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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

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Abstract

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BACKGROUND: Maternal mortality ratios (MMR) are still unacceptably high in many low-income countries especially in sub-Saharan Africa. MMR had been reported to have improved from an initial 3,026 per 100,000 live births in 1999 to 941 in 2009, at the University of Calabar Teaching Hospital (UCTH), Calabar, a tertiary health facility in Nigeria. Post-partum haemorrhage and hypertensive diseases of pregnancy have been the common causes of maternal deaths in the facility.

AIM: This study was aimed at determining the trend in maternal mortality in the same facility, following institution of some facility-based intervention measures.

METHODOLOGY: A retrospective study design was utilised with extraction and review of medical records of pregnancy-related deaths in UCTH, Calabar, from January 2010 to December 2014. The beginning of the review period coincided with the period the "Woman Intervention Trial" was set up to reduce maternal mortality in the facility. This trial consists of the use of Tranexamic acid for prevention of post-partum haemorrhage, as well as more proactive attendance to parturition.

RESULTS: There were 13,605 live births and sixty-one (61) pregnancy-related deaths in UCTH during the study period. This yielded a facility Maternal Mortality Ratio of 448 per 100,000 live births. In the previous 11-year period of review, there was sustained the decline in MMR by 72.9% in the initial four years (from 793 in 2010 to 215 in 2013), with the onset of resurgence to 366 in the last year (2014). Mean age at maternal death was 27 ± 6.5 years, with most subjects (45, 73.8%) being within 20-34 years age group. Forty-eight (78.7%) were married, 26 (42.6%) were unemployed, and 33 (55.7%) had at least secondary level of education. Septic abortion (13, 21.3%) and hypertensive diseases of pregnancy (10, 16.4%) were the leading causes of death. Over three quarters (47, 77.0%) had not received care from any health facility. Most deaths (46, 75.5%) occurred between 24 and 97 hours of admission.

CONCLUSION: Compared with previous trends, there has been a significant improvement in maternal mortality ratio in the study setting. There is also a significant change in the leading cause of maternal deaths, with septic abortion and hypertensive disease of pregnancy now replacing post-partum haemorrhage and puerperal sepsis that was previously reported. This success may be attributable to the institution of the Woman trial intervention which is still ongoing in other parts of the world. There is, however, need to sustain effort at a further reduction in MMR towards the attainment of set sustainable development goals (SDGs), through improvement in the provision of maternal health services in low-income countries.

Introduction

Maternal deaths are still unacceptably high in many low-income countries, where pregnancy and childbirth are high-risk events that constitute major public health challenge [1]. Consequently, concerted efforts have been made, including long-term goals and programs aimed at improving maternal morbidity and mortality [2] [3]. One of such goals (the 5th

Millennium Development Goal (MDG-5)), which aimed at reducing maternal deaths by three-quarters between 1990 and 2015, has been attained by only sixteen countries globally [1]. Notwithstanding, there has been an improvement in reduction of maternal mortality ratios (MMR) globally, with a report indicating 0.3% reduction in the initial five years and 2.7% reduction in the later years of the 15-year MDG span [1]. Great achievement in the MDG-5 target is particularly notable in the south, east, and Southeast

Asian countries, while West and Central African regions without exception to Nigeria have made slow progress [1].

In Nigeria, MMR had initially risen from 704 per 100,000 live births in 2000, to 800 in 2003 before gradual reduction to 545 in 2007, 400 in 2008 to 280 in 2014 [1] [4]. This recent figure is short of the MDG target of 75% reduction in MMR by the end of 2015. There is however wide regional variation with higher rates in Northern compared with Southern Nigeria [5] [6] [7] [8]. Improvement in MMR has also not been consistent in many regions, due to intermittent financing for implementation of maternal health intervention policies and programs as seen in other parts of the African continent [9]. Consequently, varying intensities of implementation of maternal health interventions, have led to varying trends and leading causes of maternal deaths in the communities [10] [11] [12].

