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Evaluation of maternal and perinatal mortality in Amachara general hospital, Umuahia south local Government Area (LGA), Abia State, Nigeria, 2014 – 2017

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Abstract

Background: Maternal and perinatal deaths are clustered around delivery and the first 24 hours after birth respectively. Whilst most maternal and perinatal deaths are preventable, women and babies continue to die from these preventable causes.

Specific objective: To evaluate maternal and perinatal mortality in Amachara General Hospital, Umuahia South, Abia State.

Methods and materials: A retrospective 3-year study was conducted among 4870 mothers and 4834 live babies in Amachara General Hospital, Umuahia South LGA. Data were collected and coded into and analyzed using Statistical Package for Social Science, Version 26.0. Categorical variables were summarized using frequency and proportions, logistic regression models were used to determine association with maternal deaths. Chi-Square test was used to test association at $p<0.05$ & $p<0.001$.

Result: Of the 4870 babies born at or after 28 weeks of gestation, 136 (2.8%) were stillbirths, maternal mortality ratio was 532.3 per 100,000 live births and perinatal mortality rate was 129.4 per 1000 births. Puerperal sepsis 86 (34.1%) and asphyxia related condition 220 (34.9%) were most common causes of maternal and perinatal deaths respectively. Mothers aged 35 years and older was one of the factors associated with increased risk of perinatal death, p-<0.05 & $p<0.001$.

Conclusion: Maternal mortality ratio and perinatal mortality rate were still high in this study and still far from the Sustainable Development Goals 2030 target. Sepsis and HIV positive were most probable causes of maternal deaths. Asphyxia related conditions were the most common possible cause of perinatal mortality. Mothers aged 35 years and older and Apgar score < 6 at five minutes after delivery were associated with increased risk of perinatal mortality.

Keywords: Evaluation; Maternal and perinatal mortality; Amachara General Hospital; Umuahia South; Abia State; Nigeria

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1. Introduction

Pregnancy, labour and early childhood are hazardous in many societies. In developing countries, maternal mortality during pregnancy and puerperium has continued to be major public health problem. Similarly, childhood mortality, death before the age of five, accounts for approximately forty percent or more of the total mortality in these places [1]. Maternal and perinatal deaths are clustered around delivery [2]and the first 24 hours after birth [3] respectively. Consequently, current strategies to reduce maternal and perinatal mortality in developing countries strongly recommend that deliveries take place at health facilities compared to other settings [4].

Whilst most maternal and perinatal deaths are preventable, women and babies continue to die from these preventable causes and in many cases these deaths are unaccounted for. Every day, 830 women die from preventable causes worldwide, for each of these deaths, approximately 20 other women suffer severe complications [5,6]. In addition, as of 2015, 18.4 of every 1000 births is a stillbirth, with one stillbirth occurring in every 16 seconds mostly because of poor monitoring during labour, and delivery [7]. The situation is even worse in developing countries like Nigeria where disparities exist across regions, geographical location, and socioeconomic class [8].

When provided by health workers with midwifery training, facility management of deliveries might offer opportunities for early recognition of pregnancy related complications and facilitate timely provision of life saving basic and comprehensive emergency obstetric and perinatal services [9-11]. A continuum of care approach that includes prenatal, intrapartum, immediate newborn and postpartum care for mother and newborn is therefore considered essential for promotion of mother-infant health [12,13].

Important barriers to the supply of and demand for facility-based deliveries remain, especially among the poorest groups [14]. Key factors constraining service delivery include lack of political commitment, insufficient financial and skilled human resources and weak health care system infrastructures [15-17]. On the demand side, perceived poor quality of care, actual and opportunity cost of care seeking, cultural beliefs, lack of women empowerment and limited male involvement limit access to facility-based care [18-21].

In sub-Saharan Africa, the region with the highest maternal mortality ratio (500 deaths per 100,000 live births) and perinatal mortality rate (56 per 1,000 births) [22,23], coverage of facility deliveries was particularly low. A recent estimate indicated that across 28 sub-Saharan countries, only 47% of births take place in a facility [24].

