MATERNAL MORTALITY: A FOCUS ON THE INCREASING ROLE OF NON-OBSTETRIC CAUSES AT A UNIVERSITY HOSPITAL IN BENIN CITY, NIGERIA

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ABSTRACT

Background: Nigeria currently has the second highest number of pregnancy-related deaths, which accounts for 15% of global estimates. Emerging contributors to maternal mortality have graced the medical literature in the last 3 decades.

Objectives: We sought to document the current contributors to maternal death in our hospital and to highlight the increasing role of non-obstetric causes of maternal mortality.

Methods: Maternal mortality recorded in the Department of Obstetrics and Gynaecology, University of Benin Teaching Hospital, Benin City from January 2011 to December 2018 was retrospectively studied to evidence a trend across the years. The major non-obstetric causes of maternal mortality were determined by simple proportion, and the relationship of maternal mortality to specific determinants was expressed as specific fatality.

Results: MMR was 1,114/100,000 live births. Mortality was higher in unbooked women, teenagers, older and grand-multiparous women, and women in lower social class. The majority of mortality was from obstetric haemorrhage. HIV deaths ranked 5th overall. HIV, VTE, cardiac disease, diabetes and anaesthesia were the leading non-obstetric causes of maternal mortality.

Conclusions: Maternal mortality is common in our environment. The contribution of non-obstetric causes of maternal mortality appears to be on the increase. The health consequences of poverty, ignorance and disease are determinants of maternal mortality. Addressing socioeconomic empowerment of women will improve overall maternal health indices.

***Key words**: Maternal mortality, Trend in maternal mortality, Non-obstetric causes, University of Benin Teaching Hospital*

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INTRODUCTION

Maternal mortality (MM) is a consequence of pregnancy and childbirth, and so can affect only mothers. The availability of skilled birth attendants and emergency obstetric care has proven to be fundamental in reducing adverse maternal health outcomes worldwide.[1] Even so, there are many negative consequences of maternal ill-health that continue to plague women far beyond the time of pregnancy, and may ultimately lead to death, modify recovery or make them vulnerable to other medical or social conditions, which may impact on the survival of the product of index pregnancy, older off-springs, or affect family social status.

In specific terms, maternal conditions contribute to 2.7% of deaths among women worldwide and 12% of deaths among women aged 15 - 44 years.[2] MM constitutes a global challenge especially in the developing countries. It is one of the primary indicators of the quality of healthcare of a nation, often expressed as maternal mortality ratio (MMR). Everyday, over 800 pregnancy-related deaths are recorded worldwide, with 99% occurring in the developing countries. And Nigeria is believed to contribute up to 15% of global MM.[3]

In 2010, an estimated 40,000 Nigerian women died in childbirth, and Nigeria remains one of the 10 most dangerous countries in the world for a woman to give birth. As the impact of maternal deaths and disabilities is additive, it is worrisome that with more complete data, there could be an even greater burden of maternal ill-health with concomitant economic impact on the country. Despite the bleak national statistics, there are some signs of growing opportunities in Nigeria. In the last ten years, the federal government has devoted far greater policy attention and resources to maternal health than previously; and a handful of state governments are beginning to tackle the challenge in a strategic and comprehensive way.[4]

At the introduction of the Millennium Development Goals (MDGs) in 2000, when the world had already become accustomed to the principles of reproductive health, it was anticipated that there would be remarkable progress toward the realization of the set goals and targets at the close of the period by 2015. However, many parts of the world failed to achieve the targets of Goal 5. In Nigeria, for example, only fifty one percent of women report visiting antenatal clinic at least 4 times during pregnancy while sixty seven percent of women in urban areas have skilled birth attendance, according to the findings of the National Demographic and Health Survey (NDHS) of 2013.[5]

The Sustainable Development Goals (SDGs) have come to replace the unachieved MDGs. The world is cautiously awaiting the needed commitment and cooperation to make progress toward the realization of these well-crafted 17 goals and 169 targets. Health is specifically addressed by Goal 3, while the other goals have been enunciated as crucial social determinants of Goal 3. With the current spate of unending poverty, illiteracy, internal wars, infectious pandemics like COVID-19, economic recession and large-scale corruption, one can only hope for the right political will and mass action to drive the much needed positive change to address the menace of MM.

