Original Article

A 6-year review of neonatal emergencies and outcome in a secondary health-care centre in Benin City, Nigeria

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Abstract

Background: An important indicator of quality health care is neonatal outcome. Few published data are available concerning neonatal emergencies and their outcome from secondary health centres, where a large number of newborns are seen.

Aim: To evaluate the neonatal emergencies, their outcome and case fatality rates (CFRs) as well as the trend of annual mortality rate in the neonatal unit (NNU) of a secondary health facility.

Methods: This retrospective study which covered a period of six years (July 2008 – June 2014) was carried out at Stella Obasanjo Hospital (SOH), a state-owned general hospital in Benin City, Edo State, Nigeria. It involved the extraction of information on patient's age, sex, diagnosis, duration of hospital stay and outcome from the medical records of the neonatal unit.

Results: There were 2,302 newborns admitted; out of which 1,283 (55.7%) were males, while 1,019 (44.3%) were females; male: female ratio of 1.3:1. The major emergencies were neonatal sepsis [NNS] (61.9%), severe birth asphyxia [SBA] (40.9%), neonatal jaundice [NNJ] (24.5%) and prematurity (16.4%) occurring singly or in various combinations. Mortality rate was 12.8% with major contributions from NNS, SBA and prematurity. Majority (93.6%) of the deaths occurred in the first week of life. Extremely low birth weight (ELBW) babies, neonatal tetanus (NNT) and meconium aspiration syndrome (MAS) had the highest CFRs of 52.6%, 38.7%, and 23.5%, respectively. There was a downward trend in the annual mortality rates. Significant predictors of mortality were NNJ ($p=0.000$), SBA ($p=0.002$), NNT ($p=0.000$), MAS ($p=0.002$), prematurity ($p=0.000$) and ELBW ($p=0.000$).

Conclusion: The emergencies noted among the newborns were mainly from preventable causes. These were also the main causes of mortality. To improve our health indices, we must educate mothers at the community level on common neonatal emergencies and proven preventive measures, while strengthening our obstetric and perinatal care services.

Keywords: Benin City, neonatal emergencies, outcome, secondary health care

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INTRODUCTION

The neonatal period is the most vulnerable period of child survival as newborns are susceptible to various diseases. Neonatal emergencies contribute significantly to infant and under-five mortality rate globally.[1,2] Every year, worldwide, about 2.7 million babies die within the first 28 days of life[3] with most of them occurring in the 1st week of life.[4] Most of these neonatal deaths occur in low-income and middle-income countries due to their low-socioeconomic state and underdeveloped health-care services. Apart from the rudimentary quality of health care available in several areas of the country, most deliveries take place in unorthodox facilities and newborns only get to the hospital after irreparable damage may have occurred.[5,6] Other factors that may contribute to the unacceptably high morbidity and mortality statistics of neonates in Nigeria may include lack of antenatal care, low maternal educational level, poor health-seeking behaviour, harmful cultural practices and poverty.[7-9] Bearing in mind that the management of neonatal morbidity is expensive, it is clear that Nigeria is confronted with enormous challenges even in the health-care centres where equipment, workforce and other resources are available for the care of the newborn. Two-thirds of all neonatal mortality is reported from 12 countries, six of which are in sub-Saharan Africa.[10] The countries which contribute to more than half (53%) of overall neonatal deaths are India, Nigeria, Pakistan, China and Democratic Republic of the Congo.[11] Furthermore, newborn deaths account for 44% of under-five deaths worldwide. This implies that newborn mortality requires greater attention if the reduction of the overall under-five mortality is to be achieved.[10] The neonatal mortality rate (NMR) in Nigeria is unacceptably high with a current estimation of 40/1000 live births.[12]

High technology facilities such as incubators and ventilators are largely unavailable in developing countries like Nigeria, whereas in the developed world, advances in neonatal care have resulted in the improved outcome of low-birth weight (LBW) and preterm babies.[13,14] In Nigeria, there are still deficiencies as monitoring care is hampered not only by the lack of equipment such as infant monitors, pulse oximeters and arterial blood gas monitors but also by the paucity of power to run the equipment effectively where they are available. In developing countries, newborns die from several causes which are largely preventable such as infections, birth asphyxia and prematurity;[15] unlike in the developed world where mortality is mainly due to unpreventable causes like congenital abnormalities.[15]

The neonatal outcome is an important indicator of accessibility, utilisation and efficiency of obstetrics and neonatal health care in the community.[16] There is a call to end preventable newborn deaths by the WHO Every Newborn Action Plan.[10] According to the plan, all countries should target NMR of 10 or less newborn deaths/1000 live births by 2035 and continue to reduce death and disability, ensuring that every newborn benefits.[10] The review of neonatal outcome (hospital-based), as well as the trend of the annual mortality rate, is essential to improve the worth of health-care delivery system in the hospital concerned and other centres as well. More so, there is a paucity of data regarding neonatal outcome from secondary health-care centres like ours; where a large number of these newborns are seen.

