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Original Article

Morbidity Pattern, Mortality, and Its' Determinants among Inborn Neonates Admitted in Rivers State University Teaching Hospital

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Abstract

Background: The neonatal period is the most critical and vulnerable period of life. The survival of neonates does not only depend on the severity of the illness but also on the standard of care.

Purpose: The present study was carried out to determine the morbidity, mortality, and its' determinants among inborn neonates in the Rivers State University Teaching Hospital, Nigeria, as no study has been published in this regard.

Materials and Methods: It was a descriptive cross-sectional prospective study carried out from April 2019 to March 2020. Eligible inborn neonates admitted were consecutively recruited.

Results: Four hundred and sixty-eight neonates were admitted during the period of study. Males predominated 251 (53.6%) with a M:F ratio of 1.2:1. The most common clinical features were difficulty in breathing 208 (54.0%), yellow eyes 178 (46.2%), and fever 116 (30.1%). Probable sepsis 265 (58.9%), neonatal jaundice (NNJ) 229 (50.9%), prematurity 215 (47.8%), and hypoglycemia 101 (22.4%) were the most common morbidities observed. Three hundred and ninety-eight (85.0%) neonates were discharged home and 29 (6.2%) died. Difficulty in breathing, prematurity, hypoglycemia, birth asphyxia, severe anemia, and birth weight was significantly associated with mortality ($P < 0.05$). Males were about ×2 more likely to survive, while babies with normal Apgar scores were more than ×5 more likely to survive. Severe anemia 20.5%, birth asphyxia 13.0%, hypoglycemia 12.9%, seizure 12.0%, and difficulty in breathing 11.1% had the highest case fatality rates.

Conclusion: The most common morbidities among inborn neonates are probable sepsis, NNJ, and prematurity, with a mortality rate of 6.2%. Difficulty in breathing, prematurity, hypoglycemia, birth asphyxia, severe anemia, and birth weight is significantly associated with mortality. Improved obstetric and neonatal care is thus vital in the reduction of morbidity and mortality.

Key words: Inborn, Morbidity, Mortality, Neonates, Port Harcourt

INTRODUCTION

The neonatal period which represents the first 28 days after birth has been found to be the most vulnerable period of life.[1] World Health Organization estimates that of 130 million babies born yearly, about 4 million neonatal deaths occur, most (98%) occurring in developing countries.[2] Neonatal deaths account for about 2/3rd of infant mortality and 1/3rd of under-five mortalities worldwide.[3-5] It is important to note that a quarter to half of these deaths occurs in the 1st day of life and three quarter within the 1st week of life.[6] Ten countries, including Nigeria, constitute 75% of the world's neonatal deaths.[6]

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In spite of a global decline of the neonatal mortality rate, there is marked disparity across regions and countries.[6] Regionally, mortality is highest in sub-Saharan Africa (SSA) and South Asia, with estimated neonatal mortality rates of 27 and 25 deaths per 1000 live births, respectively, in 2019.[6] It is worthy of note that a child born in Sub-Saharan Africa is 10 times more likely to die in the neonatal period than a child born in developed countries, whereas a child born in South Asia is 9 times more likely to die.[6]

The neonatal mortality in Nigeria has shown a very slow reduction in the last decade, that is, from 38 per 1000

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live births in 2009 to 36 per 1000 live births in 2019.[7] There was only 1.5% reduction in the annual reduction of neonatal mortality rate between the years 2000 to 2018. The neonatal mortality rate also accounts for 31% of under-five mortalities.[8]

The morbidity pattern in neonates is a useful indicator of the availability, utilization, as well as effectiveness of maternal and child health services.[9] This pattern varies from place to place as well as overtime, even in the same location.[10] The survival of neonates does not only depend on the severity of illness but also on the standard of care provided.[11] High neonatal mortality rate, therefore, reflects poor health infrastructure and poor quality of care.

In developing countries, neonates die mainly from preventable causes such as infections, birth asphyxia, neonatal jaundice (NNJ), and prematurity, whereas in developed countries, mortality during this period is mainly due to unpreventable causes like congenital anomalies.[12]

The present study was, therefore, carried out in the special care baby unit (SCBU) of Rivers State University Teaching Hospital (RSUTH), Nigeria, to determine the neonatal morbidity pattern, mortality, and its' determinants as there is no published data in this regard. These neonatal morbidity and mortality rates, which are indicators of a country's socioeconomic status, will thus evaluate the efficiency and effectiveness of the health care system in Rivers State, Nigeria. This study will also generate baseline data for the formulation of policies in health care delivery.