Importantly, the health of women during pregnancy and childbirth is highly affected by the prevailing social and economic factors, including education, household wealth, and the place of residence. Hence those with access to wealth, better education, or living in urban areas, have lower levels of mortality and higher use of healthcare services than their poorer, less-educated, or rural counterparts.[6] What is less understood is whether these same determinants drive action and better health when a woman faces other consequences of pregnancy or childbirth—the short-term morbidities and chronic disabilities, such as cardiomyopathy and chronic renal failure or social

consequences, such as violence.

There is a growing contribution of non-obstetric causes (NOC) to maternal death worldwide. In the past, immunodeficiency virus infection has had a significant toll on maternal health in our environment;[7,8] and previous researchers have reported the occasional maternal death due to viral haemorrhagic disease.[9] The role of medical conditions in the aetiology of MM is often overshadowed by the continued negative impact of the traditional causes of pregnancy-related deaths in sub-Saharan Africa and the rest of the developing world. In reality, many of these conditions like diabetes, hypertension and other cardiovascular disorders, renal disease and autoimmune disorders have a hugely significant direct as well as indirect role in MM. Hypertension, diabetes and renal disease remain important risk factors for preeclampsia, a condition known to be second only to obstetric haemorrhage in the aetiology of maternal death in Nigeria.[10-12] It is instructive to note that many underlying medical conditions may impact to varying degrees the capacity to survive or otherwise succumb to the recognizable primary causes of maternal death.[13]

Beyond the overarching approach of tackling maternal death on a broad inter-sectoral scale, effective strategies for prevention of MM will require introducing interventions which will be intercalated with measures targeting specific aetiologies that are unique to various parts of the world, emphasizing locally achievable solutions. The present study was conducted to identify current and emerging causes of MM in our environment, and to examine the contribution of NOC to the burden of maternal death in our hospital. The findings are expected to draw attention to the growing need to focus on cause-specific interventions that can be designed to address the continued scourge of MM.

METHODOLOGY

This was a retrospective descriptive study involving women who suffered MM at the Department of Obstetrics and Gynaecology, University of Benin Teaching Hospital (UBTH), Benin City, Nigeria from 1st January 2011 to 31st December 2018, conducted with the approval of the Research and Ethics Committee of the hospital. This period was identified for the study as 2012 coincided with the participation of UBTH in a national study coordinated by a team at the World Health Organization (WHO) to report the volume of MM and near-miss in Nigerian hospitals, involving the six geo-political zones, which lasted from June 2012 to May 2013. This era probably marked a turning point in the needed attention to deepen the effort to combat the scourge of maternal death and disability in Nigeria following this landmark report of Oladapo et al.[14]

UBTH is a tertiary health facility located in Edo State, South-South region of Nigeria, and it is a major referral hospital for Kogi, Ondo and Delta States. Pregnant women are also referred from both public and private hospitals within Edo State. Within the hospital, the entry point for them is the general practice clinic (GPC) from where they are referred to the antenatal clinic for booking, but in emergency situations, patients are admitted via the emergency unit of the hospital to the labor ward. On the average, between 120 and 180 patients are booked for antenatal care every week in the hospital, while follow up attendance rate is between 250 and 500 patients per week. The delivery rate in the hospital in the last five years has been about 3,600 per year, which gives an average monthly delivery rate of 300. The hospital has a total antenatal and postnatal bed capacity of 82 spaces, and 12 functioning delivery rooms in the labor ward. There are 4 operating theatres attached to the labor ward for obstetric and gynaecological surgeries.

MM is a reportable event in our hospital. And there is a regular 6-monthly audit of MM which has been in practice for more than 25

years in the department. During such audits, a non-judgmental, non-punitive, open discussion is conducted to examine the events around the time and immediately following a maternal death, with a view to identifying the remote and immediate contributors, exchange knowledge and experiences, and proffer feasible interventions that could have mitigated or averted such adversity. Following these audits, reviews are conducted at 3 monthly intervals to determine progress toward the implementation of targeted interventions from the previous meetings.

The information for this study was retrieved into pro forma sheets designed for the study from the computer-coded data bank of the Department of Obstetrics and Gynaecology. The primary outcome of interest in this study was the occurrence of MM resulting from NOC. This was measured in terms of the number of maternal deaths, the specific aetiologies involved, the socio-demographic determinants, and the trend in the burden of MM across the years of the study. Information on sociodemographic characteristics, clinical diagnosis, and primary causes of maternal death were extracted and analyzed.