Predictors of maternal and perinatal death were similar: low maternal education, lack of antenatal care, referral from other facility, maternal age >35 year of age, no antenatal care or antenatal care outside of a health facility, referral from other facility or informal setting, previous caesarean section, latent-phase labour admission, operative vaginal birth, non-use of a labour monitoring tool, no labour companion, and non-use of uterotonic for post-partum haemorrhages (PPH) prevention. This nationwide programme for routine data aggregation shows that maternal and perinatal mortality reduction strategies in Nigeria require a multisectoral approach [25]. Several lives could be saved in the short term by addressing key predictors of death, including gaps in the coverage of internationally recommended interventions such as companionship in labour and use of labour monitoring tool.

Simple clinical interventions have proven to play a significant role in reducing the morbidity and mortality associated with women and children. However, this is strongly dependent on a functional health care system embedded with reliable monitoring and evaluation of health activities at the communities and facilities. Maternal and Perinatal Death Surveillance and Response (MPDSR) is an accountability framework based on accurate and consistent monitoring of comprehensive health report involving stakeholder review of data [26]. It is a cost-effective and superior approach that permits the routine identification, notification, quantification, mapping, and determination of causes and prevention of all maternal and perinatal deaths [8]. MPDSR is currently not in place in Abia State and health workers send reports of maternal and perinatal cases to the Ministry of Health. This study aims at evaluating maternal and perinatal mortality in Amachara General Hospital, a secondary health facility in Abia State for a three-year period to assess the extent of healthcare services provided to mothers and children.

2. Material and methods

The study was carried out in General Hospital, Amachara in Umuahia South Local Government Area (LGA), Abia State, South Eastern Nigeria. Umuahia South LGA is one of the 17 LGAs in Abia State. Abia State is one of the eastern states in Nigeria created on the 27th of August 1991 from the Old Imo State [27]. Its administrative capital is located in Umuahia. Abia State is bordered northwards by Anambra, Enugu, and Ebonyi states, to the west by Imo State, to the east and

southeast by Akwa Ibom and Cross Rivers States and to the south by Rivers State. The indigenous dwellers of the community are Igbo's whose main occupation is farming. They produce yam, cassava, maize, palm oil and plantain. They are Christians of different denomination but dominated by Methodist Church and orthodox churches. It is located 5.11 Latitude and 7.37 Longitude, and it is situated at elevation 64 meters above sea level. The LGA has an area of 140.4 Square Kilometer and a population of 215,236 as per 2006 census data of Nigeria projected to 289,100 at 2.7% in 2016 annual growth rate [28]. Male and female population are 144,435 and 144665 respectively. The population of under-five children in Umuahia south is 23,390 which is 8.1% of Umuahia South LGA, males are 11,912 (50.9%) and females are 11,478 (49.1%) and population of child-bearing women (15 – 49 years) is 58,267 which is 20.1% of the population of Umuahia South. Its residents are made up of civil servants, business people and farmers [27].

Umuahia South LGA houses a Privately owned University- Gregory University, with several Government and private owned primary, secondary, and tertiary institutions including a few churches, industries, hotels, hospitals, etc. Notable among these are: Federal government Girls Secondary School Old Umuahia, Umuokpara Secondary School. Majority of the residents are traders while few engage in vocations such as civil service, commercial bus driving, tailoring, shoe making, farming, patent medicine, etc. The religion mainly practiced by these people is Christianity. The tribe is the Igbo and the most common spoken language is the Igbo language followed by English.

The population of under-five children in Umuahia south is 23,390 which is 8.1% of Umuahia South LGA, males are 11,912 (50.9%) and females are 11,478 (49.1%) and population of child-bearing women (15 – 49 years) is 58,267 which is 20.1% of the population of Umuahia South [28].