MATERIALS AND METHODS

This hospital-based descriptive cross-sectional prospective study was carried out over a one-year period from April 2019 to March 2020 in the SCBU of the River State University Teaching Hospital. The RSUTH, a government-owned tertiary institution, is a 375-bedded hospital made up of the departments such as Paediatrics, Obstetrics and Gynaecology, Surgery, Internal medicine, Pathology, Radiology, Pharmacy, Physiotherapy, as well as Nursing departments. The pediatrics department consists of other specialties in addition to neonatology such as nephrology, endocrinology, infectious disease and immunology, hemoncology, pulmonology, cardiology, neurology and community, and social pediatrics. The hospital serves as a referral center for all the primary health centers in the 23 local government areas, general hospitals, and private-owned hospitals within the state and its environs. Patients are expected to pay out of pocket for services rendered except an insignificantly few number under the National Health Insurance Scheme (NHIS).

The SCBU is a 30-bedded unit, consists of an inborn and outborn section, and it is run by two consultant pediatricians, resident doctors with a nurse: Patient ratio of 6:1. The inborn section consists of 14 cots, seven functional incubators, a Resuscitaire/radiant warmer, and eight phototherapy machines, while the outborn section, which is much smaller, consists of six cots, a Resuscitaire/radiant warmer, three functional incubators, and four phototherapy machines. The unit also consists of two breastfeeding rooms for mothers of inborn and outborn babies, an office for the chief nursing officer, nursing relaxation room, and doctors call room. This unit does not provide intensive care services such as mechanical ventilation, total parenteral nutrition, and blood gas analysis, among others. Babies admitted into the inborn section are babies whose mothers had antenatal care (ANC) in RSUTH, Rivers state government-owned primary health care (PHC) centers, and general hospitals and delivery in any of these centers, whereas the outborn section admits all babies whose mothers did not undergo ANC in RSUTH, PHC or the government-owned general hospitals with/without delivery in RSUTH as well as babies from other health facilities in and around the state.

Ethical approval was sort from the RSUTH Health Research Ethics Committee and consent was obtained from parents/caregivers before recruitment into the study. Inclusion criteria were inborn babies whose parents gave consent while all outborn and inborn babies whose parents/caregivers did not give consent and brought in dead babies were excluded from the study.

A convenient sampling method was employed and babies admitted were consecutively recruited. All parents/caregivers of eligible babies admitted were meticulously clerked by a resident doctor, thoroughly examined, and diagnosis made clinically based on the protocol in the unit and where necessary with the support of laboratory and radiological findings. A pretested structured questionnaire was used to record information such as sex, age at presentation, birth weight, gestational age at birth, Apgar score at 1 and 5 min after birth, clinical features, mothers age, parity, mode of delivery, HIV status of mothers, and maternal level of education and occupation. Other information recorded was diagnosis made and outcome.

Diagnosis of probable sepsis was made for babies with suspected sepsis with a result of full blood count showing white blood cell count of the $>20 \times 10^9$/L or $<5 \times 10^9$/L or neutrophil count of >75% or <40%.[13] NNJ was diagnosed clinically with a serum bilirubin value greater than the normal on the nomogram for the baby's gestational age and weight. Birth asphyxia was diagnosed using Apgar score at 1 and 5 min and clinical manifestations. The

gestational age of the babies was calculated from the 1st day of the last menstrual period or ultrasonographic findings done in the 1st trimester of pregnancy. Hypoglycemia was defined as random blood sugar <2.6 mmol/L, while infants with birth weights ≥4.0 kg were defined as macrosomia regardless of their gestational age. Severe anemia requiring blood transfusion was defined as hematocrit level <31%. Prematurity was defined as liveborn neonates delivered before 37 completed weeks.

Sick babies were treated based on the unit's standard operation procedure. Babies were closely followed up until either discharged home, discharged against medical advice (DAMA), died, or referred to other centers for cases where desired services needed were unavailable in RSUTH.

