

Original Research Article:

Magnitude, trends and causes of maternal mortality: A 7-year review at a tertiary hospital in Rivers State, Nigeria.

Abstract:

Background: Maternal mortality ratios (MMR) are still unacceptably high in many low- and middle-income countries especially in sub-Saharan Africa. Background Data for the causes of maternal deaths are needed to inform policies to improve maternal healthcare and reduce maternal mortality.

Objective: This study sought to determine the magnitude and trend in maternal mortality and the causes at a tertiary hospital over a seven-year study period.

Methodology: This was a retrospective review of maternal mortality and causes from 2012 to 2018. Data on number of maternal deaths, deliveries and causes of death were retrieved from the departmental annual reports and hospital records and entered into Microsoft Excel 2013. Data were presented as line graphs, charts and frequency tables.

Results: One hundred and ten (110) maternal deaths occurred out of 17,080 total births during the study period giving an overall MMR of 644. The MMR increased progressively from 580 in 2012 to 785 in 2018 with a sharp rise to the highest, and decline to the lowest, values at the midpoint. The commonest causes of maternal deaths were Pre-eclampsia (PET) and Eclampsia 44(40%), Postpartum Haemorrhage (PPH) 25(22.7%) and Ruptured Uterus 13(11.8%).

Conclusion: The maternal mortality ratio is high and the trend is worsening. The leading causes of maternal deaths were PET/Eclampsia and Postpartum haemorrhage accounting for about two-thirds of all deaths. Efforts must be geared towards improvements in the management of these cases, if this trend is to be reversed.

Key Words: Maternal mortality, Magnitude, Trends, Causes, Tertiary hospital, Rivers State,

Introduction:

The rate of maternal death is one of the key indices for measuring the state of health, quality of healthcare, and general socioeconomic development in any society. It is estimated that 287,000 maternal deaths occurred worldwide in 2010, and 99% of these were in developing countries,

especially in sub-Saharan Africa [1]. More than 50% of all maternal deaths were from just six countries: Ethiopia, India, Nigeria, Pakistan, Afghanistan, and the Democratic Republic of Congo [2,3]. According to the World Health Organization (WHO), Nigeria had the second highest number of annual maternal deaths globally. Nigeria has a maternal mortality ratio of about 814 per 100,000 live births as at 2015 [1]. Within Nigeria, Maternal Mortality Rate (MMR) figures differs between geo-political regions, with southwestern region having one of the lowest rates and higher rates in Northern regions [4,5,6,7,8].

Reduction of maternal mortality has long been a global health priority and is a target in the UN Millennium Development Goals (MDG) framework [9] and a key concern of the Global Strategy for Women's and Children's Health launched by the UN Secretary-General in September, 2010 [10]. A key requirement for further advances in reduction of maternal deaths is to understand the causes of deaths for effective policy and health programme decisions. Between 2003 and 2009, haemorrhage, hypertensive disorders, and sepsis were responsible for more than half of maternal deaths worldwide [11].

In a study in Lagos, Nigeria, Okonofua F et al [12] found eclampsia, primary post-partum haemorrhage, obstructed labour and puerperal sepsis as the leading obstetric causes of maternal deaths. Other studies have also found haemorrhage and pre-eclampsia and eclampsia as the leading causes of maternal deaths. Sageer et al [13] found figures of 43.4% and 36.9% of causes respectively in South-west Nigeria; Agan et al [8] found figures of 33.4% and 21.2% of causes respectively in South-south Nigeria; Tesfaye et al [14] found figures of 46.5% and 16.3% of causes respectively in Eastern Ethiopia. Nwagha et al [6] found sepsis as the commonest cause 25.8% before haemorrhage (23.7%) and pre-eclampsia/ eclampsia (12.4%). In a recent review of causes at their Centre, Agan et al [15] found sepsis (21.3%) and hypertensive diseases (16.4%) as the leading causes of death.