2.1. Study population

The study population comprised of all women (and their babies) who were admitted for delivery or on account of complications within 42 days of delivery or termination of pregnancy between 1st February 2014 and 31st January 2017. This population was chosen to account for all pregnancy-related complications that could result in severe morbidity or death in Amachara General Hospital as well as the standard denominators for estimating the burden of maternal, foetal, and neonatal mortality (live births and all births).

2.1.1. Eligibility criteria

All the mothers who delivered in the hospital and their babies delivered after 28 weeks of gestation between February 1st 2014 and January 31st 2017 were included in this study. Also, all the babies admitted within the first seven days of birth at the newborn special care section of the hospital over the study period were included in the study

2.2. Study design

This study involved 3-year retrospective review of records in General hospital Amachara covering the period from February 1st 2014 to January 31st 2017.

2.3. Data Collection Method

Data from the mothers' delivery registers as well as the babies' admission and discharge registers at the newborn special care units of the hospital were collected and coded into the structured data collection form. Data collected included maternal age, maternal deaths, antenatal booking status, parity, level of education, employment status, previous obstetric history, antenatal antepartum conditions, intrapartum complications, gestational age at delivery, birth weight, first- and fifth-minute Apgar scores, fetal sex, newborn special care unit admission, perinatal complications and possible causes of perinatal deaths.

2.4. Study Instruments

A structured data collection form comprising of the following sections: Maternal socio-demographic variables, obstetric history, perinatal, interventions/treatment, intrapartum findings. Maternal-fetal and perinatal outcomes were used for data collection.

2.5. Measurement of Variables

Variables were duly measured and recorded.

2.6. Statistical Analysis

Data collected were cleaned interred into and analyzed using Statistical Package for Social Sciences (SPSS), Version 26.0. Categorical variables were summarized using frequency and proportions. The maternal and perinatal deaths and stillbirth were computed. The maternal mortality ratio, stillbirth rate, perinatal mortality rate, stillbirth rate and neonatal death rate were equally computed. A modified version of the Wigglesworth classification of causes of perinatal mortality was used to classify the possible causes of perinatal mortality [29]. At the level of bivariate, the association between perinatal mortality and explanatory variables was determined using Cox proportional hazards model (α=5.0%). Variables that were found to be statistically significant at the level of bivariate were included in the multivariate analysis in order to identify the determinants of perinatal mortality. The indicators of the status variables were the cases of maternal and perinatal mortality. The time to event variable is the life span of the fetus which covers the period of 28 weeks of gestation and the first week after delivery. Maternal deaths were recorded and any dead fetus within this interval attracted a code of 0 and 1 if otherwise.

Independent predictors for maternal death, and for perinatal death were separately explored using logistic regression models. Each variable was first entered in a univariable logistic regression model with death as the binary outcome for unadjusted estimates. Variable levels were aggregated where appropriate. Multilevel mixed-effects logistic regression models were used to determine the sociodemographic and clinical characteristics that were associated with maternal death. A similar model was used to determine the variables associated with perinatal death. Random effects were adjusted for at the hospital level.

Unadjusted and adjusted odds ratios (OR) with corresponding 95% confidence intervals (CI) and p-values are reported. Statistical significance was accepted at $p<0{\cdot}05$.

2.7. Ethical considerations

Ethical approval for this work was sought for and obtained from the ethics and research committee of Abia State University Teaching Hospital, Aba. Permission was obtained from the Management of General Hospital Amachara and informed consent was obtained from the participants. All information received from our participants was handled with utmost confidentiality.

Limitations

There are some limitations. Despite the use of a manual of operating procedures to standardize implementation of the study in the hospital, the large number of medical staff, clinical protocols, and patient medical record formats in use across the network may have resulted in misclassification or heterogeneity in documentation of pregnancy-related events, and the incompleteness of important data. A range of predictors that were not included that may influence maternal and perinatal deaths; residual confounding may be present. For example, pregnancy weight gain, use of traditional herbal medicines during pregnancy, alcohol and drug use were not captured in our data, so could not be explored. Finally, our study was conducted in a hospital network that largely represents publicly-funded referral-level secondary facilities in Abia State, Nigeria and private health facility was not included in this study, our data might not reflect the quality of care in the private health sector, or at lower level health facilities.

