

# Reducing maternal deaths in a low resource setting in Nigeria

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## Abstract

**Objective:** To assess the impact of the adoption of evidence based guidelines on maternal mortality reduction at Enugu State University Teaching Hospital, Nigeria.

**Materials and Methods:** A retrospective review of all maternal deaths between 1<sup>st</sup> January, 2005 and 31<sup>st</sup> December, 2010 was carried out. Evidence based management guidelines for eclampsia and post-partum hemorrhage were adopted. These interventions strategy were carried out from 1<sup>st</sup> January, 2008-31<sup>st</sup> December, 2010 and the result compared with that before the interventions (2005-2007). Main outcome measure: Maternal mortality ratio (MMR) and case fatality rates.

**Results:** There were 9150 live births and 59 maternal deaths during the study period, giving an MMR of 645/100 000 live births. Pregnant women who had no antenatal care had almost 10 times higher MMR.

There was 43.5% reduction in the MMR with the interventions (488 vs. 864/100 000 live births  $P = 0.039$ , odds ratio = 1.77). There was also significant reduction in case fatality rate for both eclampsia (15.8% vs. 2.7%;  $P = 0.024$ , odds ratio = 5.84 and Post partum hemorrhage (PPH) (13.6% vs. 2.5%  $P$  value = 0.023, odds ratio = 5.5. Obstetric hemorrhage was the most common cause of death (23.73%), followed by the eclampsia.

**Conclusion:** Administration of evidence based intervention is possible in low resource settings and could contribute to a significant reduction in the maternal deaths.

**Key words:** Eclampsia, guidelines, hemorrhage, low resource settings, maternal death, Nigeria

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## Introduction

As we approach 2015, the target date to achieve the Millennium Development Goal 5 (MDG), there has been a progressive decline in global annual maternal deaths.<sup>[1-3]</sup> Maternal deaths have declined globally by almost half from 543 000 in 1990 to 273 465 in 2011.<sup>[1,2]</sup>

Maternal mortality ratio (MMR) in developed countries has declined significantly to extremely low values of 1.5, 4.1, 5.3, and 7.9 maternal deaths/100 000 live births in Iceland, Ireland, Denmark and Canada respectively.<sup>[1]</sup> This seems not to be the case in developing countries, especially in sub-Saharan Africa with the greatest burden of maternal

death. MMR still remains one of the key health indicators with the widest gap between developed and developing countries. MMR is about 12 times higher in developing countries.<sup>[1,4]</sup> Latest MDG report shows that 56% of global maternal deaths occurred in sub Saharan Africa, followed by 29% in South East Asia.<sup>[3]</sup>

Nigeria is the most populous nation in sub Saharan Africa with a MMR of 525/100 000 live births.<sup>[5]</sup> Recent report indicates that Nigeria is one of the six countries that account for 50% of global maternal deaths.<sup>[6]</sup> There has been global

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and national initiatives aimed at improving maternal health hence reducing the unacceptably high MMR in low income countries including Nigeria. In Nigeria, these strategies and initiatives include the adoption of the safe motherhood initiative launched in Nairobi in 1987, the road map for accelerating the attainment of MDG 4 and 5 in 2005, the integrated maternal, Newborn, and child health strategy in 2007 and currently the establishment of the midwife service scheme to address the shortage of skill birth attendants at delivery. Despite all these policies and strategies, maternal death still remains a great challenge in Nigeria.

In Nigeria, the 5 leading causes of maternal death include obstetric hemorrhage, eclampsia, sepsis, obstructed labor and complications of unsafe abortion.<sup>[7-10]</sup> Some of deaths from these causes are preventable.

A previous study at Enugu State University Teaching Hospital (ESUTH), reported an unacceptably high MMR of 840/100 000 live births and identified eclampsia and obstetric hemorrhage, (especially post-partum hemorrhage) as the two most common causes of maternal death.<sup>[8]</sup> Based on this earlier report, the Department of Obstetrics and Gynecology adopted evidence based strategies toward addressing these two major causes of maternal death in the institution with the aim of reducing maternal deaths.

The study aims at evaluating the impact of the adoption of this evidence based guidelines on maternal mortality reduction in the institution. Maternal and perinatal mortality rate has been reported as a significant measure of efficient obstetric services.<sup>[11]</sup>

## Materials and Methods

### Community setting

ESUTH is a tertiary health institution located in Enugu, a metropolitan city and the capital of Enugu State, South East, and Nigeria. It provides health services to about seven million people of Enugu State and other neighboring states of Ebonyi, Anambra, Imo, Abia, and some parts of Benue State. It is the only government owned tertiary hospital within the city center offering obstetric services.

### Study design

A retrospective review of all maternal deaths at ESUTH over a period of 6 year; 3 years before (1<sup>st</sup> January, 2005-31<sup>st</sup> December, 2007) and after (1<sup>st</sup> January, 2008-31<sup>st</sup> December, 2010) the adoption of the guidelines aimed at maternal mortality reduction. The case files of all maternal deaths were retrieved (91% retrieval rate) from the medical records department and relevant data including the age, parity, marital, booking, and educational status of women and the cause of deaths were extracted for analysis. Additional supplementary data were extracted also from

the admission and discharge register, delivery (labor ward) register, operation (theatre) register, and hospital death register.