Apart from the direct causes of maternal deaths, there are numerous factors (indirect causes) that contribute to maternal mortality, a critical factor being the interval between the onset of an obstetric complication and its outcome. Delay in instituting treatment is usually associated with adverse outcome and hence the three delays concept. In the WHO systematic analysis by Say et al [9], it was found that more than a quarter of deaths were attributable to indirect causes. In the study by Okonofua et al [12], they found delay in arrival in hospital, the lack of antenatal care and patient's refusal to receive recommended treatment as the patient's associated causes of death, while delay in treatment, poor use of treatment protocols, lack of equipment and lack of skills by providers to use available equipment were the identified facility-related causes of death. In another study, by Sageer et al [13], the leading contributory factors of maternal deaths were inadequate human resource for health, delay in seeking care, inadequate equipment, lack of ambulance transportation, and delay in referral services.

There has not been any evaluation on trends and causes of maternal mortality at the RSUTH. This study therefore sought to determine the magnitude and trend in maternal mortality and to understand the direct causes of deaths for effective policy and health programme decisions.

Methodology:

This was a retrospective review of maternal mortality and causes from 2012 to 2018. Data on number of maternal deaths, total number of deliveries and live births, and causes of death during the study period were retrieved from the departmental annual reports and hospital records and entered into Microsoft Excel 2013. Data were presented as line graphs, frequency tables and charts.

Maternal death was defined as the 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 [16]. MMR was calculated as total number of deaths divided by the total number of live births a year multiplied by 100,000. Each MMR reported in this study was per 100,000 live births. The denominator was omitted in the results and discussion sections for ease of presentation.

This study was conducted in the RSUTH, a tertiary hospital owned and funded by the Government of Rivers State, and patients are expected to pay directly for services (except few that participate in the National Health Insurance Scheme). During the period 2012-2014 there was a Free Medical Care (FMC) programme where user fees for antenatal care, postnatal care and delivery including Caesarean section, as well as drugs and consumables but excluding blood for transfusion, was paid for by the government to the hospital by way of reimbursement. Afterwards the programme was scrapped and patients have to bear the full cost of all treatment.

The hospital provides emergency obstetric services to women referred from other centers, as well as providing antenatal care and delivery services for low and high-risk pregnant women booked with the hospital. The hospital is well equipped and has availability of qualified team comprising of Obstetricians, Pediatricians and Anaesthetists. There is availability of laboratory and blood bank services in the hospital.

Results:

One hundred and ten (110) maternal deaths occurred out of 17,080 total births during the seven-year study period giving an overall MMR of 644 (Table 1). The MMR trend shows a fairly stable but increasing rates in the first three years 2012-2014 from 580-625, with a steep rise in 2015 to 1090, followed by a sharp decline in 2016 to 252 and a resurgence of progressively increasing rates of 725 in 2017 and 785 in 2018 (Figure 1).

Overall, the commonest causes of maternal deaths were Pre-eclampsia (PET) and Eclampsia 44(40%), Postpartum Haemorrhage (PPH) 25(22.7%), Ruptured Uterus 13(11.8%) and Sepsis / Retroviral Disease (RVD) 12(10.9%) as shown in figure 2. Table 2 shows the year by year distribution of the causes of maternal deaths and the trend has been that PET/Eclampsia was the commonest cause of death every year, followed by Postpartum haemorrhage except in 2015 when it was the commonest. About two-thirds (62.7%) of maternal deaths resulted from these two causes.

Table 1: Trends in maternal mortality during the period:

| Time period | Total number of births | Number of maternal deaths |
|--------------|---------------------------|---------------------------|
| 2012 | 3106 | 18 |
| 2013 | 3251 | 19 |
| 2014 | 2239 | 14 |
| 2015 | 2019 | 22 |
| 2016 | 2378 | 6 |
| 2017 | 1793 | 13 |
| 2018 | 2294 | 18 |
| Total | 17080 | 110 |
| MMR | (110/17080x100000) | 644 |