Data were entered into a Microsoft Excel spreadsheet and thereafter analyzed using SPSS version 23. The results were presented in frequency tables, percentages, pie, and bar charts. Chi-square test of association and Fishers' exact test were carried out to determine if there were statistical significance in the association between outcome variables and the independent variables. Statistical significance was considered if $P < 0.05$ at 95% confidence interval. Forward regression was carried out to identify possible predictors of the outcome variable. Odds ratio and confidence intervals were generated which aided in describing the strength of the associations established between the outcomes and predictor variables.

RESULTS

Characteristics of Neonates Admitted

Four hundred and sixty-eight babies were admitted during the period of study. There were 251 (53.6%) males and 217 (46.4%) females with M:F ratio of 1.2:1. The majority, 447 (95.5%), presented within 24 h of life and were of 1st birth order 198 (42.3%). Most were of the gestational age of 37–42 weeks, 250 (53.4%) with a mean of 36.54 ± 3.56 weeks, while birth weights of 2.5–3.99 kg were most common 222 (37.2%) with mean of 2.81 ± 0.97 kg, Table 1.

Maternal Sociodemographic Factors

Most of the mothers were of age group 27–36 years 323 (69.0%) with a mean of 31.80 ± 5.37 years, multiparous 296 (63.7%), and had ANC in RSUTH 284 (60.7%). Four hundred and nineteen (89.5%) mothers had singleton gestation {419 (89.5%)}, with the predominant mode of the delivery being Caesarean section 356 (76.1%). Of 49 multiple gestations, 34 (69.4%) were twin, 12 (24.5%) triplet, and 3 (6.1%) were quadruplets. Majority of the mothers had tertiary education 244 (52.2%) and were mainly traders/artisans 197 (42.1%), Table 2.

Clinical Features of Neonates Admitted

The most common clinical features of neonates admitted in the SCBU were difficulty in breathing 208 (54.0%), yellow eyes 178 (46.2%), and fever 116 (30.1%), Figure 1.

Morbidity Pattern of Neonates Admitted

The most common morbidities in neonates admitted were probable sepsis 265 (58.9%), NNJ 229 (50.9%), prematurity

Table 1: Characteristics of neonates admitted

Variables	Frequency, *n*=468(%)
Sex	
Male	251 (53.6)
Female	217 (46.4)
Age at presentation (hours)	
≤24	447 (95.5)
>24	21 (4.5)
Birth order	
1st	198 (42.3)
2nd	126 (26.9)
3rd	73 (15.6)
≥4th	71 (15.2)
Gestational age (weeks)	
<37	215 (46.0)
37–42	250 (53.4)
>42	3 (0.6)
Birth weight (kg)	
<2.5	174 (37.2)
2.5–3.99	222 (47.4)
≥4.0	72 (15.4)

Table 2: Maternal sociodemographic factors

Variables	Frequency, *n*=468 (%)
Mother's age	
17–26	66 (14.1)
27–36	323 (69.0)
>36	79 (16.9)
Parity	
Primiparous	172 (36.8)
Multiparous	296 (63.2)
Place of ANC	
RSUTH	284 (60.7)
PHC	184 (39.3)
Type of pregnancy	
Singleton	419 (89.5)
Multiple	49 (10.5)
Mode of delivery	
SVD	112 (23.9)
CS	356 (76.1)
Mother's level of education	
No formal education	6 (1.3)
Primary	25 (5.3)
Secondary	193 (41.2)
Tertiary	244 (52.2)
Mother's occupation	
Civil/public servant	123 (26.3)
Traders/artisans	197 (42.1)
Professionals	30 (6.4)
Unemployed	118 (25.2)

ANC: Antenatal care, RSUTH: Rivers State University Teaching Hospital, PHC: Primary Health Care, SVD: Spontaneous vertex delivery, CS: Caesarean section

215 (47.8%), and hypoglycemia 101 (22.4%), while the least common was meningitis 7 (1.6%), Figure 2.

Outcome of Neonates

Of 468 neonates admitted into the SCBU, 398 (85.0%) were discharged home while 29 (6.2%) died. Thirty-three (7.1%) were DAMA and 8 (1.7%) were referred to other health facilities. Reasons given by parents/caregivers for discharging their babies against medical advice were financial constraint 20 (60.6%), tired of the hospital environment 5 (15.2%), father's decision 4 (12.1%), and no reason given 4 (12.1%), Figure 3.

