

Predictors of Neonatal Mortality in a Tertiary Institution of a Developing Country

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ABSTRACT

Background: Nigeria continues to have one of the highest rates of neonatal deaths in Africa. Hospital-based studies had implicated prematurity, neonatal sepsis, poor antenatal care, and perinatal asphyxia as major causes of neonatal mortality. This study aimed to highlight the predictors of neonatal deaths and offer solutions to reduce them.

Methods: This 5-year retrospective review investigated the neonatal mortality rate at the University of Calabar Teaching Hospital from 2013 to 2018. The demographic characteristics, clinical parameters, duration of hospital stay, and challenges encountered in managing the patients were documented in this study. The obtained data were analysed in SPSS software (version 26).

Results: Neonatal mortality rate of 60 per 1000 live births was recorded in this study. The major causes of death were prematurity (n=86, 39.8%), perinatal asphyxia (n=45, 20.8%), neonatal sepsis (n=37, 17.1%), and congenital malformation (n=34, 15.7%). Low socioeconomic class and out-born were additional risk factors in this regard.

Conclusion: The neonatal mortality rate is higher than the average national rate and the figure obtained in the same center more than a decade ago. Infrastructural decay during the study period may partly explain the high neonatal mortality rate. Enhancement of the infrastructure and use of kangaroo mother care are recommended to reduce neonatal death, especially among premature babies.

Keywords: Developing country, Neonatal mortality, Predictors

Introduction

Child mortality has been at the hub of health discourse since time immemorial. Governments, health professionals, and policymakers have reserved an exclusive interest in reducing the prevalence of childhood deaths globally (1). The United Nation's Millennium Development Goals (MDGs) and Sustainable Development Goals have developed sound intervention strategies to reduce childhood mortality from 1990 to 2015 and 2015 to 2030, respectively (1,2). Globally, neonatal death decreases from 5 million in 1990 to 2.5 million (approximately 7000 per day) in 2018 (3). Despite the improvements, many countries in Asia and sub-Saharan Africa, including Nigeria, could not achieve the millennium development target of reduction by two-third in child mortality as of 2015 (3). The national demographic health survey of 2018 shows that Nigeria had an estimated neonatal mortality

rate of 39 deaths per 1000 live births only lower than the Central African Republic and Pakistan with a neonatal mortality rate of over 41.2 and 41.9/1000 live births, respectively (3,4).

Hospital-based case-controlled studies had previously implicated low-birth weight, lack of antenatal care, maternal illness, mother's age, prematurity, and perinatal asphyxia as the major aetiological agents in childhood mortality (5, 6). However, these investigations are limited since neonates delivered at home were not captured in these studies. Evidence from the Nigerian Demographic Health Survey showed that home delivery in Nigeria contributes significantly to the high neonatal mortality in the country (7). This study aimed to determine the causes and factors associated with neonatal mortality. Findings from the study would be useful for

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Please cite this paper as:

Komomo Ibor E, Joan J, Offiong I, Chigozie U. Predictors of Neonatal Mortality in a Tertiary Institution of a Developing Country. Iranian Journal of Neonatology. 2020 Dec; 11(4). DOI: [10.22038/ijn.2020.47649.1815](https://doi.org/10.22038/ijn.2020.47649.1815)

public health researchers and policymakers in reviewing and designing new community-based intervention strategies aimed at reducing neonatal mortality in Nigeria.

Methods

This 5-year-retrospective review was investigated the mortality records of all neonates (both in-born and out-born) admitted to the Newborn Unit of the University of Calabar Teaching Hospital (UCTH), Calabar, Nigeria, from 2013 to 2018. The obtained information included age at first presentation, duration of the illness before the presentation, place of delivery, place of the initial intervention, medication/ treatment given before the presentation, and social class of the parents using a socioeconomic classification tool as described by Oyedeji (8), which utilizes the mother's educational qualification and the father's occupation.

The clinical parameters, diagnosis, and duration of hospital stay followed by challenges encountered in the course of managing the children were also documented in this study. The obtained data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS software (version 26). A p-value less than 0.05 was considered statistically significant.