A database was generated from the completed pro forma sheets. Analysis of data was done using SPSS version 20 (SPSS Inc., Chicago IL). Sociodemographic variables were categorized and expressed as frequency, with the effect of maternal age, parity, social class and booking status on maternal mortality expressed as relative risk (RR). P value < 0.05 was considered statistically significant.

RESULTS

There were a total of 22,257 deliveries over the 8-year period. The booked patients made up 71% and the live birth rate was 95%. Maternal mortality was recorded in 235 women, with overall MMR of 1.1% (1,114/100,000 live births). MMR among booked women of 161/100,000 live births was 6 times lower than MMR for referred women of 953/100,000 live births.

A teenager had a relative risk of mortality of 2.88 compared with a woman in age group 20 to 29 years. Compared with women in age group 30 to 34 years, those who were 35 years or older had a relative risk of dying of 3.43. Grand-multiparity conferred a relative risk of mortality of 4.57 and 3.2 compared with nulliparous and para 1 to 4 women, respectively. Compared with higher social class, lower socioeconomic status had a relative risk of mortality of 33. The relative risk of mortality for women who were referred was 15.5. (Table 1)

Table 1: Impact of sociodemographic characteristics of women delivered during the 8-year period on maternal mortality

Characteristic	Number of deliveries (n=22,257)	Mortality (n=235)	Risk of mortality
Age (year)			
19	106	3 (1.3)	0.0 28
20 - 24	1483	26 (11.0)	0.0 18
25 - 29	6452	51 (21.7)	0.0 08
30 - 34	10907	74 (31.5)	0.0 07
35	3309	81 (34.5)	0.0 24
Parity			
0	5342	35 (14.9)	0.0 07
1 - 4	15802	164 (69.8)	0.0 1
5	1113	36 (15.3)	0.0 32
Social class			
Upper	10683	19 (8.1)	0.0 02
Middle	9348	68 (28.9)	0.0 07
Low	2226	148 (63)	0.0 66
Booking status			
Booked	15774	34 (14.5)	0.0 02
Referred	6483	201 (85.5)	0.0 31

Table 2: Proportion of maternal mortality due to obstetric and non-obstetric causes

Causes of maternal mortality	Number of maternal mortality per year							
	2011	2012	2013	2014	2015	2016	2017	2018
Obstetric haemorrhage	9	6	13	7	7	4	5	10
Hypertensive disorders of pregnancy	6	18	12	6	2	6	8	8
Puerperal sepsis	10	13	7	4	4	2	7	7
Abortion and its complications	0	0	2	2	0	0	1	2
Complications of obstructed labour	0	2	2	2	0	0	0	0
Non -obstetric causes	5	3	3	0	2	2	6	10
Total mortality	30	51	39	21	15	14	27	37
MMR	1,021	1,478	1,186	685	614	814	1,257	1,724

Across the 8-year period, MMR ranged from 0.61% to 1.72%. A progressive decline in MMR was observed in the first 5 years, with 58% reduction between 2012 (1.48%) and 2015 (0.61%). An increase of 53% in MMR was noted in the last 3 years (2016: 0.81% vs 2018: 1.72%). (Table 2)

During the period under review, the major obstetric causes of MM remained prominent with obstetric hemorrhage, preeclampsia/eclampsia and puerperal sepsis ranking tops in that order. In the first year of this period, HIV-related deaths were the 5th major cause of MM, and this position was regained in the last 2 years contributing 4% and 5.4% to MM respectively. NOC were responsible for between 5.9% and 27% of all MM recorded over the 8-year period. There was a progressive increase in the proportion of MM due to NOC from the second year of this review. (Table 2)

Table 3 shows the relative contribution to maternal death by NOC of MM. HIV-related deaths (22.6%), deaths from VTE (9.7%), deaths due to cardiac disease (9.7%) and diabetic keto-acidosis (9.7%), and anesthesia-related deaths (6.5%) were the top 5 contributors to mortality among the NOC of MM recorded during the period under review. Other rare conditions associated with MM included Guillain-Barre syndrome, viral haemorrhagic disease due to Lassa fever, chronic liver disease and upper gastro-intestinal bleeding.