According to the World Health Organization, maternal death is defined “death of a woman while pregnant or within 42 days of 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.”<sup>[12]</sup>

Maternal deaths before arrival at the hospital were excluded from the study. Furthermore, maternal deaths due to accidental and incidental causes were excluded from the study.

Post-mortem examination was not carried out in any case recorded as the relations of the deceased refused the procedure.

### Intervention

The department identified eclampsia and post-partum hemorrhage as the two most common causes of maternal deaths. Evidence based management options and guidelines were identified through literature review in PubMed and Google scholar. These guidelines were adapted to our local setting and were presented at departmental academic board meeting. It was approved by the departmental board. There was training and retraining of all resident doctors and nurses in the department on these guidelines. The final adopted guidelines included: (1) The use of magnesium sulfate ( $MgSO_4$ ) for the management of severe preeclampsia and eclampsia using the pritchard regimen. Pritchard regimen involves the administration of a loading dose of 4 g of  $MgSO_4$  intravenously over a period not less than 5 min followed immediately by deep intramuscular injection of 5 g in each buttock. Subsequently a maintenance dose of 5 g administered intramuscularly every 4 hourly in alternate buttock.<sup>[13]</sup> This maintenance dose is continued for 24 h after the last episode of convulsion or delivery. Prior to this time, diazepam was the drug used for the management of eclampsia in the hospital; (2) Active management of the third stage of all labor with intramuscular oxytocin 10 IU giving within 1 min of delivery of the infant. In a patient with risk factor for PPH, it was augmented with either oxytocin infusion 20 IU in 500 ml of ringer’s lactate over 4 h or 0.5 mg ergometrine intramuscularly. Ergometrine was avoided in hypertensive and cardiac disease patients. Although oxytocin and ergometrine were used previously in the institution, there was no outlined guideline. Secondly, active management of the third stage of all labor was not the case in the institution then.

Clinical parameters such as the presence of knee jerk reflex, respiratory rate > 15 cycles/min and urine output > 25 ml/min were used to monitor patients on magnesium sulfate treatment as illustrated by Tukur.<sup>[14]</sup>

### Study variables

These measures were implemented for a period of 3 years (1<sup>st</sup> January 2008-31<sup>st</sup> December 2010) hence the need to assess its impact by comparing with the previous years (1<sup>st</sup> January 2005-31<sup>st</sup> December, 2007) using MMR and case fatality rate as outcome measures.

### Statistical analysis

The results were analyzed using the Statistical Package for Social Science (SPSS) version 17 using Fisher's exact test and Chi-square (with Yates correction) as appropriate at 95% confidence interval. *P* value (two tailed) less than 0.05 was considered statistically significant. Ethical approval was obtained from the ethical committee of the hospital.

## Results

There were 9150 live births and 59 maternal deaths within the 6 years study period giving a MMR of 645/100 000 live births [Table 1]. Majority of the women belonged to age group 30-39 years, were parity 0-4 (74.6%), were married (89.2%) and were "unbooked," i.e. women who had no antenatal care (57.6%). Forty seven (80.2%) women had completed secondary education. The mean age of the women was  $31.4 \pm 5.6$  years.

MMR was almost 10 times higher among those that had no antenatal care (3096/100 000 vs. 310/100 000 live births, Chi-squared with Yates correction = 109; *P* < 0.001. Odds ratio = 9.97).

There was 43.5% reduction in the MMR with the adoption of the interventions (488 vs. 864/100 000 live births, *P* = 0.039, odds ratio = 1.77) Table 2.

There was over 80% reduction in the case fatality rate for eclampsia (15.8% vs. 2.7%; *P* = 0.024, odds ratio = 5.84). The case fatality rate for PPH also dropped by 82% (13.6% vs. 2.5% *P* = 0.023, odds ratio = 5.5). There was about 30% decline in prevalence of PPH (2.17% vs. 1.50%, *P* value 0.007, odds ratio 1.5) Table 3.

Obstetric hemorrhage was the most common cause of maternal death (23.73%), mainly post-partum hemorrhage (84.5%) followed by eclampsia. Human

immunodeficiency virus infection/acquired immune deficiency syndrome contributed 9.2% of maternal deaths [Table 4].

## Discussion

The MMR over the 6 year period was 645/100 000 live births. This value is lesser than 840/100 000 live births reported earlier in the institution.<sup>[8]</sup> It is also lower than 1098 and 903/100 000 live births reported in similar tertiary health institutions in Nnewi and Ebonyi respectively in the same South Eastern region of Nigeria.<sup>[9,15]</sup> Although, this may be a sign of improvement in maternal care in the institution, the MMR is still very high, almost 36 times higher than the average MMR of 18/100 000 live births in the developed world.<sup>[11]</sup> MMR is one of the key indices for measuring the state of maternal health in a region. These findings buttress the huge gap in the quality of care between the developing and developed countries.