Results

In total, 3725 neonates presented within the period under review of which 216 cases died giving a neonatal mortality rate of approximately 60/1000 live births. Of the 216 non-survived neonates, 125 cases were male giving a male to female ratio of 1.4:1. A total number of 131 neonates (60.6%) were outborn of which 74 (34.2%) cases were delivered at other health facilities. The other newborns were delivered in non-health facilities, such as home (n=17, 7.9%), church (n=13, 6.0%), and Traditional Birth Attendance (TBA) (n=27m 12.5%). It is worth mentioning that 85 (39.4%) of the patients were inborn. Table 1 tabulates the relationship between the social class and the place of delivery. The majority of the patients in the study

Table 1. Place of delivery and social class of the neonates (n=216)

Place of delivery	Social class			Total
	High	Middle	Low	
Teaching hospital	12	40	33	85
Other hospital	10	29	35	74
Home delivery	0	2	15	17
Traditional Birth Attendance	1	2	24	27
Church	0	1	12	13
Total	23	74	119	216

F= 9.2, P< 0.05

(n=119, 55.1%) were from the low social class followed by the middle and high social classes. Out of 119 women from low social class, 68 mothers (57.1%) gave birth in hospitals, whereas 51 (42.9%) mothers gave birth in other places (i.e., home, churches, and TBAs). Furthermore, out of 23 mothers from the high social class, 22 (95.7%) women delivered in hospital, whereas one mother (4.3%) gave birth in other places. There is a significant relationship between place of birth and the social class with an F ratio of 9.2 and P<0.05.

The major causes of death were prematurity (n=86, 39.8%) followed by perinatal asphyxia (n=45, 20.8%), neonatal sepsis (n=37, 17.1%), and congenital malformation (n=34, 15.7%) (Table 2). The major contributory factors identified in 86 children who died from prematurity were intraventricular haemorrhage (n=31, 36%), respiratory distress syndrome (n=17, 19.8%), hypothermia (n=8, 9.3%), and septicemia (n=4, 4.7%). Totally, 154 (71.3%), 36 (16.7%), and 13 (6%) patients presented within 24 h, 72 h, and after one week of the onset of the illness, respectively; moreover, 171 (79.2%) patients had neither presented to any facility nor received any form of medication before presentation in our facility. It should be noted that 21 (9.7%) neonates received syrups and injections either from patent medicine stores or health workers in the neighborhood and 11 (5.1%) newborns had herbal concoctions; however, 13 (6.0%) cases sought for help from faith base organization before the presentation.

There is no significant relationship between the type of intervention before the presentation and the social class ($X^2=10.9$, $P>0.05$). A total number of 155 (71.8%) neonatal deaths occurred within the first week of life, whereas 61 (28.2%) cases died after seven days of life. Of the early neonatal deaths (deaths within 7 days of life), 25 (11.6%) neonates died within 24 h of life. Moreover, of the babies that died within 24 h, 13 (52%), 5 (20%), 5 (20%), and 2 (8%) neonates died due to severe birth asphyxia, neonatal

Table 2. Causes of neonatal death in Calabar, Nigeria

Cause of death	Frequency	Percentages
Prematurity	86	39.8
Perinatal asphyxia	45	20.8
Neonatal sepsis	37	17.1
Neonatal hyperbilirubinaemia	5	2.3
Congenital malformation	34	15.7
Neonatal tetanus	4	1.9
Aspiration pneumonia	3	1.4
Congenital pneumonia	2	0.9
Total	216	100

septicemia with chorioamnionitis, extreme preterm low birth with respiratory distress syndrome, and cyanotic congenital heart disease, respectively.

Discussion

This study showed that the mortality rate amongst neonates admitted to our hospital was about 60 per 1000 live births. This rate is higher than that (39/1000 live births) obtained by the Nigerian demographic health survey in 2018 (4). In addition, the mortality rate was significantly higher than that (24.4/1000 live births) obtained in a study conducted by Asindi et al.(9) during 1988 in the same center, which implies that no significant progress has been made over the years in reducing neonatal death in the center. This apparent high rate may be attributable to the fact that these neonates, in most cases, come in very bad condition and they are often transferred from long distances to our facility in public vehicles with high risk of hypothermia and exposure to infection, thereby increasing the risk of dying. It is worth mentioning that the UCTH is a reference centre admitted neonates from all over the state and its environs.

The lack of equipment, such as incubators for managing low-birth-weight babies, poor power supply to keep the few incubators functioning necessary for preterm survival, and irregular water supply are all contributory factors. However, it is worth mentioning that the study period predates the recent improvement in the facilities in our newborn units, and it is expected that future studies will give a much lower neonatal mortality rate. The mortality rate in this study and Nigeria in general are unacceptably high, compared to that in the developed countries (e.g., the USA, Canada, and Russia) with a rate of 2.5-3.5 per 1000 live births (3). This has been the trend for many years despite the great support of the millennium development goals over the past 10 years. It is hoped that with the recent millennium sustainable goals, the Nigerian Every New Born Action Plan (10), and an initiative of the Federal Ministry of Health, Nigeria, the newborn death will be decimated and neonatal survival will improve, thereby closing the existing gap between Nigeria and the developed countries of the world.