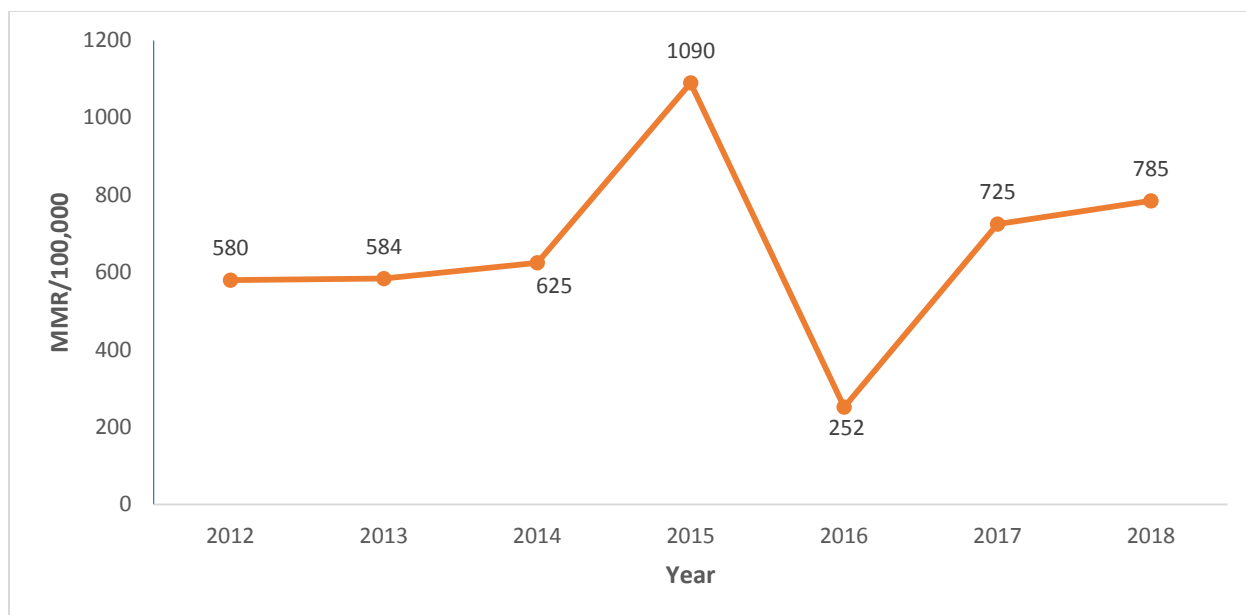


Figure 1: Line graph showing trends in maternal mortality ratio (MMR) during the period

Table 2: Distribution of cause of maternal death during the period:

| Cause of death | 2012 n (%) | 2013 n (%) | 2014 n (%) | 2015 n (%) | 2016 n (%) | 2017 n (%) | 2018 n (%) |
|--------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| PET/Eclampsia | 8 (44.4) | 7 (36.8) | 6 (42.9) | 5 (22.7) | 1 (16.7) | 5 (38.5) | 12 (66.6) |
| Ruptured uterus | 3 (16.7) | 2 (10.5) | 1 (7.1) | 3 (13.6) | 2 (33.3) | 1 (7.7) | 1 (5.6) |
| PPH | 5 (27.8) | 4 (21.1) | 3 (21.4) | 9 (40.9) | 2 (33.3) | 1 (7.7) | 1 (5.6) |
| Post CS | 0 (0.0) | 3 (15.8) | 0 (0.0) | 2 (9.0) | 1 (16.7) | 1 (7.7) | 1 (5.6) |
| SCD/RVD/Sepsis | 0 (0.0) | 1 (5.3) | 2 (14.3) | 2 (9.0) | 0 (0.0) | 5 (38.5) | 2 (11.0) |
| Obstructed labour | 2 (11.1) | 2 (10.5) | 2 (14.3) | 1 (4.5) | 0 (0.0) | 0 (0.0) | 1 (5.6) |
| Total | 18 (100.0) | 19 (100.0) | 14 (100.0) | 22 (100.0) | 6 (100.0) | 13 (100.0) | 18 (100.0) |