A retrospective study of the medical records in the University of Calabar Teaching Hospital (UCTH), a tertiary hospital in Calabar, Cross River State, Nigeria, found a decreasing trend in maternal mortality, from 3,026 per 100,000 live births in 1999, to 941 in 2009, [6]. During the 11-year study period, there were 231 maternal deaths, yielding an average maternal mortality ratio of 1,513 per 100,000 live births, with most women being 20-34 years old (63.3%), married (67.1%) and unemployed (55.4 (63.3%). Obstetric haemorrhage (33.4%) was the commonest cause of death, followed by hypertensive diseases of pregnancy (21.2%), septic abortion (14.3%) and obstructed labour (9.1%) [6].

Archibong et al., in their review of existing maternal health policies including an in-depth interview with key stakeholders in Cross River state health sector, identified factors that may have significantly impacted on the state's maternal morbidity and mortality status [13]. Specific programs such as Midwife Service Scheme (MSS), National Health Insurance Scheme (NHIS) and Integrated Maternal Neonatal and Child Health (IMNCH), were found to have been adopted and made functional, especially through the state's counterpart funding in collaboration with non-governmental partners. Though the authors identified that only 40% of budgetary allocation to the health sector was usually released, they were however unable to obtain adequate information on the state's budgetary income funding especially from donor agencies [13].

Also, despite poor budgetary allocation and release to the health sector, there has been significant improvement in water and electricity supply to primary healthcare facilities, as well as the construction of several road networks by the government of Cross River State [13]. These activities with potentially significant indirect effect on health outcomes were aimed at improving retention and attraction of health personnel to rural settings, and reduction in delays of

providing and receiving essential health services. Assessment and evaluation of the impact of these infrastructural interventions may be useful towards identifying areas of strengths and weaknesses in our prevention efforts.

Therefore, there is still much work to be done in containing preventable maternal deaths, especially in low-income countries. This position has been supported by relevant stakeholders leading to the current Sustainable Development Goals (SDG) target of having less than 70 maternal deaths per 100,000 live births by 2030, as a consolidation of the gains of the MDG strategic achievements [14] [15]. Consequently, it is key to institute and assess maternal death prevention programs and practices, to identify areas of strength and weakness towards re-evaluation and promotion of best practices. This evaluation is especially important in settings with dwindling economies such as Nigeria, where there is increasing need to do much more with less money amidst other competing needs [16].

The University of Calabar Teaching Hospital (UCTH) was one of the leading recruitment sites for the world Maternal Antifibrinolytic trial (Woman Trial). This is a large pragmatic randomised double-blind, placebo-controlled trial to quantify the effect of early administration of tranexamic acid for postpartum haemorrhage on maternal death, Peripartum hysterectomy and other outcomes. The multi-centre trial is coordinated by the London School of Hygiene and Tropical Medicine [17]. The Trial was commenced in 2009, and over 16000 women were randomised, and the target sample size of 20,000 eligible women was attained in August 2016. The first and the second nested study aimed to evaluate the effect of tranexamic acid on markers of coagulation and hemostatic effect of tranexamic acid in randomised women respectively. Although the trial has been concluded, there is need to evaluate its impact on MMR in the region. This study was therefore aimed at assessing a 5-year trend in maternal mortality in UCTH Calabar, Nigeria, following institution of these interventions.

Methodology

A retrospective review of clinical data was carried out for all maternal deaths that occurred in UCTH within the study period of January 2010 when the interventions were commenced, to December 2014, using hospital records. This activity was conducted with assistance from three (3) trained medical research assistants. Records that were mutilated beyond recognition of basic sociodemographic data, as well as those that lacked information on the cause of maternal death, were excluded. Available records of live births during the

study period were also obtained from the medical records unit. Ethical approval for the study was obtained from UCTH health research ethics committee. 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 [18]. Socio-demographic characteristics, as well as the number and causes of death, were determined. Place of initial care and duration of admission before death was also determined. The number of live births during the study period was also determined. Data were entered and analysed using SPSS version 21.0.

Results

Sixty-one (61) maternal deaths occurred in UCTH, Calabar, during the study period (2010-2014), with an estimated maternal mortality ratio of 448 maternal deaths per 100,000 live births (Table 1).