Determinants of Mortality among Neonates Admitted

The determinants of mortality in inborn neonates admitted were difficulty in breathing, prematurity, hypoglycemia, birth asphyxia, severe anemia, and birth weight ($P < 0.05$), Table 3.

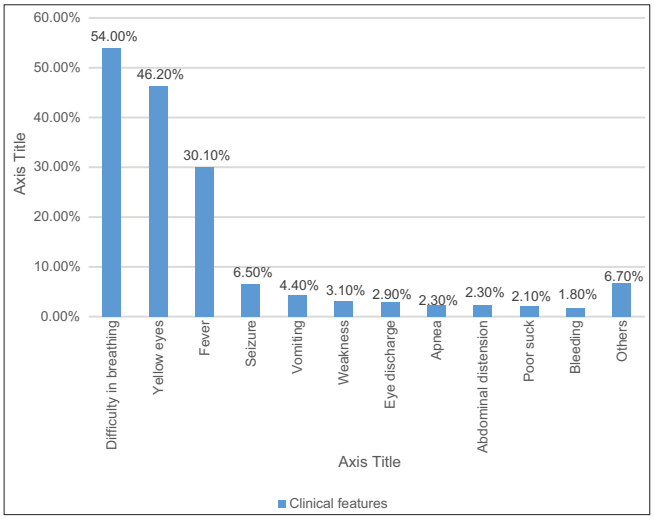

Figure 1: Clinical features of neonates admitted

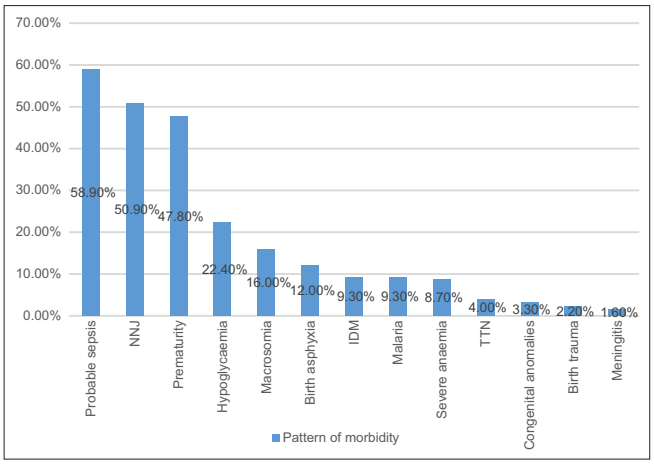

Figure 2: Morbidity pattern of neonates admitted. IDM: Infant of diabetic mothers, TTN: Transient tachypnea of the newborn

Factors Associated with Outcome among Neonates Admitted

Males were close to ×2 more likely to survive than the females, while babies with normal Apgar scores were more than ×5 more likely to survive than those with low Apgar scores. Gestational age, temperature at presentation, mode of delivery, and birth weight were significantly associated with mortality ($P < 0.05$), Table 4.

Case Fatality Rates (CFR) of Clinical Features and Morbidities

The CFR was highest in neonates with severe anemia, 20.5% followed by birth asphyxia 13.0%, hypoglycemia 12.9%, seizure 12.0%, and difficulty in breathing 11.1%.

Table 3: Determinants of mortality among neonates admitted

Variables	Mortality		*P*-value
	No {*n*=439(%)}	Yes {*n*=29(%)}	
Clinical features			
Difficulty in breathing	185 (42.2)	23 (79.3)	<0.0001*
Yellowness of the eyes	165 (37.6)	13 (44.8)	0.437
Fever	112 (25.5)	4 (13.8)	0.187
Seizure	22 (5.0)	3 (10.3)	0.196
Weakness	10 (2.3)	2 (6.9)	0.166
Morbidities			
Probable sepsis	250 (56.9)	15 (51.7)	0.699
NNJ	217 (49.4)	12 (41.4)	0.401
Prematurity	146 (33.3)	20 (69.0)	<0.0001*
Hypoglycemia	88 (20.0)	13 (44.8)	0.002*
Macrosomia	56 (12.8)	2 (6.9)	0.560
Birth asphyxia	47 (10.7)	7 (24.1)	0.028*
Malaria	41 (9.3)	1 (3.4)	0.500
Severe anemia	31 (7.1)	8 (27.6)	0.0001*
Congenital abnormalities	14 (3.2)	1 (3.4)	1.000
Birth trauma	9 (2.1)	1 (3.4)	0.476
Meningitis	5 (1.1)	2 (6.9)	0.064
Birth weight (kg)			
<2.5	149 (33.9)	25 (86.2)	
2.5–3.99	220 (50.1)	2 (6.9)	<0.0001*
≥4.0	70 (15.9)	2 (6.9)	