SUBJECTS AND METHODS

This retrospective and descriptive study was carried out at the Stella Obasanjo Hospital (SOH), Benin City; a secondary health-care centre with a 20-bed neonatal unit (NNU), between July 2008 and June 2014. The NNU is divided into two sections, the in-born and out-born, each having 10 beds. The mothers are permitted free access into the unit to ensure adequate breastfeeding. Available facilities for neonatal care include incubators, phototherapy units and resuscitation equipment such as suction machines, ambu bags and oxygen therapy units. Mechanical ventilatory support and total parenteral nutrition are currently unavailable. The unit is run by two consultant paediatricians, two medical officers, four house officers and eight nurses. The institution has a laboratory that is manned by qualified laboratory scientists, runs for 24 h daily and caters for routine tests such as packed cell volume, random blood sugar, as well as blood banking services. Some tests, however, are not done after working hours due to shortage of workforce, for example, serum electrolytes/urea, full blood count, cerebrospinal fluid biochemistry and microscopy/culture/sensitivity. Even then, laboratory tests are hardly paid for by parents who are mostly indigent. Thus, laboratory and radiologic support of diagnosis were largely inaccessible due to financial constraints. Services in the hospital are largely out-of-pocket payments.

The medical records of all newborns admitted into the unit were reviewed. Data extracted from the records included age at admission, sex, duration of stay in the unit, diagnosis at time of admission, and outcome. The neonatal emergencies were categorised by using the mnemonic 'THE MISFITS' which represents Trauma, Heart disease/hypoxia/hypovolaemia, Endocrine

(congenital adrenal hyperplasia, thyrotoxicosis), Metabolic (electrolyte imbalance), inborn errors of metabolism, Sepsis (meningitis pneumonia, urinary tract infection), formula mishaps (under-or-over dilution), intestinal catastrophes (volvulus, intussusception, necrotising enterocolitis), toxins/poisons and seizures.[17] The unit protocol for the diagnosis of neonatal sepsis (NNS) is the presence of risk factors and abnormal full blood count in a symptomatic infant[18,19] while that for the diagnosis of birth asphyxia is based on APGAR score of ≤3 at the 5th min plus abnormal neurologic features.[20] Hypoglycaemia was defined as blood glucose of <50 mg/dl.[21] A newborn was said to have normal birth weight (NBW) when his birth weight ranges between 2500 and 3999 g. Newborns with LBWs were those with birth weights <2500 g with the smallest subgroup in this category being those with extremely LBW (ELBW); having a birth weight of <1000 g.[22] Macrosomic babies, on the other hand, was one with birth weight ≥4000 g. Outcome refers to discharged, discharged against medical advice and death. Ethical approval was obtained from the Ministry of Health, Edo State.

The data obtained was entered into the IBM Statistical Products and Servicing Systems (SPSS) IBM, Inc. 233 South Wacker Drive, 11th Floor, Chicago IL, USA) Version 20.0 spreadsheet and analysed. The results were cross-tabulated as frequency tables, means, standard deviations, percentages, and ranges were used as appropriate to describe continuous variables. Binary logistics regression model was used to identify morbidities that predicted mortality in the newborns. The value of $P < 0.05$ was considered statistically significant.

RESULTS

There were 2302 newborn admitted into the NNU during the study period. Among these, 1283 (55.7%) were males while 1019 (44.3%) were female, giving a male-to-female ratio of 1.3:1. The median age at presentation was 3.05 days. Majority (1,837 [79.8%]) of the newborns had NBW while the macrosomic babies were 61 (2.6%). The LBW babies were 404 (17.5%) with the preterm babies making up 16.4% of the total admissions.