Table 1: Trend in Maternal Mortality Ratio in UCTH (2010-2014)

Year	No. Maternal deaths n (%)	No. Live Births	MMR per 100,000 live births
2010	21 (34.4)	2,647	793
2011	18 (29.5)	3,482	517
2012	10 (16.4)	3,051	328
2013	6 (9.8)	2,787	215
2014	6 (9.8)	1,638	366
Total	61 (100)	13,605	448

MMR=Maternal Mortality Ratio

This excludes one subject whose hospital record was mutilated beyond recognition of basic socio-demographic data and maternal cause of death. There was a significant decline in maternal mortality ratio from 793 in 2010 to 215 in 2013 and gradual resurgence in 2014.

Table 2: Socio-demographic characteristics of maternal deaths (subjects) (N=61)

Variable	Frequency	Percent
Age group		
< 15	1	1.6
15-19	5	8.2
20-24	10	16.4
25-29	22	36.1
30-34	13	21.3
35-39	8	13.1
≥40	2	3.3
Total	61	100
Marital status		
Married	48	78.7
Single	10	16.4
Cohabiting	3	4.9
Total	61	100
Occupation		
Civil servant	7	11.5
Business woman / trader	18	29.5
Student	5	8.2
House wife	5	8.2
Unemployed	26	42.6
Total	61	100.0
Educational level		
Primary	25	41.0
Secondary	31	50.8
Tertiary	3	4.9
Not stated	2	3.3
Total	61	100.0

Mean age at maternal death was 27.7 ± 6.5 years, with most deaths (45, 73.8%) occurring within 20 to 34 years of age. Over three-quarters (78.7%) were married, while 25 (41.0%) had an occupation as civil servant (7, 11.5%) or businesswoman/trader (18, 29.5%). Thirty-three (55.7%) had at least secondary level of education (Table 2).

Approximately three-quarters (45, 73.8%) of maternal deaths were attributable to direct causes. Septic abortion (13, 21.3%) was the commonest cause of maternal death, followed by hypertensive diseases of pregnancy (10, 16.4%). Relatively less common causes were antepartum haemorrhage (5, 8.2%), prolonged obstructed labour (4, 6.6%) and molar pregnancy (4, 6.6%). Malaria in pregnancy (4, 6.6%), and AIDS (4, 6.6%) were the commonest indirect cause of death. Other medical causes of maternal deaths included congestive cardiac failure (3, 4.9%), pulmonary embolism (2, 3.3%), while hematologic causes were aplastic anaemia (1, 1.6%) and sickle cell disease (1, 1.6%), (Table 3).

Table 3: Comparison of causes of maternal death in UCTH

Cause of Death	1999 – 2009		2010 - 2014		Percentage change
	Frequency	Percentage	Frequency	Percentage	
Direct causes					
Septic abortion	15	6.5	13	21.3	+14.8
Hypertensive disease of pregnancy	49	21.2	10	16.4	-4.8
Antepartum hemorrhage	11	4.8	5	8.2	+3.4
Prolonged obstructed labor	21	9.1	4	6.6	-2.5
Molar pregnancy	0	0	4	6.6	+6.6
Puerperal sepsis	33	14.3	3	4.9	-9.4
Intrauterine fetal death					
septicemia	0	0	2	3.3	+3.3
Post-partum hemorrhage	66	28.6	2	3.3	-25.3
Ectopic pregnancy	6	2.6	1	1.6	-1
Amniotic fluid embolism	0	0	1	1.6	+1.6
Indirect causes					
Malaria in pregnancy	12	5.2	4	6.6	+1.4
Aids	11	4.7	4	6.6	+1.9
Congestive cardiac failure	0	0	3	4.9	+4.9
Pulmonary embolism	0	0	2	3.3	+3.3
Anesthetic complication	4	1.7	1	1.6	-0.1
Aplastic anemia	0	0	1	1.6	+1.6
Sickle cell disease	0	0	1	1.6	+1.6
Hepatitis/jaundice in pregnancy	3	1.3	0	0	-1.3
Total	231	100	61	100	-

*-Obtained from table 4 of the previous study on trend in maternal causes of death (1999-2009) in same study setting⁶.

The common age groups for the occurrence of maternal death due to septic abortion were 15-19 (4, 30.8%) and 25-29 (5, 38.5%) years). Half of the maternal deaths due to hypertensive diseases of pregnancy, prolonged obstructed labour and molar pregnancy occurred among women who were 25-29 (5, 50%), 20-24 (2, 50%) and greater than 39 (2, 50%) years old respectively. All the four maternal deaths due to malaria occurred at 30 years of age (Table 4).