3. Results

Findings from table 1 shows that 2396 (49.2%) of the 4870 deliveries were males while 2474 (50.8%) were females., 3029 (62.2%) were delivered at term and 4203 (86.3%) were of normal weight. Also, of the 4870 deliveries 4695 (96.4%) were singleton. See table 1 for more information.

Table 1 Socio-demographic variables of births at Amachara General Hospital, Umuahia South, Abia State, 2014 – 2 2017. There was a total of 4870 deliveries and 4870 babies obtained from the records over the 3-year period covered by the study

Variables		**Frequency (N = 4870)**	**Percentage (%)**
Foetal sex	Male	2396	49.2
	Female	2474	50.8
Gestational age at delivery	Preterm	891	18.3
	Term	3029	62.2
	Post term	950	19.5
Mode of delivery	Spontaneous vaginal delivery	3964	81.4
	Assisted vaginal delivery (Forceps/vacuum delivery)	34	0.7
	Elective caesarian section	263	5.4
	Emergency caesarian section	609	12.5
Type of gestation	Single	4695	96.4
	Twin	141	2.9
	Multiple (more than two)	34	0.7
Birth weight in Kilograms (Kg)	Extreme low birth weight <1.5	19	0.4
	Very low birth weight 1.5-<2	24	0.5
	Low birth weight 2.0 - <2.5	419	8.6
	Normal birth weight 2.5 - <3.5	4203	86.3
	Macrosomia ≥ 3.5	205	4.2

Table 2 Stillbirth rates, early neonatal death rates, and perinatal mortality rates at Amachara General Hospital, Umuahia South, Abia State, 2014 – 2 2017

Variables		**Frequency (N = 4870)**	**Percentage (%)**
Stillbirths	Number of stillbirths	136	2.8
	Stillbirth rate (per 1000 births)	27.9	0.3 (0.279)
Total number of live births		4734	100.0
	Number of early neonatal deaths	445	9.4
	Early neonatal death rate (per 1000 live births)	94	9.4
Total number of perinatal deaths		630	100.0
	Perinatal mortality rate (per 1000 births)	129.4	20.6

Table 2 shows that stillbirth rate was 27.9 per 1000 births with early neonatal death rate of 94% per 1000 live births and perinatal mortality rate of 129.4 per 1000 births respectively. Please see table 2 for more details.

Findings from table 3 shows that asphyxia related conditions were the most common possible cause of perinatal mortality over the period of 3 years. These accounted for 220 (34.9%) of the 630 perinatal deaths. Other possible causes of perinatal mortality were early neonatal infections accounting for 114 (18.1%), immaturity 106 (16.8%), macerated stillbirths without congenital malformations 71 (11.3%), lethal congenital malformations 3 (0.5%) and others 116 (18.4%). Please see table 4 for more information.

Table 3 Possible causes of Perinatal mortality

Variables		**Frequency (N = 630)**	**Percentages (100.0%)**
Possible causes of Perinatal mortality	asphyxia	220	34.9
	Early neonatal infection	114	18.1
	Immaturity	106	16.8
	Macerated still births without congenital malformation	71	11.3
	Lethal congenital malformation	3	0.5,
	Others	116	18.4,

Table 4 Socio-demographic and antenatal variables of mothers who were delivered of babies at Amachara General Hospital, Umuahia South, Abia State, 2014 – 2 2017

Variables		**Frequency (N = 4870)**	**Percentage (%)**
Age range in years	<20	88	1.8
	20 – 34	4159	85.4
	≥35	623	12.8
Marital status	Single	409	8.4
	Married	4422	90.8
	Widowed	39	0.8
Levels of education	No formal education	248	5.1
	Primary	443	9.1
	Secondary	2231	45.8
	Tertiary	1948	40.0
Levels of employment	Employed	3073	63.1
	Unemployed	1797	36.9
Residential area of Mothers	Within Amachara	3107	63.8
	Outside Amachara	1763	36.2
Antenatal care booking status	Booked	3964	81.4
	Un-booked	906	18.6
Parity	Primiparous	2206	45.3
	Multiparous	2430	49.9
	Grand Multiparous	234	4.8
Antepartum health conditions	Normal pregnancy	4130	84.8
	Pregnancy induced hypertension	34	0.7
	Pre-eclamptic toxaemia	10	0.2
	Eclamptic toxaemia	1	0.02
	Previous caesarean section scar	161	3.3

