ambulance.

Mode of delivery

In our series, 39% of patients had a cesarean section. The caesarean section death rate was 3.74%. Diallo et al [22] in Guinea and Pabamé [23] in N'Djamena, each reports a case fatality rate of 3.4%. In his study, Bouillin [24] found a caesarean section death rate of 4.4% in Senegal with regional disparities ranging from 1.3% in Dakar to 11.5% in Kolda. A much lower rate is recorded in Burkina Faso [10], ie 2.3%. These rates are certainly not comparable with those in

developed countries where caesarean lethality varies between 0.07 and 0.34% [25,26].

Fetal prognosis

Neonatal mortality was 58.8% in our series and was mainly due to retroplacental hematoma, arterial hypertension and its complications as well as uterine rupture. This rate remains higher than the rate of 23% found by Cissé [27] in Le Dantec, and the rate of 18% found by Thiam [8] in Dioum.

Etiological data

Causes of death

In our study the direct causes, which are postpartum hemorrhages and high blood pressure and its complications accounted for 68% of cases.

Our results were higher than those of other studies, specially than those of Rafanomezantsoa in Madagascar [13] with 60%, those of Cissé in Senegal [27] with 64% and those of Saucedo in France [7] with 57.9%.

Our rate is lower than that of Formulu [6] with 89.7% and Thiam [8] with 80%.

Unlike Gabon, Mayi-Tsonga [9] demonstrated that the first indirect cause of maternal death was HIV / AIDS.

Postpartum haemorrhage is the leading cause of maternal mortality before blood pressure and its complications with a rate of 43.3%.

Our results were corroborated by the studies of Formulu [6] and Cisse [27] where postpartum haemorrhage was the leading cause of maternal death with 56.4% and 30%, respectively. Similarly, in a study conducted in Senegal, in a rural area, the causes of maternal deaths identified were, in order of frequency: postpartum haemorrhage, eclampsia, obstructed labor and puerperal infections [29]. In Mali, Kire [30] and Malle [31] found respectively 63.2% and 28.57% for haemorrhage and as the leading cause of death.

Our data were different from those of Rafanomezantsoa [13] in Madagascar and Foumane [12] in Cameroon, who stated that in their series, high blood pressure was the leading cause of maternal mortality. Similarly, the prevalence of hypertension during pregnancy was confirmed by several African studies including a multicentre study conducted in Benin, Ivory Coast and Senegal in which 29% of maternal deaths are due to high blood pressure. [32]. Similarly, toxemia during pregnancy is recognized as the leading cause of maternal mortality in Latin America and the Caribbean [33].

However, for Formulu [6], preeclampsia / eclampsia was the third leading cause of maternal mortality at 15.4%. Similarly, at the UHC le Dantec, Cisse [27] found a maternal mortality by eclampsia of 20.6% while Tchaou [34] said that maternal mortality in Benin due to high blood pressure and its complications was 6, 8%.

Another study in Guinea, between 1997 and 1999, recorded 12 maternal deaths out of 226 cases of hypertension, a death rate of 5.3 [35]. Akpadza and his collaborators in Togo report 2.82% [36]. Toure and his collaborators in Niger report 2.8% [37]. A Malagasy study at the Soavinandriana Hospital Center in 2005-2008 indicated that there were no maternal deaths related to arterial hypertension and its complications in a series of 77 cases, which implies a speed and effectiveness of management [29].

In Ghana, infections were the leading cause of maternal mortality from 2008 to 2010 with 19.4% of cases [38]. From 2000 to 2002, Benhamou et al found that infections accounted for 12 cases out of 261 maternal deaths in the United Kingdom and 7 cases out of 222 maternal deaths in France [39].

Moment of death

Most of our women died in the first 48 hours of postpartum, 79%. These figures are similar to those found in Mali in 2008, with 70% of maternal deaths in the first two days postpartum [60]. Similarly Thiam [8] found in his series that 76% of deaths occurred in the postpartum.

Contrary to our results, Mayi-Tsonga [9] claimed that only 7% of deaths occurred in the post partum and 93% of deaths in per partum.

Conclusion of maternal death audits

Our study reveals that:

- The delay in the consultation was the cause of death in 52% of the cases; either because they resort to health centers late; or because they refuse to receive care

- The delay in evacuation by late transfer of the patient was evoked in 25% of deaths;

- delay to treatment due to staff shortages or administration default: either by misdiagnosis, inappropriate treatment, lack of supervision, or shortage of essential drugs or blood products or by non-availability of the operation ward was found in 23% of maternal deaths.

According to the audit committee, 70% of the deaths among the audited files were avoidable. These deaths are usually related to a lack of blood products, financial difficulties or unavailability of emergency medications.

Deaths were preventable in 60% of anemia cases , 47.3% of hemorrhages cases and 40% of infections. The haemorrhagic group has the largest share of preventable deaths, 84%; followed by high blood pressure complications and infections 62% and 57%, respectively [7].

In Adis Abeba, the use of maternal death audits has determined that 67% of avoidance factors are related to the competence of medical staff and lack of blood [39].

Conclusion

The maternal mortality rate in Senegal is no exception to the rule as in all developing countries. The region of Kolda is one of the most affected one in Senegal. Such a phenomenon can be attributed to several factors, late evacuations linked to a lack of means of communication and transportation, and financial constraints, which delay the implementation of emergency obstetric care. Strategic interventions to reduce this mortality rate should be based on community education on safe motherhood, on raising the standard of living of the population, on improving the level of education, communication systems and better transportation, access to quality reproductive health services and availability of emergency obstetric care.

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