Most subjects (58, 95.0%) had initially sought none (47, 77.0%) or hospital of lower quality (11, 18.0%) before presenting at the study centre. Approximately three-quarters of maternal deaths (46, 75.5%) occurred within 25 and 96 hours of admission (Table 5).

Table 4: Age distribution of common causes of maternal deaths in UCTH (2010-2014)

Variable(years)	Frequency	Per cent	Mean age (years)
Septic Abortion			
15-19	4	30.8	24.2 ± 6.9
20-24	2	15.4	
25-29	5	38.5	
35-39	2	15.4	
Total	13	100	
Hypertensive diseases of pregnancy			
20-24	2	20	27.6 ± 4.8
25-29	5	50	
30-34	2	20	
35-39	1	10	
Total	10	100	
Prolonged obstructed labour			
<15	1	25	21.8 ± 6.3
20-24	2	50	
25-29	1	25	
Total	4	100	
Molar pregnancy			
25-29	1	25	39.3 ± 8.0
35-39	1	25	
≥40	2	50	
Total	4	100	
Malaria in pregnancy			
30-34	4	100	30.0 ± 0.0

Discussion

There has been varying degrees but significant reduction in maternal deaths globally, with many low-income countries, however lagging behind. In this facility-based study, annual maternal mortality ratio was found to have decreased quite consistently in the last five years. This is in keeping with global expectations towards the attainment of the MDG-5 target [15]. This success could be attributable to several on-going intervention programs. Previous studies have shown that a significant proportion of maternal mortality and life-threatening complications occurred in women who did not receive antenatal care but referred to the maternity unit in emergency condition [6]. In 2010, the Cross River State legislators approved the Governor's request for free maternal care services to all categories of pregnant women in the State [13].

Table 5: Pattern of the health-seeking behaviour of subjects

Variable	Frequency	Percentage
Place of initial care		
None	47	77.0
Hospital of lower status	11	18.0
Same hospital	3	5.0
Total	61	100.0
Duration of admission before death		
<24 hours	8	13.1
25-48 hours	19	31.2
49-96 hours	27	44.3
97 hours - 10 days	6	9.8
>10 days	1	1.6
Total	61	100.0

This was to promote the number of antenatal clinic attendants and encourage women to utilise skilled birth attendants in the state government-owned health facilities for labour and deliveries. Increased utilisation of skilled birth attendants might have contributed to the decline in incidences of obstetric complications because, in the last five years, the

Cross River State government has been offering free maternal and newborn care in all the primary and secondary health facilities in the state [13]. This has increased the number of antenatal attendants; hospital supervised deliveries and prompt referral. Analysis of health facility-based data by Pathfinder International in a stakeholders' forum has shown a gradual decline in maternal mortality and a remarkable uptake in obstetrics and neonatal services including HIV and contraception programs in the state [19].

Much of the success of improvement in maternal mortality seen in this study might have also been influenced by the dedicated implementation of the Woman Trial. In this trial, every woman with postpartum haemorrhage was given 1 to 2 gm of tranexamic acid or placebo. During the five year period more than 500 women with PPH were recruited in which perhaps, more than half of them might have been treated. This is reflected in the significant difference in the proportion of maternal deaths caused by postpartum haemorrhage (PPH) comparing pre-intervention and intervention periods [6]. In this study, a significant reduction in the occurrence of PPH was the main cause of the significant reduction in maternal deaths [20]. In a recent Cochrane review [21] that included 12 trials involving 3285 women undergoing caesarean section (9 trials, 2453 participants) and spontaneous labour (3 trials, 832 participants), Tranexamic acid (TXA), in addition to other uterotonics, decreased postpartum blood loss and prevented PPH and blood transfusion.

Furthermore, in a double-blinded trial by Xu J and colleagues [22], TXA was shown to significantly reduce obstetric haemorrhage during caesarean section compared to the control group ($P < 0.01$). Also, the quantity of total blood loss from placental delivery to 2 hours postpartum was significantly reduced ($P = 0.02$) in TXA group than the control. Woman trial which recruited 20,000 women with PPH was concluded in March 2016, and the data were analysed in September 2016 and has been published in Lancet in December 2016. The results showed a significant reduction in primary outcomes- maternal mortality and peripartum hysterectomy in the treated group compared with the placebo group.