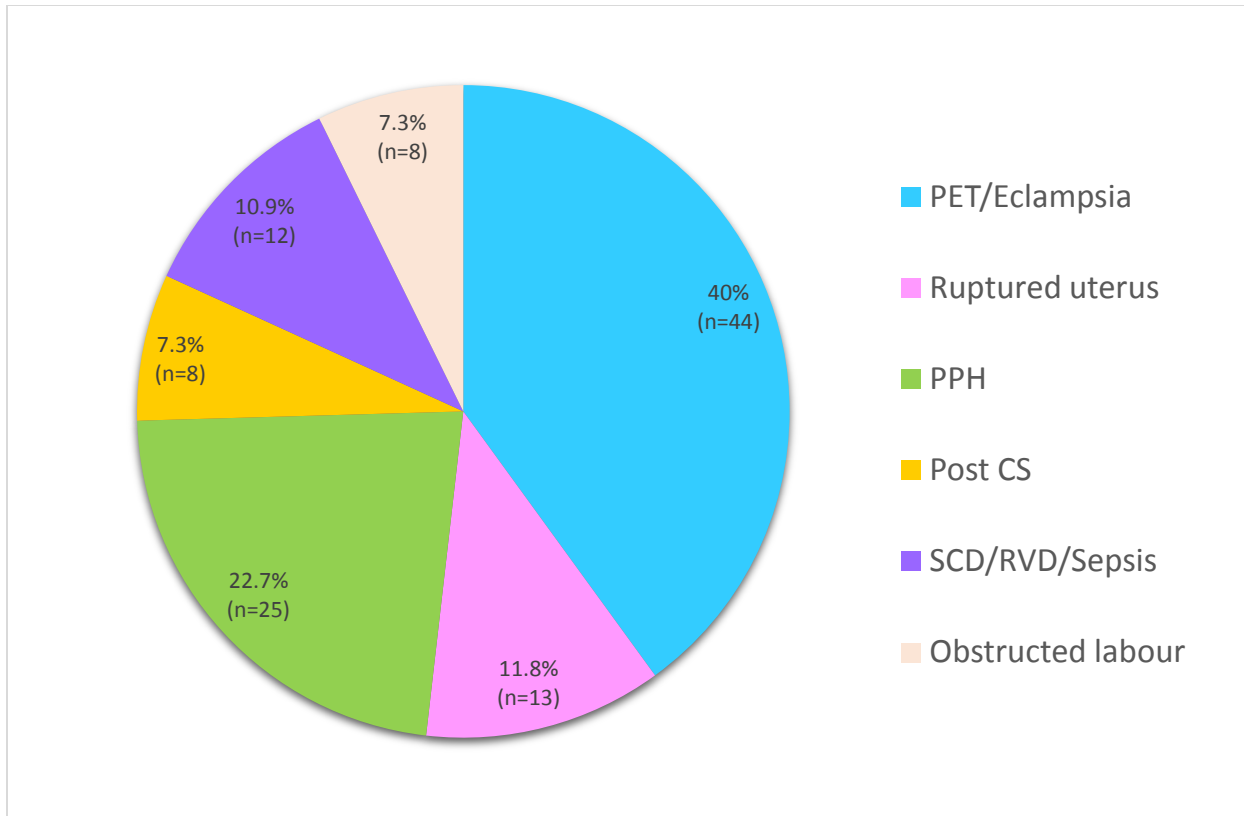


Figure 2: Causes of death (n=110) over the years (2012 – 2018)

Discussion:

This study recorded a high MMR of 644 per 100,000 live births for the 7-year period 2012-2018. This is however lower than The Nigerian national MMR of 814 in 2015 recorded by WHO [1] and the 903.7 recorded by Nwagha et al [6] and much higher figures from other studies in Nigeria [17,18,19]. This is however higher than the findings of a similar study in the South-South region of Nigeria by Agan et al 2018 [15] of 448, but lower than their earlier finding of 1,513 at the same center in 2010 [8]. The success in reduction of MMR in their study was attributed to the free maternal care services to all categories of pregnant women in their state, as well as the dedicated implementation of findings from the Woman Trial to reduce postpartum haemorrhage. Although the MMR of 644 in this study is lower than the current WHO estimate for Nigeria, it is abysmal when compared with the estimates for developed nations, such as 3 for Denmark, 8 for the UK, and 14 for Singapore [1]. This is also far from the new target of the Sustainable Development Goal (SDG) to reduce the global MMR to less than 70 per 100,000 live births by 2030, with no country having an MMR over 140 per 100,000 livebirths [20].

This study also revealed a consistent increase in MMR over the study period, with figures for 2012(580), 2013(584) and 2014(625) being lower than the overall average of 644. This might be

attributed to the free medical care programme in the state at that time. The highest annual MMR of 1090 was recorded in 2015 when the scheme was abruptly terminated. Nwagha et al [6] in their study also recorded consistent increase in the MMR over the 3-year period of 2003(756.8), 2004(897.6) and 2005(1052.2). However, Agan et al [15] reported a consistently decreasing MMR over their 5-year study period.