*Statistically significant

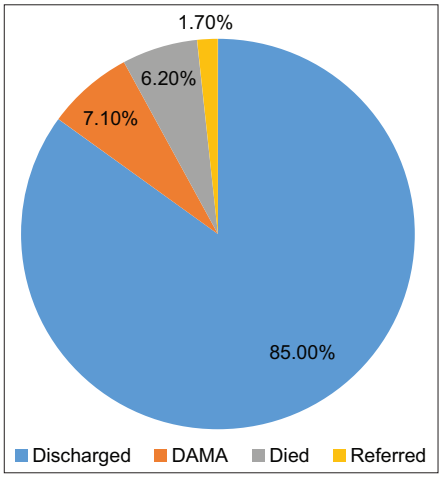

Figure 3: Outcome of neonates

Table 4: Factors associated with outcome among neonates admitted

Variables	Mortality		*P*-value	OR (95% CI)
	No {*n*=439(%)}	Yes {*n*=29(%)}		
Sex				
Male	241 (54.9)	10 (34.5)	0.033	1.8 (0.70–4.39)
Female	198 (45.1)	19 (65.5)	-	-
Gestational age (weeks)				
<37	189 (43.1)	26 (89.7)		
37–42	247 (56.3)	3 (10.3)	<0.0001	
>42	3 (0.7)	0 (0.0)		
Apgar score				
≥7	390 (88.8)	20 (69.0)	0.015	5.3(1.39–19.95)
0–3	24 (5.5)	4 (13.8)	0.963	1.0(0.15–6.16)
4–6	25 (5.7)	5 (17.2)	-	-
Temp at presentation (°C)				
<36	196 (44.0)	25 (86.2)	0.018	0.2(0.07–0.78)
≥36	246 (56.0)	4 (13.8)	-	-
Mode of delivery				
SVD	95 (21.6)	17 (58.6)	0.002	0.3(0.05–1.66)
CS	344 (78.4)	12 (41.4)	-	-
Maternal HIV status				
Positive	15 (3.4)	3 (10.3)	0.093	
Negative	424 (96.6)	26 (89.7)		
Pregnancy complications				
Yes	240 (54.7)	21 (72.4)	0.062	0.062(0.23–1.68)
No	199 (45.3)	8 (27.6)	-	-
Birth weight (kg)				
<2.5	149 (33.9)	25 (86.2)	0.018	0.2(0.04–0.74)
2.5–3.99	220 (50.1)	2 (6.9)	0.257	3.1(0.44–22.73)

The least CFR was observed in neonates with macrosomia 2.8% and malaria 2.4%, Table 5.

DISCUSSION

Evaluating the morbidity pattern and mortality in neonatal units is integral in measuring the quality of health care services rendered and as such identifies deficiencies in the system. This would provide a framework on which interventions are designed to improve the outcome of newborns.

In the present study, there was a male preponderance in the ratio of 1.2:1. Similar findings were observed in all other studies in Nigeria,[14-20] Pakistan,[21] Ghana,[22] India,[23-25] and Bangladesh.[26] This observation is not surprising as gender has been found to be a significant predictor of health and development in children with boys showing greater vulnerability.[27] It has also been observed that the male gender is more likely to be born premature and tends to have more neonatal complications.[28]

More term babies were admitted into the SCBU in the present study as also observed in some Indian studies.[23,24] This was, however, at variance with the study in Ghana[22] and Bangladesh[26] were preterm babies dominated. This difference could be due to the difference in geographic locations as well as varying disease pattern.