	HIV positive	156	3.2
	Sepsis	267	5.5
	Anaemia in pregnancy	57	1.18
	Previous perinatal deaths	54	1.1

Table 4 shows that of the 4,870 deliveries over three-year period 248 (5.1%) mothers had no formal education and the rest 4,622 (94.9%) had some levels of formal education, 4,422 (90.8%) were married. Also, of the 4870 mothers, 623 (12.8%) were equal and older than 35 years while the 4247 (87.2%) were younger than 35 years of age and 3964 (81.4%) mothers booked for antenatal care. Please see table 5 for more information.

Table 5 Maternal mortality rates at Amachara General Hospital, Umuahia South, Abia State, 2014 – 2 2017

Variables	**Frequency (N = 4870)**	**Percentage (%)**
Total number of live births	4734	100.0
Maternal deaths	252	5.2
Maternal mortality ratio (per 100,000)	532.3	10.9

Findings from table 5 shows that out of the 4,870 mothers, 252 (5.2%) maternal deaths were recorded. This gave maternal mortality ratio of 532.3 per 100,000 live births with a total of 3,734 number of live births. Please see table 6 for more information.

Table 6 Probable causes of maternal mortality

Variables		**Frequency (N = 252)**	**Percentage (100.0%)**
Probable causes of maternal mortality	Pregnancy induced hypertension	8	3.2
	Pre-eclamptic toxaemia	4	1.6
	Previous caesarean section scar	70	27.8
	HIV positive	48	19.0
	Sepsis	86	34.1
	Anaemia in pregnancy	16	6.3
	Previous perinatal deaths	20	8.0

Table 6 shows that previous caesarian scar, HIV positive and sepsis were most probable causes of 70 (27.8%), 48 (19.0%) and 86 (34.1%) maternal deaths, suggesting that on average, about three of every ten women with previous scar and two of every ten women with HIV positive and about three of every ten women with sepsis did not survive their underlying complications. Please see table 7 for more information.

Table 7 shows the crude and adjusted hazard ratios for factors influencing perinatal death. Marital status, mothers´ residential area , type of gestation, Apgar score ≤ 6, birth weight, ANC booking status, previous history of perinatal death, antepartum heamorrhage, high parity, maternal HIV infection, and fetal sex were statistically significant with increased risk of perinatal death, *p-<0.05 & **p<0.001, however, on multivariate analysis, marital status, residential area, ANC booking status, multiple gestation, birth weight, antepartum haemorrhage and previous history of perinatal death remained significantly associated with increased risk of perinatal mortality. Maternal age, obstructed labour and mode of delivery were associated with increased risk of perinatal mortality in adjusted hazard ratio, *p<0.05. Please see table 8 for more details.

Table 7 Multivariate Cox proportional hazards regression model showing adjusted hazards ratios for the risk factors for perinatal mortality at amachara General Hospital, Umuahia South, Abia State, Nigeria