The leading causes of death in this study were Pre-eclampsia / Eclampsia (40%) and Postpartum haemorrhage (22.7%). Other studies have reported these two culprits as the main causes but with postpartum haemorrhage as the major offender [11,12,13,14]. Agan et al [8] in their earlier study reported the leading causes as postpartum haemorrhage (33.4%) and pre-eclampsia / eclampsia (21.2%) but in their later study, Agan et al [15], it was sepsis (21.3%) and hypertensive disorders in pregnancy (16.4%). They deduced that the significant reduction in MMR might have been as a result of reduction in deaths from postpartum haemorrhage following the dedicated implementation of the Woman Trial. The demotion of postpartum haemorrhage to second place in our study might also be linked to the implementation of the Woman Trial in our Centre. Our Centre was one of the recruitment sites for the world Maternal Antifibrinolytic trial (Woman Trial), a large randomized double-blind, placebo-controlled trial to quantify the effect of early administration of Tranexamic acid for postpartum haemorrhage on maternal death etc. The multi-Centre trial was coordinated by the London School of Hygiene and Tropical Medicine [21].

The high mortality from PET/Eclampsia (40%) in this study is unacceptable as it is preventable through early diagnosis and prompt treatment. While the hospital cannot do much in cases of delays in presentation, much can be achieved by prompt treatment of all cases adhering to a treatment protocol adopting the findings of the Magpie Trial, that Magnesium Sulphate halves the risk of Eclampsia and reduces the risk of maternal deaths [22]. A dedicated implementation of the Magpie Trial and Woman Trial findings might lead to a reduction in deaths from PET/Eclampsia and Postpartum haemorrhage, and a reduction in the MMR in our Centre.

Conclusion:

The study showed that the maternal mortality ratio is high and the trend is worsening. The leading causes of maternal deaths were PET/Eclampsia and Postpartum haemorrhage accounting for about two-thirds of all deaths. Efforts must be geared towards improvements in the management of these cases, if this trend is to be reversed. There is urgent need to develop protocols for implementing the findings of the Magpie Trial and the Woman Trial aimed at reducing the occurrence of deaths from PET-Eclampsia and Postpartum haemorrhage respectively.

The findings from this study should inform the prioritization of health policies, programmes, and funding to reduce maternal deaths in the State and country at large. Further efforts are needed to improve the availability and quality of Data related to maternal mortality.

Source of Support: Nil

References:

1. World Health Organization (WHO). Trends in maternal mortality: 1990-2015. Estimates by WHO, UNICEF, UNFPA, World Bank and United Nations Population Division. Geneva, Switzerland: WHO; 2015. Available at <http://www.who.int/reproductivehealth/publications/monitoring/maternal-mortality-2015/en/>. Accessed 24 Dec 2019.
2. Hogan C. Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards MDG5. *Lancet* 2010; 375(9726): 14.
3. World Health Organization (WHO). Working together for health. The World Health Report 2006. Switzerland: WHO; 2006.
4. Federal Ministry of Health FMOH/NPC. National Demographic and Health survey. Abuja: National Population Commission; 2004.
5. Doctor HV, Olatunji A, Findly SE, Afenyadu GY, Abdulwahab A, Jumare A. Maternal mortality in northern Nigeria: findings of a health and demographic surveillance system in Zamfara State, Nigeria. *Tropical doctor*. 2012; 42(3): 140-3. <https://dx.doi.org/10.1258/td.2012.120062>.
6. Nwagha UI, Nwachukwu D, Dim C, Ibekwe PC, Onyebuchi A. Maternal mortality trend in South East Nigeria: less than a decade to the millennium development goals. *Journal of Women's Health*. 2010; 19(2): 323-7. <https://dx.doi.org/10.1089/jwh.2008.1028>.
7. Adegoke AA, Campbell M, Ogundeji MO, Lawoyin TO, Thomson AM. Community Study of maternal mortality in South West Nigeria: how applicable is the sisterhood method. *Maternal and Child Health Journal*. 2013; 17(2): 319-29. <https://dx.doi.org/10.1007/s10995-012-0977-z>.
8. Agan T, Archibong E, Ekabua J, Ekanem E, Abeshi S, Edentekhe T, et al. Trends in maternal mortality at the University of Calabar Teaching Hospital, Nigeria, 1999-2009. *International Journal of Women's Health*. 2010; 2: 249. <https://dx.doi.org/10.2147/ijwh.s11971>.
9. United Nations. United Nations Millennium Development Goals. 2013. <http://www.un.org/millenniumgoals/maternal.shtml>. (accessed Dec 28, 2019).
10. United Nations' Secretary General. Global Strategy for Women's and Children's Health. New York: United Nations, 2010.
11. Say L, Chou D, Gemmill A, Tuncalp O, Moller A, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. *Lancet Glob Health* 2014; 2: e323-33. Available at [http://dx.doi.org/10.1016/S2214-109X\(14\)70227-X](http://dx.doi.org/10.1016/S2214-109X(14)70227-X).
12. Okonofua F, Imosemi D, Igboin B, Adeyemi A, Chibuko C, Idowu A, et al. Maternal death review and outcomes: An assessment in Lagos State, Nigeria. *PLoS ONE*. 2017; 12(12): e0188392. Available at <https://dx.doi.org/10.1371/journal.pone.0188392>.
13. Saager R, Kongnyuy E, Adebimpe WO, Omosehin O, Ogunsola EA, Sanni B. Causes and contributory factors of maternal mortality: evidence from maternal and perinatal death surveillance and response in Ogun State, Southwest Nigeria. *BMC Pregnancy and Childbirth*. 2019; 19: 63. <https://dx.doi.org/10.1186/s12884-019-2202-1>

14. Tesfaye G, Loxton D, Chojenta C, Assefa N, Smith R. Magnitude, trends and causes of maternal mortality among reproductive aged women in Kersa health and demographic surveillance system, eastern Ethiopia. *BMC Women's Health*. 2018; 18: 198. <https://dx.doi.org/10.1186/s12905-018-0690-1>
15. Agan TU, Monjok E, Akpan UB, Omoronyia OE, Ekabua JE. Trend and Causes of Maternal Mortality in a Nigerian Tertiary Hospital: a 5-year Retrospective Study (2010-2014) at the University of Calabar Teaching Hospital, Calabar, Nigeria. *Open Access Macedonian Journal of Medical Sciences*. 2018; 6(6): 1153-8. <https://dx.doi.org/10.3889/oamjms.2018.220>.
16. Pattison R, Say L, Souza JP, Broek Nvd, Rooney C. WHO maternal death and near-miss classification. *Bulletin of the World Health Organization*. 2009; 87(10): 734-A.
17. Oladipo TO, Lamina MA, Fakoya TA. Maternal deaths in Shagamu in the new millennium: A facility-based retrospective analysis. *BMC Pregnancy Childbirth*. 2006; 6: 6. <https://dx.doi.org/10.1186/1471-2393-6-6>.
18. Uzoigwe SA, John CT. Maternal mortality in the University of Port Harcourt Teaching Hospital: PH in the last year before the New Millennium. *Niger J Med* 2004; 13: 32-35.
19. Audu LR, Ekele BA. A Ten-year review of maternal mortality in Sokoto, Northern Nigeria. *West Afr J Med* 2002; 21: 74-76.
20. World Health Organization (WHO). Strategies towards ending preventable maternal mortality (EPMM). 2015.
21. Shakar H, Elbourme D, Gulmezoglu M, Alfrevic Z, Ronsmas C, Allen E. the Woman Trial (World Maternal Antifibrinolytic Trial): Tranexamic acid for treatment of postpartum haemorrhage: an international randomized, double-blind placebo-controlled trial. *Trials*. 2010; 11: 40. <https://dx.doi.org/10.1186/1745-6215-11-40>.
22. The Magpie Trial Collaborative Group. Do women with pre-eclampsia, and their babies, benefit from magnesium sulphate? The Magpie Trial: a randomized placebo-controlled trial. *Lancet*. 2002; 359(9321): P1877-1890. [https://dx.doi.org/10.1016/S0140-6736\(02\)08778-0](https://dx.doi.org/10.1016/S0140-6736(02)08778-0).