Table 5: Case fatality rates of clinical features and morbidities

Variable	Total	Mortality	CFR (%)
Difficulty in breathing	208	23	11.1
Fever	116	4	3.4
Seizure	25	3	12.0
Probable sepsis	265	15	5.7
NNJ	229	12	5.2
Prematurity	215	20	9.3
Hypoglycemia	101	13	12.9
Macrosomia	72	2	2.8
Birth asphyxia	54	7	13.0
Malaria	42	1	2.4
Severe anemia	39	8	20.5
Congenital abnormalities	15	1	6.7
Birth trauma	10	1	10.0

About three-quarters of neonates were delivered via Caesarean section. A similar finding was also documented by Hussain[21] in Pakistan. In contrast, Okechukwu and Achonwa[20] in Abuja Nigeria, Verma *et al.*,[23] Saini *et al.*[25] in India, and Tajkia *et al.*[26] in Bangladesh documented SVD as the predominant mode of delivery. This variance in the mode of delivery could be because of the different health facilities' standard operating procedures as well as varying pregnancy and fetal complications.

Probable sepsis was the most common morbidity observed in neonates admitted in the SCBU in the present study

followed by NNJ and prematurity. These three morbidities were the most common also reported in India.[24] In Jigawa state,[14,15] Jos[17] Nigeria, Pakistan,[21] and Bangladesh,[26] neonatal sepsis and prematurity were observed to be the most common morbidities. A previous study in Port Harcourt[29] carried out 5 years before the present study and in India,[25] neonatal sepsis, NNJ, and severe birth asphyxia were the most common morbidities documented, whereas in Delta state[19] in Nigeria and Ghana,[22] birth asphyxia and prematurity were the leading morbidities. In addition, NNJ, prematurity, and birth asphyxia were the most common morbidities observed in Zaria, Nigeria.[30] Interestingly, a study done in Calabar,[29] Nigeria, more than a decade earlier revealed birth asphyxia, neonatal tetanus, and sepsis as the most common morbidities. Another study done in Benin city,[31] Nigeria, also reported neonatal tetanus as one of the most common morbidities observed. Neonatal tetanus which was once common morbidity in Nigeria is very rare in recent times because of the gains of immunization and increased awareness in the utilization of ANC services as well as increased hospital deliveries. This varying morbidity observed is not surprising as disease pattern varies from place to place and from time to time even in the same locality. It is pertinent to note that only inborn babies were recruited in the present study as opposed to all other studies cited where both inborn and outborn were considered as this could also contribute to the difference in the morbidity pattern. Regular auditing of neonatal units is thus advocated. This is critical in assessing the quality of care provided, identifies deficiencies in the system, and assists policymakers in effective planning.

The mortality rate of inborn neonates in the RSUTH of 6.2% was comparable with the 6.4% reported among inborn babies in Zaria,[18] Nigeria. It was, however, lower than the 8.93%, 9.73% documented in Ghana[22] and India,[24] respectively, but much lower than most other studies in Nigeria,[14-16,19,20,29,31,32] India,[23-25] and Pakistan.[21] It was, however, higher than the 3.9% documented in Bangladesh.[26] The lower mortality reported in the present study could be attributable to the fact that only the inborn babies were included, unlike all the other studies[14-16,19,20-25,29,31,32] where both inborn and outborn babies were studied. It is pertinent to note that studies carried out in Kano[18] and Benin city,[31] Nigeria showed that mortality in the inborn babies was significantly much lower than that of the outborn. This could be attributable to late presentation of sick babies to the hospital, lack of ANC, harmful traditional practices, and lack of skilled attendance among women delivered at home or by unqualified persons. The high mortality observed in the developing countries could be due to lack of manpower and poor infrastructural development as is the case with the present neonatal center which does not have neonatal intensive care units and unavailability of mechanical ventilators, parenteral nutrition, and blood gas analyzers, among other very important equipment important for neonatal care and survival.

Prematurity, probable sepsis, and NNJ were the leading causes of mortality among inborn neonates in Port Harcourt. Prematurity being the leading cause of death was also observed by Also and Gwarzo[14] in Jigawa state, Toma *et al*.[17] in Jos, Hussain[21] in Pakistan, Verma *et al*.,[23] Kotwal *et al*.,[24] and Saini *et al*.[25] in India. These findings were, however, at variance with the study by Abdullahi[15] in Jigawa state and Ekwochi *et al*.[16] in Enugu, Nigeria, who documented birth asphyxia as the most common cause of mortality, while Ugwu[19] in Delta state, Nigeria, documented neonatal sepsis as the most common cause. In addition, Tette *et al*.[22] in Ghana reported hypoglycemia as the most common cause of mortality. These differences could also be attributed to the varying geographic locations, maternal and fetal risk factors, and the availability of quality infrastructure and care. It is, however, worthy of note that the leading causes of death in these studies were preventable and as such the importance of improved obstetric care and neonatal care cannot be overemphasized.