Variables (Covariates)		**Crude hazard ratio (95% CL)**	**Adjusted hazard ratio (95% Cl)**
Maternal age range	≥35	14.8 (10.4 – 19.5)	8.4 (6.5 – 13.8)*
	<35		
Marital status	Single	25 (18.4 – 34.6)**	9.8 (7.8 – 14.6)**
	Married		
Residential area	Outside Amachara	0.9 (0.6 – 1.3)**	11.8 (9.2 – 17.5)**
	Within Amachara		
Types of gestation	Twin or higher – order	3.8 (1.4 – 5.7)*	7.6 (3.5 – 12.6)**
	Singleton		
APGAR score at 5 minutes	>6	0.5 (0.3 – 0.9)**	0.0003 (0.0001 – 0.0028)**
	≤6		
Birth weight	Low birth weight & Macrosomia	1.6 (1.2 – 4.2)**	6.5 (4.6 – 9.7)**
	Normal birth weight		
ANC booking status	Un-booked	2.8 (2.1 – 4.0)*	1.6 (1.2 – 2.6)**
	Booked		
Previous history of perinatal death	Yes	48.7 (37.6 – 5 8.7)*	3.4 (2.6 – 4.2)**
	No		
Ruptured uterus	Yes	28.5 (9.4 – 64.7)	12.5 (9.2 – 14.8)*
	No		
Antepartum haemorrhage	Yes	16.4 (7.8 – 42.6)*	3.2 (1.8 – 5.8)*
	No		
Obstructed Labour	Yes	2.6 (2.1 – 12.4)	0.8 (0.4 – 1.9)*
	No		
Prolonged pregnancy	Yes	2.4 (1.4 – 5.4)	1.3 (0.6 – 1.8)*
	No		
Parity	≥5	1.2 (0.9 – 2.7)*	1.5 (0.8 – 2.2)
	<5		
HIV status	Positive	1.8 (1.2 – 2.8)*	1.4 (1.1 – 1.9)
	Negative		
Mode of delivery	Operative delivery	1.4 (1.1 – 1.8)	1.3 (0.8 – 1.7)*
	Vaginal delivery		
Fetal age	Male	1.4 (0.8 – 1.8)*	1.2 (0.8 – 1.6)
	Female		

*Significant at p-<0.05; **Significant at p-<0.001

4. Discussion

Findings from this study showed that maternal mortality ratio (MMR) was 532.3 per 10,000 live births, stillbirth rate was 27.9 per 1,000 births, early neonatal death rate was 94 per 1,000 live birth and perinatal mortality rate was 129.4 per 1,000 births. Nigeria still accounts for a high proportion of maternal deaths worldwide with worsening indices from 2008 till date. In 2013, Nigeria had shown and upward trend in MMR, 545 deaths per 100,000 live births in 2008, 576 deaths per 100,000 live births in 2013 and 814 deaths per 100,000 live births in 2018 [30,31]. Although a slight downward trend was observed in 2017 in this study, 532.3 per 100,000 per live births was still unacceptably high and worse than in the figure obtained from Gombe State [32] where 342 per 100,000 live births was observed in 2000 to 211 deaths per 100,000 live births in 2017 [33]. The downward trend in MMR observed in Gombe State is in keeping with worldwide trend showing a 38% reduction in MMR from the figure of 2000 to that of 2017. Disparity exist across regions in Nigeria with the North East being only second to North West with regards to poor maternal and child health indices compared to other zones in the country. Therefore, probably giving insight to high MMR recorded in the states [30]. In addition, the level of literacy, economic instability and insecurity which had ravaged the region for over a decade could have negatively influenced accessibility, availability and utilization of maternal and child health services which will invariably lead to poorer maternal and child health indices in these region [30]. The high level observed in this study could be due to sever cases being referred from non-health facilities.

Also, findings from this study showed that 86 (34.1%) and 70 (27.8%) of maternal deaths were as a result of sepsis and previous caesarian scar respectively and this in contrasts with the study in Ogun state [34] which showed that 43.3% and 36.9% of the maternal deaths were as a result haemorrhage and eclampsia/pre-eclampsia respectively. This was also corroborated from findings in Lagos state MPDSR report which showed eclampsia/pre-eclampsia, post-partum haemorrhage (PPH), obstructed labour and puerperal sepsis accounted for most of the maternal deaths [35].