Table 1: Major diagnoses during the study period

Diagnoses	Number of patients	Percentage of total admission
NNS	1425	61.9
SBA	942	40.9
NNJ	565	24.5
Prematurity	378	16.4
MAS	132	5.7
Macrosomia	61	2.6
Congenital anomalies	46	2.0
NNT	31	1.3
Hypoglycaemia	23	1.0
Intestinal catastrophes (intestinal obstruction, necrotising enterocolitis)	11	0.5
Trauma	10	0.4

NNS: Neonatal sepsis, SBA: Severe birth asphyxia, NNJ: Neonatal jaundice, MAS: Meconium aspiration syndrome, NNT: Neonatal tetanus

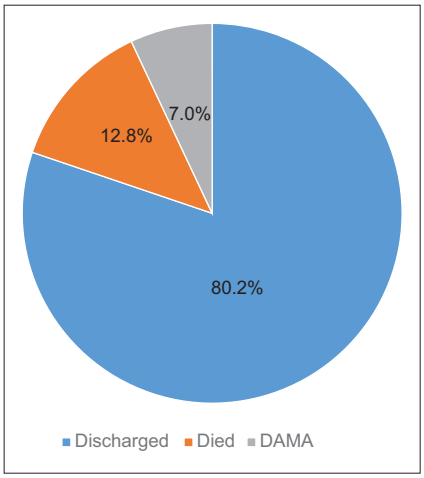

Figure 1: Outcome of admitted cases

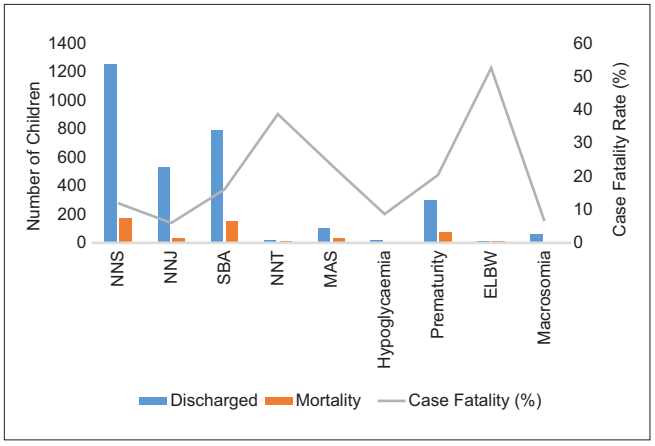

Figure 2: Case Fatality Rates of the common cases seen at the neonatal unit of the Hospital. (NNS: Neonatal sepsis, NNJ: Neonatal jaundice, SBA: Severe birth asphyxia, NNT: Neonatal tetanus, MAS: Meconium aspiration syndrome, ELBW: Extremely Low birth weight)

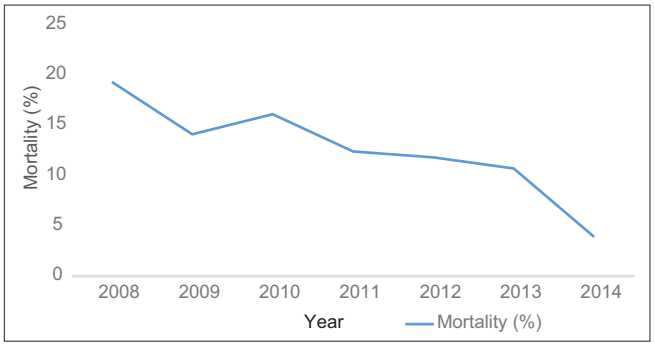

Figure 3: Trend of mortality rate in the neonatal unit of Stella Obasanjo hospital from July 2008 to June 2014

Table 2: Binary logistic regression models of determinants of outcome (discharged or mortality)

Parameters	Outcome		β	95% CI	OR	*P*
	Mortality (%)	Discharged (%)				
NNS	171 (12.0)	1254 (88.0)	−0.106	0.695-1.166	0.900	0.425
NNJ	34 (6.0)	530 (94.0)	−0.768	0.312-0.690	0.464	0.000*
SBA	152 (16.1)	790 (83.9)	0.427	1.168-2.011	1.533	0.002*
NNT	12 (38.7)	19 (61.3)	1.608	2.329-10.704	4.993	0.000*
MAS	31 (23.5)	101 (76.5)	0.705	1.300-3.149	2.023	0.002*
Hypoglycaemia	2 (8.7)	21 (91.3)	−0.718	0.097-2.460	0.488	0.385
Prematurity	77 (20.4)	301 (79.6)	0.698	1.468-2.751	2.010	0.000*
ELBW	10 (52.6)	9 (47.4)	1.883	2.524-17.133	6.576	0.000*
Macrosomia	4 (6.6)	57 (93.4)	−0.585	0.199-1.562	0.557	0.266

NNS: Neonatal sepsis, SBA: Severe birth asphyxia, NNJ: Neonatal jaundice, MAS: Meconium aspiration syndrome, NNT: Neonatal tetanus, CI: Confidence interval, OR: Odds ratio, ELBW: Extremely low birth weight

The major diagnoses were NNS (1,425 [61.9%]), severe birth asphyxia (SBA) (942 [40.9%]), neonatal jaundice (NNJ) (565 [24.5%]), prematurity (378 [16.4%]) and meconium aspiration syndrome (MAS) (132 [5.7%]); occurring singly or in various combinations [Table 1]. Neonatal tetanus (NNT) contributed 31 (1.3%) to the total admissions [Table 1]. Other cases include congenital anomalies and trauma [Table 1].