Also, through the Cross River State essential drugs program, iron and folic acid supplements are readily available in most primary and secondary health facilities which are dispensed free to pregnant women. This may have contributed to the low prevalence of anaemia in pregnancy. It is estimated that anaemia may be the underlying factor-responsible for as much as 20% of all maternal deaths in sub-Saharan Africa [23]. The most suitable mass intervention to prevent anaemia in pregnancy is the administration of haematinics to pregnant women aimed at raising the haemoglobin concentration. Furthermore, availability of highly subsidised contraceptive services may be responsible for the

decreased incidence of death from unsafe abortion due to a possible reduction in some unwanted pregnancies [24].

Worthy of note is the effort of various NGOs in improving maternal and newborn care during the study period. For instance, Tulsi-Chanrai foundation, an Indian NGO in partnership with the state ministry of health since 2009, has trained different categories of health workers in the state on the use of partograph, infection prevention, management of preeclampsia/eclampsia and active management of the third stage of labour [25]. Protocols and guidelines for treatment of obstetric complications are now conspicuously displayed in the form of wall-chart in the maternity units of hospitals and health centres. Sustained training on Focused Antenatal Care has been conducted across the three major districts courtesy of Malaria Action Program for States (MAPS) in conjunction with USAID and Global Fund. Among other benefits, this emphasises on complication readiness, recognition of danger signs, birth preparedness and family-centred care during pregnancy [26]. Previous studies have shown that when maternal and newborn care services are offered free highly subsidised, there is a positive impact on health demography of the population [27].

In this study, septic abortion is now a leading cause of maternal death, replacing post-partum haemorrhage which was reported in the previous study in the same setting. In the data presented by Pathfinder International [19], 'stock out' of parenteral antibiotics was commonly reported in the monthly summary form compared to other essential drugs like misoprostol. Significant reduction in the occurrence of PPH as the cause of maternal death may be due to increased utilisation of misoprostol for management and prevention of PPH during the study period [28]. This is in keeping with similar reports in Bangladesh which reported significantly lower mortality ratios in higher compared with lower and no misoprostol coverage areas (38 vs 45 vs 51) maternal deaths per 100,000 live births, respectively [29]. These findings were reported despite similar and inadequate utilisation of skilled birth attendants in the study areas [29].

Malaria in pregnancy constituting 6.6% was the commonest indirect cause of death in this study. This proportion is slightly higher than what was reported in the previous study in the same setting by Agan et al. (6.6% vs 5.2%), suggesting the need for improvement in the implementation of malaria prevention measures [6]. Difficulty in the improvement of malaria in pregnancy prevention in the study setting could be due to the high prevalence of undetected asymptomatic malaria parasitaemia reported in previous studies, with potential progression to more severe and even fatal disease [30] [31]. This study is however limited by the inability to assess maternal deaths that may have occurred in transit to health facilities, as well as the effect of sociopolitical and

other factors that may have contributed to the improvement in maternal mortality during the study period.

In conclusion, there is a significant decline in maternal mortality in the study centre in the last 5 years. This might be explained by the institution of the Woman trial intervention which reduced the occurrence and severity of PPH, as well as more proactivity of caregivers in their attendance to parturition. Given a high proportion of deliveries usually occurring in rural settings, there is need to consider shortly, institution of the Woman trial in rural settings. Such scale-up using the existing primary health care facilities may yield accelerated attainment of the SDGs, especially in resource-poor settings. Septic abortion and hypertensive diseases of pregnancy have replaced post-partum haemorrhage, which was previously noted as leading cause of maternal death. This indicates the need for implementation of community and facility-based strategies for infection control towards containment of septic abortion which is the new leading cause of maternal death.

Ethical approval and consent

Ethical approval and consent was obtained from the Research Ethical Committee of the UCTH and the Research Ethics Committee of the Cross River State Ministry of Health

Author's contribution

TUA initiated and conceived the idea and project and wrote the initial draft; EM was involved with literature search and synthesis, UBA was involved with data analysis and collation as well as literature search, OEO was the sole biostatistician in the project and JEE did literature synthesis and analysis as well. All authors were involved at different stages of the manuscript writing and review. All authors read and approved the final draft before submission to the journal.

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