Women who had no antenatal care during the pregnancy had MMR almost 10 times higher than those that had antenatal care. Antenatal care has been shown as one

**Table 1: Yearly maternal mortality ratio distribution**

Year	No. of maternal deaths	No. of live births	Maternal mortality ratio
2005	10	1172	853
2006	12	1222	981
2007	11	1426	771
2008	10	2116	473
2009	8	1986	402
2010	8	1228	651
Total	59	9150	645

**Table 2: Maternal mortality ratio distribution before and after the adoption of strategies for the reduction of maternal deaths**

Period of study	No. of maternal deaths	No. of live births	MMR
2005-2007	33	3820	864
2008-2010	26	5330	488
	59	9150	645

$\chi^2=4.288$ ; 95% CI, *P* value=0.038, Odds ratio=1.77, MMR=Maternal mortality ratio

**Table 3: The prevalence rate and case fatality rate distribution for Eclampsia and PPH during the study period**

Year	No. of deaths	No. of cases	No. of deliveries	Prevalence rate (PR %)	<i>P</i> value	CFR	<i>P</i> value
Eclampsia							
2005-2007	9	57	4049	1.41	N/A	15.8	0.024
2008-2010	2	74	5649	1.31	0.0072	2.7	
PPH							
2005-2007	12	88	4049	2.17		13.6	0.023
2008-2010	2	80	5649	1.42		2.5	

PPH=Post partum hemorrhage, PR=Prevalence rate, CFR=Case fatality rate

**Table 4: Probable cause of death**

Probable cause of death	No. of maternal deaths (59)	%
Obstetric hemorrhage	14	23.7
Eclampsia	11	18.6
Puerperal sepsis	7	11.9
Obstructed labor/ruptured uterus	7	11.9
Severe anemia/malaria	6	10.2
HIV/AIDS	5	8.5
Unsafe abortion	4	6.8
Ruptured ectopic gestation	3	5.1
Diabetic	1	1.7
Hepatitis	1	1.7

HIV=Human immunodeficiency virus, AIDS=Acquired immune deficiency syndrome

of the interventions that can reduce maternal mortality as it provides an opportunity to offer intervention and information to pregnant women that will promote good health and survival of mother and the babies. World Health Organization recommends a minimum of four visits.<sup>[3]</sup> In Nigeria, 36% of pregnant women do not receive antenatal care<sup>[5]</sup> and this may be contributory to the high national MMR. Universal access to prenatal care to all pregnant women is very necessary in our effort to achieve MDG 5.

There was 43.5% reduction in MMR with the adoption of these interventions in the department. The use of magnesium sulfate with clear guidelines for management of eclampsia might have been associated with this reduction. There was also a significant reduction in the case fatality rate for eclampsia with the introduction of Magnesium sulfate in the department. Similar findings has recently been reported in Kano, in Northern Nigeria.<sup>[16,17]</sup> Magnesium sulfate is the drug of choice for prevention of both initial seizure<sup>[18]</sup> as well as recurrence of seizures.<sup>[19,20]</sup> Both randomized control trials as well as real world use of magnesium sulfate has shown a significant decline, almost a 50% drop in maternal death when compared to diazepam, or phenytoin and even lytic cocktail.<sup>[21]</sup> Before the routine use of magnesium sulfate in the UK for the treatment of eclampsia, 7 deaths were recorded among 383 eclamptic women,<sup>[22]</sup> but none recorded after its introduction in 214 eclamptic women.<sup>[23]</sup> Although, the role of MgSO<sub>4</sub> in reduction of maternal death from eclampsia is well-established, its use remains low in many low resource countries like Nigeria due to the challenges of its availability at all times and cost barrier.<sup>[14]</sup> MgSO<sub>4</sub> should be made freely available in our health institutions. There should be training and retraining of health care providers on how it can be administered safely and monitored for toxicity. These should be complimented with a clear guideline on its use displayed at strategic positions.

Active management of all labor cases in this study may have also contributed to the reduction of MMR during the

intervention period. There was a significant reduction in the prevalence of post-partum hemorrhage as well as the case fatality rate during the period. The clearly written guidelines available for the care providers at the labor ward and post natal ward might have helped promote promptness in action thus, eliminating unnecessary delays. Hemorrhage, mostly post-partum hemorrhage constitutes about 30% (in some countries 50%) of direct maternal death worldwide.<sup>[11]</sup> It contributed 23.7% in our study. It has been observed that achieving the MDG 5 by 2015 is unattainable except priority attention is paid towards its prevention and treatment especially in low resource countries.<sup>[11,24]</sup>

International federation of gynecology and obstetrics, in pursuant of this objective recently published a safe, effective and feasible guideline for the prevention and treatment of post-partum hemorrhage in low resource settings with a recommendation for its adoption by health institutions offering maternity care. This involves active management of the third stage of all labor with oxytocics.<sup>[24]</sup>

The study is a retrospective pre/post intervention study with the challenge of incomplete data and quality of documented information. To overcome these challenges, all record in the various units and department were checked and relevant data extracted.

In conclusion, evidence-based intervention with clear guidelines can be successfully implemented in low resource countries and could contribute significantly in the reduction of maternal deaths associated with post-partum hemorrhage and eclampsia.

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