Mortality rate was 12.8% [Figure 1] with major contributions from NNS, SBA, and prematurity [Table 2]. Among the newborns that died, 170 (57.6%) were male while 125 (42.4%) were female. Majority [276 (93.6%)] of the deaths occurred in the 1st week of life. ELBW, NNT, and MAS had the highest CFRs of 52.6%, 38.7% and 23.5%, respectively [Figure 2]. These were followed by prematurity (20.4%), SBA (16.1%) and NNS (12%) [Figure 2]. There was a downwards trend in the mortality rate in the unit over the 6-year period with the rate remaining fairly stable between 2011 and 2013 before a further drop in 2014 as shown in Figure 3.

The significant predictors of mortality in the study include NNJ (odds ratio [OR] = 0.464; 95% Confidence interval [CI] [0.312–0.690], *P* = 0.000), SBA (OR = 1.533; 95% CI [1.168–2.011], *P* = 0.002), NNT (OR = 4.993; 95% CI (2.329–10.704), *P* = 0.000), MAS (OR = 2.023; 95% CI [1.300–3.149], *P* = 0.002), prematurity (OR = 2.010; 95% CI [1.468–2.751], *P* = 0.000), and ELBW (OR = 6.576; 95% CI [2.524–17.133], *P* = 0.000) [Table 2]. While there is six and half times likelihood of mortality in ELBW newborns, NNT has five times likelihood of mortality [Table 2]. Prematurity and MAS both have two times while SBA has one and a half times likelihood of mortality [Table 2].

DISCUSSION

The current study revealed that preventable emergencies such as NNS, SBA, neonatal jaundice, and prematurity were the major reasons for admission. This finding agrees with those from various other studies in Nigeria.[23-26] These emergencies are recognised by bodies like the World Health Organisation as the major causes of neonatal morbidity and mortality either in combination with other causes or singly.[10] The fact that NNS, severe asphyxia and prematurity were the major causes of death in the current study reiterates the need to make sure that deliveries be preferably carried out in certified health institutions with equipped facilities and manpower to adequately resuscitate newborns. Furthermore, NNT, an emergency which ought to have been eliminated as far back as the year 2000, still contributes to neonatal morbidity and mortality in our study locale as has been reported by similar studies in Nigeria.[24,27,28] Its persistence may be due to the very low rate of antenatal clinic attendance among pregnant women, delivery outside the hospital setting, low immunisation coverage and ignorance resulting in poor care of umbilical cord stump.[29-31] However, unlike in our setting, Ekwochi *et al.*[25] in Enugu, Nigeria reported that NNT was not a common cause of admission in their centre. They attributed this finding to higher uptake of tetanus toxoids by mothers during pregnancy in Enugu compared to those in other Southern parts of Nigeria.[25] All efforts must, therefore, be put in place to ensure reduction of newborn morbidity and deaths resulting from the aforementioned avoidable conditions.

The mortality rate (12.8%) noted in the present study is less than that documented by Ekwochi *et al.* (14.2%)[25] in Enugu, as well as by Omoigberale *et al.* (20.3%) at the University of Benin Teaching Hospital (UBTH) in the same city as the present study.[24] The higher mortality rate seen in UBTH may be as a result of the fact that as a tertiary referral centre, it may receive several moribund cases that may be difficult to salvage. In general, the high mortality rates seen in developing countries may be due to several reasons such as low socioeconomic status, poor health-seeking behaviors, the suboptimal national budget for health matters, inadequate facilities and workforce, especially in

rural areas.[26] The death rate of the current study is similar to that recorded by Okechukwu and Achonwa[23] in the Special Care Baby Unit (SCBU) of University of Abuja Teaching Hospital, Nigeria (13.3%) while that observed by Abiodun and Oluwafemi[26] in Ondo State (7.4%) was less than our finding and those of the other workers[24,25] earlier mentioned. Although Abiodun and Oluwafemi[26] stated that the rate they found might be lower because other authors had higher proportions of preterm neonates in their series, we opine that the cost-free health-care programme which they run may have contributed. The NMR of 12.6% in Douala, Cameroon[32] is similar to the present finding; with the main causes of neonatal mortality being prematurity, neonatal infection and birth asphyxia. In the work of Rakholia *et al*.[33] in Uttarakhand, India, the NMR was 20.53% which is higher than the current finding. While CFRs were highest in ELBW babies and those with NNT in this survey, hypoglycaemia and hypothermia had the highest CFRs in the study by Abiodun and Oluwafemi in Ondo State.[26]