The study revealed that prematurity, perinatal asphyxia, and neonatal septicaemia are the major causes of neonatal death in the UCTH during the period under review which is similar to the findings obtained in other studies conducted in sub-Saharan Africa (3). It is worthy of note that

over two decades ago, these causes were identified as major causes of death in new-borns. Therefore, it is a matter of great concern that what killed our neonates two decades ago is still claiming their lives and it calls to question the efficacy of our strategies to reduce neonatal mortality due to these factors. Furthermore, it calls the need for changing our strategies in curbing newborn death during the 21st century in the developing countries.

Globally, prematurity is the leading cause of death in children under the age of 5 years, and it is estimated that one million deaths occur each year due to complications of prematurity (11). Our study is in tandem with the global findings as prematurity was responsible for over a third of newborn deaths. The major contributory factors to death amongst preterm were intraventricular haemorrhage, hypothermia, respiratory distress syndrome, and infections. Previous studies have shown that the administration of antenatal steroids at 34 weeks of gestation to pregnant women with threatened preterm delivery can prevent neonatal respiratory morbidity and mortality by accelerating foetal lung maturation. In this study, none of the mothers who had preterm deliveries received antenatal corticosteroids (12, 13). This may explain in parts the high mortality rates among preterm babies.

Studies performed in Uganda (14) and Rwanda (15) identified delays in accessing appropriate care as a major contributory factor to neonatal mortality. In these studies, over two-thirds of our patients presented within 24 h of the onset of illness. However, those who presented late gave a lack of money and transportation, as well as a long distance from the place of residence to the hospital as the reasons for a delayed presentation. The study also showed that certain inappropriate interventions, such as syrups obtained from patent medicine stores, injections from quacks who know little or nothing about newborn care, and herbal concoctions from TBAs can lead to delay in accessing appropriate medical care, thereby contributing to mortality.

Studies have shown that delivery in places, such as homes; where there is no effective supervision contribute to neonatal mortality (16, 17). This is because such places are often ill-equipped with deplorable hygienic conditions and facilities for resuscitation, thereby exposing the newborns to perinatal asphyxia, infections, and hypothermia, which are major risk factors for neonatal death.

In this study, about a third of the deaths occur

in neonates who were delivered in places where there was little or no supervision (i.e., homes, churches, and TBA). Our study also revealed that women from a low social class are more likely to deliver at home or places where there is no supervision. This implies that a low level of maternal education and poverty may be the major reasons why women deliver at home and other places where they are unlikely to be assisted by trained or skilled health care workers.

A study by the Nigerian population commission in conjunction with the Nigerian demographic health survey in 2018 showed that the educational status of the mothers correlated highly with whether their delivery is assisted by a skilled provider and the place of delivery. The study further revealed that only 16% of the mothers with no form of education had their deliveries assisted by skilled providers; however, 14% of the women in this group delivered in a health facility. On the other hand, 92% and 88% of the mothers with secondary level of education or above had their deliveries assisted by skilled providers and delivered in a health facility, respectively (4).

The results of the aforementioned study also indicated that early neonatal death (death within the first week of life) accounted for over two-thirds of the mortalities. The finding of the present study is in line with the result of the study conducted by Lehtonen et al., which shows that despite the significant reduction in childhood mortality, reduction of early neonatal death has significantly lagged behind other MDGs achievements, and is a growing contributor to the overall under five-year mortality (18).

The causes of early neonatal death are closely related to the level of a country's industrialization. Many factors responsible for early neonatal death in low-income countries are preventable with relatively easy and cost-effective interventions. These strategies include contraception, vaccination of pregnant women, hygienic delivery in hospitals, training of healthcare workers in resuscitation practices, simplified algorithms allowing for early detection of perinatal infections, and early initiation of breastfeeding and skin-to-skin care (18).

Conclusion

The neonatal mortality rate was high during the study period. Major contributors to neonatal deaths include prematurity, perinatal asphyxia, and infections. Low social class and unsupervised pregnancies and deliveries were also identified risk factors for neonatal deaths. Therefore, it is recommended to improve the facilities for

newborn care, such as incubators, constant power, and water supply. Moreover, the use of kangaroo mother care for neonates who are preterm but well and the administration of antenatal steroids in rural areas to the mothers between 24 to 34 weeks of gestation with threatened preterms can improve their survival; moreover, it provides the poor class with incentives for hospital delivery in rural areas.

Acknowledgments

We acknowledge the cooperation of the records clerks of the University of Calabar Teaching Hospital in sorting and pulling out the case notes of the patients used for the study.

Conflicts of interest

The author declares no conflict of interest.

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