Table 3: Contribution to maternal deaths by non -obstetric causes over the 8 years

Condition	Number of maternal deaths (n=31)	Percentage
HIV/AIDS	7	22.6
VTE	3	9.7
Cardiac disease	3	9.7
Diabetic ketoacidosis	3	9.7
Complications of a naesthesia	2	6.5
Guillain -Barre syndrome	2	6.5
Viral haemorrhagic fever	1	3.2
Pulmonary tuberculosis	1	3.2
Tetanus infection	1	3.2
Cerebrovascular accident	1	3.2
Acute severe asthma	1	3.2
Pneumonia	1	3.2
Acute fatty liver of pregnancy	1	3.2
Severe malaria	1	3/2
Chronic liver disease	1	3.2
Upper GI bleeding	1	3.2
Sickle cell anaemia	1	3.2

DISCUSSION

As expected, the obstetric causes of maternal death in our environment were shown to account for the majority of MM in the period under review. The increasing role of many non-obstetric contributors like HIV/AIDS, anaesthesia, VTE, cardiac disease and diabetic keto-acidosis to maternal death was also highlighted in the present study. Of note is that in the last 4 of the 8 years covered in the present review, the contribution of NOC of MM more than doubled from 13% in 2015 to 27% in 2018.

The world experienced a progressive decline in MMR from the year 2000, dropping by 38 percent – from 342 deaths to 211 deaths per 100,000 live births between 2000 and 2017,[1] despite the failure of many nations to achieve the target of the MDGs. Ande et al[8] and Oyeniyan et al[15] also documented a decline in MMR studying different periods between 2005 and 2015. A similar trend was noted in our hospital during the first 5 of the 8 years we reviewed. However, a gradual rise in the MMR recorded in our facility became obvious in the last 3 years of the review period. This rising trend is similar to the finding of Mustapha et al[16] who worked in Damaturu, Yobe State. The important contribution of NOC of MM in our environment may explain in part this recent increase in the burden of maternal deaths.

The predisposing sociodemographic variables for adverse maternal outcome were highlighted in the present study to include teenage, advanced maternal age, high parity and low social status, which are similar to the findings of earlier research.[6] Advanced maternal age was associated with high risk of maternal death, an association which is probably due to the increased chance of medical co-morbidities. The risk of maternal death was increased in grand-multiparous women. Those in the lower socioeconomic class had a relative risk of dying 33 times more than women who were in the high social class, perhaps due to poor health-seeking behaviour and delay in presenting for care due to lack of financial support to access proper care. A similar observation has been reported by Olonade et al[17] in western Nigeria.

In the present study, it was observed that obstetric haemorrhage along with hypertensive disorders of pregnancy and puerperal sepsis continue to rank highest as causes of MM in our hospital. This finding is clearly in agreement with reports spanning more than 2 decades from different parts of the developing world.[1,6,10,12] Interestingly, there were no deaths due to obstructed labour in the last 4 years of the present study, with NOC becoming the 5th major cause of MM in our hospital. Perhaps an improved knowledge of labour management among different cadre of health workers, prompt referral to expert care, and better awareness and acceptance of Caesarean section by the pregnant population and their relatives, can partly explain the diminished role of obstructed labour in maternal deaths. Importantly, HIV/AIDS, VTE and complications of anaesthesia have become significant contributors to the burden of maternal deaths in our hospital.

From early 2000s, the volume of hospital admissions due to advanced HIV/AIDS increased astronomically in our environment, and the pregnant population was particularly affected, with some researchers in our hospital reporting a significant role for HIV/AIDS in the burden of MM. While the WHO reported that HIV-related indirect MM had risen to 2.5%[18] in 2005, Onakewhor et al[7] recognized this trend in their review which found that HIV/AIDS was contributory to 25% of all maternal deaths in our hospital in 2011. Another study conducted by Ande et al[8] about the same time showed that HIV/AIDS had gradually become one of the leading causes of MM in the hospital. Similarly, the present study showed that HIV/AIDS was one of the 5 leading causes of maternal death at the beginning of the period under review; and in the last 4 years of the period, HIV/AIDS had re-emerged as the 4th leading contributor to MM. Agan et al[19] also recently showed that HIV/AIDS was the commonest indirect cause of maternal death in their hospital.