The downward trend in the mortality rate noted in the current study is similar to that documented by Oladokun *et al*.[34] in University College Hospital (UCH), Ibadan. The downward trend in mortality noticed in the present study may have been as a result of an increase in workforce and material resources. At the beginning of the study period, only a Consultant Paediatrician was available, and he was the Medical Director who was laden with administrative duties. However, during the study period, another Consultant Paediatrician was employed alongside medical officers. More equipment such as phototherapy lamps and incubators were purchased which further helped in the management of the newborns. Although there was a downward trend in the mortality rate for the SCBU of UCH over the 10-year period of 1991–2000, the range was higher than that documented in a previous study[35] from the same centre. The authors attributed this lack of improvement in the annual NMR to poor funding of the health sector resulting in inadequate staffing and non-provision/non-functioning of equipment needed for monitoring and nursing high-risk neonates.[34] Since the current study is the first in the NNU of SOH, it will serve as a baseline for future comparison and assessment.

The LBW rate of the present study is less than the rates recorded by Omoigberale *et al*. (27.8%)[24] and Ekwochi *et al*. (24.5%)[25] probably because they are major referral/tertiary centres with better gadgets and facilities to tackle the problems of preterm babies in their localities. Neonatal jaundice, SBA, MAS, NNT, prematurity and extreme LBW (ELBW) were significant predictors of mortality in the current study. LBW and a higher risk of mortality have been recorded by other authors.[34] Low socioeconomic status, poor maternal nutrition, inadequate antenatal care, the high prevalence of infections[34] are contributors to the delivery of LBW infants especially in developing countries like Nigeria. There is, therefore, need to intensify health education of the populace on pregnancy care, safe childbirth and newborn care. In addition, available and affordable measures like the use of hot water bottles and Kangaroo mother care (KMC) can be employed in place of unavailable incubators; if we must make progress. KMC which although is not practiced in the centre, is however, useful for stable LBW babies.[36] Although the training of traditional birth attendants (TBAs) is controversial, one must realize that many mothers still deliver at their places.[37] TBAs should thus be trained to identify risk factors and ensure prompt referral of pregnant women. They must appreciate the purpose of clean delivery kits and hygienic cord care.[38,39] This would appreciably decrease the spread of nosocomial infections in the NNU.

In consonance with the finding of the present study, several other workers had documented the fact that majority of the neonatal deaths were within the first 7 days of life.[4,34,40] A combination of factors have been attributable to this including poor perinatal care, inadequate prevention of infections, inadequate monitoring and provision of warmth among others.[34] The health professional must, thus, pay particular attention to the 1st week of life. Investment in this critical period provides the greatest potential for ending preventable neonatal deaths.[10]

Taking action to address preventable newborn deaths is a task for all governments, civil society, donors, the private sector and other partners.[10] Protecting newborns implies making sure that their mothers are properly cared for during the antenatal, delivery and postnatal periods. Furthermore, the National Health Insurance Scheme should be strengthened to prevent out-of-pocket payment for health services. The out-of-pocket payment for health services is rampant in our setting, preventing adequate laboratory investigations of newborns to aid management as well as provision of appropriate medications when required.

Data obtained from the medical records was not encompassing as information such as socioeconomic status of parents was not documented. Our records also did not categorise the newborns into babies born within (inborn) and outside (out-born) our hospital facility. The authors were, thus, unable to compare morbidity and mortality between the two categories.

CONCLUSION

NNS, SBA and neonatal jaundice were the major emergencies in this series. These were also the main causes of mortality. The highest CFRs were among ELBW babies and those with NNT. There was a downwards trend of the annual mortality rate. The common neonatal emergencies noted were mainly from preventable causes. Thus, to decrease newborn deaths in our setting, there should be the education of mothers at the community level on common neonatal emergencies and proven preventive measures, while strengthening our obstetric and perinatal care services in the nation by for instance ensuring that health personnel are adequate and the necessary equipment available.

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Conflicts of interest
There are no conflicts of interest.

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