This study's high perinatal mortality rate corroborates with the study at Federal Capital Territory Administration, Abuja [36]which recorded 129.5 per 1,000 births. The high perinatal mortality rates observed in both studies have important implications because perinatal mortality is regarded as a key indicator of the maternal and child health status of any population as well as a major contributor to overall under-five mortality. Also, hospital-based data potentially underestimate the true rates of perinatal mortality because newborns are not followed up after discharge from the hospital and only 36% of births in Nigeria are delivered in the health facilities[37]and out of hospital deliveries are likely to be associated with poorer outcomes.

Amachara General Hospital offer specialist, comprehensive as well as emergency obstetrics and newborn care and are therefore is a referral centre for complicated obstetric and newborn cases from other health facilities within and outside the area. This might have accounted for the high perinatal mortality rate observed in this study. The high perinatal death rate found in this study contrasts with the low rates reported from developed countries.[38,39] Also, it is similar to report from several facility-based studies in Nigeria which had reported high rates [40,44,45,46,47].

In Malawi, where 92% of births were in facilities, neonatal mortality was found to be lower among babies born in a higher-quality facility than those born in a lower-quality facility, using differential distance between the closest facility and a high-quality facility as an instrumental variable [48]. Studies on the effects of user-fee removals consistently find strong increases in facility birth, but few find significant reductions in mortality [49,50]. An evaluation of the Janani Suraksha Yojana (JSY) conditional cash-transfer programme in 284 districts in India found no association between district-level facility birth and maternal mortality in an adjusted model (with a trend in the wrong direction; ie, maternal mortality was higher in districts with higher proportions of facility birth). Randive and co-workers[51] conclude that the "high institutional births that JSY has achieved are of themselves inadequate to reduce MMR [maternal mortality ratio]" and that "other factors including improved quality of care at institutions are required for intended effect". While one study claimed an effect of JSY on neonatal mortality [52], supported by a replication study [53],another evaluation found the evidence insufficient and explained the absence of a mortality effect with the inability of lower-level facilities to manage life-threatening complications [48].

That intrapartum stillbirth is the outcome most closely aligned with care at birth fits with expectations that better access to comprehensive emergency obstetric care (CEmOC) might prevent some of these deaths. Caesarean section, in particular, can prevent intrapartum stillbirth and be life saving for mother and baby if accessed in time, but the number of caesarean sections remains low in most sub-Saharan African countries [54]. In this study population, the proportion of caesarean sections is higher than the minimum 5% only for certain subgroups, such as women living very close to a facility, or those who are wealthier. This finding collaborates with a study carried out by E-clinical-Medicine [21], part of the lancet discovery science.

In this study, asphyxia related conditions 34.9%, early neonatal infections 18.1% and macerated stillbirth without congenital malformation 11.3% were the common possible causes of perinatal mortality over the 3-year period of study. These findings corroborate with the study in Abuja [36] where it was reported that asphyxia, early neonatal infection and immaturity were the main probable causes of perinatal mortality. The results from our study are similar to reports from several studies which have reported these as the leading cause of perinatal deaths [42,45,55,56]. The increased deaths due to asphyxia may be due to the late referral of intra-uterine hypoxia cases to these hospitals and also possibly due to delayed or poor early neonatal resuscitation. Globally, the main direct causes of newborn deaths are reported to be preterm birth, severe infections and asphyxia 18,57, with prematurity playing a prominent role in developing countries [59]. Maternal parity of five and above, obstructed labour, postdatism and ruptured uterus were found to be risk factors for perinatal death at bivariate analysis; however, these were not significant at multivariate analysis. However, being unmarried was found to be associated with increased risk of perinatal mortality compared to being married. This might have been because married women are more likely to have partner support leading to increased social and economic support and are more likely to afford antenatal and intrapartum care services at the health facilities. Also, women´s status in the society have been noted to interact with other factors, albeit in unclear terms to influence perinatal death [60]. Other studies conducted in the United States and Zimbabwe found unmarried marital status to be an independent predictor of perinatal death [61,62].