HIV/AIDS resurgence may be due to drug resistance and complacent attitude towards HIV treatment and care services. Hopefully, the recent recommendation[20] that antiretroviral drugs, once initiated, be taken for life, will likely halt the explosion in drug resistance and reverse the recent observed role of HIVAIDS in MM in our environment.

The role of VTE in the aetiology of MM has always been documented in the developed world, especially as their recorded deaths from the direct obstetric causes continue to decline. The rare report of VTE in maternal death reviews in our environment questions the consideration given to its potential contribution to MM, considering that we continue to grapple with the rising number of maternal deaths resulting from the direct obstetric causes. Interestingly, Korubo et al[21] found that doctors in their hospital in Port Harcourt demonstrated poor knowledge of VTE, a situation that suggests that the diagnosis of VTE may be easily missed. Furthermore, the needed capacity for early diagnosis and prompt treatment of VTE is grossly limited in many health facilities.[22] However, two recent maternal death reviews in Edo State and Ondo State reported that 11% [23] and 3.3% [15] respectively, of their recorded MM were due to pulmonary embolism.

In 2006, Enohumah and Imarengiaye[24] investigated the role of anesthesia in pregnancy-related mortality in our hospital. In their study, anesthesia was one of the 4 leading causes of maternal deaths, with 8 deaths attributed directly to anaesthesia which was often general anaesthesia. In the present study, anaesthesia-related deaths were in the top 5 of NOC of maternal death. MM due to anaesthesia complication was recorded in the first year and the 7th year of this review. However, the role of anaesthesia in MM in our hospital has diminished significantly since the publication of Enohumah and Imarengiaye.[24] Over the last 2 decades, regional anaesthesia, especially spinal analgesia, has become increasingly available for many surgical cases in our hospital, and the skill for the procedure has improved remarkably. Perhaps this technique has brought with it a measure of safety and the resultant reduced contribution of anaesthesia to MM.

The prominent role of medical conditions in the pathway of severe maternal morbidity and MM was shown in the present study as the contribution of cardiac disease, diabetes, asthma, as well as infectious morbidity like pneumonia, viral haemorrhagic fever, pulmonary tuberculosis, malaria and tetanus. A review by Mocumbi et al,[13] had previously shown the central role of cardiovascular disease burden such as chronic hypertension, rheumatic heart disease and cardiomyopathies as major contributors to MM in developing countries. These NOC have gradually become significant impediments to the realization of improved maternal health in our environment. It is, however, instructive to note that many of these conditions have clear predisposing factors like obesity, hypertension and diabetes, and are unfortunately driven by an underlying state of poverty, ignorance and disease. Perhaps the adoption of a practice of systematic search for risk factors for cardiovascular disease in early pregnancy will help to identify women who will require close observation to mitigate the emergence of severe maternal morbidity as pregnancy advances.

This study highlights the increasing role of NOC of MM in our hospital, the re-emergence of HIV/AIDS-related maternal death as well as the contribution of rare causes of maternal deaths like Guillain-Barre syndrome, tetanus infection and viral haemorrhagic fever, many of which deserve serious attention. The occasional contribution of anaesthesia and VTE to MM was also documented in this study. These findings provide an opportunity for addressing the scourge of MM by directing attention to cause-specific interventions.

The retrospective design employed in the present study has the limitation that borders on validity, usually due to inadequate data retrieval arising from poor documentation in case notes with attendant missing

information. However, the data bank of the department made it possible to get accurate data on the record of MM in our facility. This was further supported by the information from the archives of the regular MM audit in our hospital. Though the present study is hospital-based, the findings can be representative considering the referral status of UBTH.

CONCLUSION

There is an increasing role of NOC of MM in our hospital. As the direct obstetric causes of MM are tackled to improve maternal health, the NOC will likely become more important contributors. We advocate a large multi-centre study to confirm if this pattern reflects the reality in our environment. Interventions to tackle MM must continue to look closely at these identified contributors and explore the possibility of advancing cause-specific interventions to address the scourge of MM.

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Author Contribution

NO Enaruna: Project concept and design, Data collection, Data analysis, Final manuscript writing
RN Maduka: Project development, Data analysis and interpretation, Manuscript preparation
Both authors read and approved the final manuscript.

Conflict of Interest

We declare that we have no conflict of interest.

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