This study found high case fatality rates for previous caesarian section scar, HIV positive and sepsis in pregnancy. Previous caesarian scar, HIV positive and sepsis were most probable causes of 70 (27.8%), 48 (19.0%) and 86 (34.1%) maternal deaths, suggesting that on average, about three of every ten women with previous scar and two of every ten women with HIV positive and about three of every ten women with sepsis did not survive their underlying complications. These findings are consistent with the observations in Nigeria Near-miss and Maternal Death Survey where maternal systemic infections and eclampsia also had the worst outcomes [5]. The underlying reasons for these persistent findings are likely to be multifactorial though would be most likely related to delays in presentation to the hospital and delays in treatment upon arrival at the hospital. Such contributory factors were reported previously in the Nigeria Near-miss and Maternal Death Survey [63]. Not only do sepsis and eclampsia require appropriate interventions (antibiotics and magnesium sulphate) to avert a maternal death, but also a timely administration of such interventions before end-stage organ damage ensues. This assertion is supported by the general availability of magnesium sulphate in the majority of the participating hospitals, which did not translate to improved outcomes for women with eclampsia. The situation is further compounded by the lack of capacity to initiate magnesium sulphate administration at lower level facilities (or sources of referral) due to complex dosing regimens, fear of magnesium toxicity, or regulatory issues, such that women referred with severe pre-eclampsia or eclampsia to referral-level facilities arrive when magnesium sulphate can make little or no difference to maternal survival [64,65].

Mothers aged 35 years and older had an increased risk of perinatal mortality compared to those aged below 35 years. This finding corroborates the findings of the study in Abuja[36] and that by Fawole et al. in Nigeria and another study on low and middle income countries [45,66].Women 35 years and older have been reported to be more likely to experience a term stillbirth than women aged below 35 years with stillbirths in this group of women reported to be more likely due to major congenital anomalies, maternal disorders. Residential area was found to be a determinant of perinatal mortality in this study. Babies born to mothers who lived outside Amachara Hospital had an increased risk of perinatal death compared to those born to mothers who lived close to the hospital. The finding of a higher risk of perinatal mortality among this category of women could be as a result of having to commute longer distances to assess antenatal care and intrapartum care services at the health facilities compared to those who lived within the area council thus making accessibility of antenatal and delivery services more difficult. The findings of this study corroborate the findings of the study in Abuja [36]and that of Akello et al [45].who found an increased risk of perinatal death among babies whose mothers travelled greater distances to access care [67].

5. Conclusion

Maternal mortality ratio and perinatal mortality rate are still high in this study and these figures are still far from the Sustainable Development Goals (SDG) 2030 target. Sepsis, HIV positive and previous caesarian scar were most probable causes maternal deaths. Asphyxia related conditions, early neonatal infections, immaturity, macerated stillbirths without congenital malformations, lethal congenital malformations were the most common possible cause of perinatal mortality over the period of 3 years. Mothers aged 35 years and older, residential areas far from the health facility, obstructed labour and mode of delivery, Apgar score < 6 at five minutes after delivery, birth weight, ANC unbooking status, multiple gestation, marital status and macrosomia were observed to be associated with increased risk of perinatal mortality.

Recommendation

To ensure survival of women and neonates amongst those presenting with life-threatening complications, the quality of care at Nigerian referral-level hospitals needs to improve, particularly with regard to the capacity to manage critically ill referrals. However, real change in maternal and perinatal health profile will be dependent on the country's ability to improve emergency obstetric and neonatal care at lower-level facilities and strengthening of the referral network to reduce the burden of potentially life-threatening complications that may overwhelm the tertiary health care system. As the predictors of death were similar for women and neonates, quality of care improvement strategies should be focused on the mother-infant dyad in a way that allows for an integrated approach for optimized labour, childbirth and early neonatal care. For example, a targeted approach in increasing companionship in labour will not only increase the practice of respectful care, but also improve maternal and perinatal survival.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding the publication of this paper.

Statement of ethical approval

Ethical approval for this work was sought for and obtained from the ethics and research committee of Abia State University Teaching Hospital, Aba. Permission was obtained from the Management of General Hospital Amachara.

Statement of informed consent

Informed consent was obtained from all individual participants included in this study.

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