Difficulty in breathing, prematurity, birth asphyxia, hypoglycemia, severe anemia, birth weight, as well as gestational age, temperature at presentation and mode of delivery were observed to be significantly associated with mortality. Thus, improved antenatal and obstetric care, early diagnosis as well as prompt and provision of standard neonatal care will reduce morbidity and mortality from these disease conditions.

Surprisingly, mortality was 2 times more in the female gender than the males in the present study. A similar finding of more mortality in female gender was also documented in India.[25] This was at variance with most other studies carried out in Jigawa state,[15] Enugu[16] and Jos[17] Nigeria, where the mortality rate was higher in males, although they were not statistically significant. The reason for this difference could not be ascertained.

Neonates with normal Apgar score were more than 5 times more likely to survive than those with a low Apgar score in the present study. This is not surprising as birth asphyxia was observed in the present study to be significantly associated with mortality and documented by Abdullahi[15] to have the highest CFR in Jigawa state in Nigeria. Improvement in the obstetric care and standardized neonatal care with a well-equipped neonatal care unit will reduce the occurrence as well as the survival of asphyxiated babies.

Eighty-five percent of neonates admitted were discharged home in the present study. This was comparable with the

84.9% and 86.0% reported in Jigawa state[14] and Zaria,[30] Nigeria, respectively. It was, however, higher than the 70.0%, 77.0%, 78.5%, 78.9%, and 78.6% in India,[23] Jigawa,[15] Abuja,[20] Kano[18] Nigeria, and Bangladesh,[26] respectively, but lower than the 90.07% documented in Jammu and Kashmir in India.[24] These different rates could be attributable to the difference in the quality of care provided.

The DAMA in the present study of 7.1% is comparable with the 6.0% and 5.3% reported in Jigawa state,[15] Nigeria, but higher than 3.2%, 1.5%, and 0.2% reported in Kano,[18] Jigawa[14] Nigeria and India.[24] DAMA is usually as a result of poverty and ignorance as observed in the present study where close to two-thirds of the reasons given for DAMA were financial constraints and the other reasons being tired of the hospital environment and father's decision. Massive enrolment into the NHIS would thus drastically reduce the DAMA rate as parents/caregivers would not need to pay out of pocket.

Severe anemia had the highest CFR of 20.5% in the present study followed by birth asphyxia (13.0%) and hypoglycemia (12.9%). This is not surprising as these three morbidities were significantly associated with mortalities. It is, however, surprising that although prematurity was the most common cause of mortality in the present study, its' CFR was much lower, 9.3%. This was also the case for probable sepsis (5.7%) and NNJ (5.2%). In Jigawa state,[14] CFR was highest in neonatal tetanus (42.8%) followed by prematurity (20.4%) and severe birth asphyxia (16.3%). In this study, severe anemia had a much lower CFR of 14.3% when compared with the present study. Similar findings, like the latter study, were observed in Benin,[19] Nigeria. Birth asphyxia and prematurity had the highest CFRs of 26.78% and 21.81% in Pakistan[21] and 9.4% and 4.3% in Bangladesh.[26] In India, however, meconium aspiration syndrome and congenital abnormalities had the highest CFRs accounting for 33.3% and 23.1%, respectively. Thus, the establishment of well-equipped neonatal intensive care units with adequate man-power will reduce drastically the CFRs of various disease conditions in the newborn and as such reduce neonatal morbidity and mortality rates.

CONCLUSION

The most common morbidities among inborn neonates in the RSUTH are probable sepsis, NNJ, and prematurity with a mortality rate of 6.2%. Causes of death are preventable, with the leading cause being prematurity followed by probable sepsis and NNJ.

Difficulty in breathing, prematurity, birth asphyxia, hypoglycemia, severe anemia, birth weight as well as gestational age, temperature at presentation, and mode of delivery are significantly associated with mortality. Male gender and neonates with normal Apgar score are close to 2 times and more than 5 times more likely to survive, respectively. CFRs are highest with severe anemia followed by birth asphyxia and hypoglycemia.

Improved obstetric care, provision of standard neonatal care with well-equipped neonatal intensive care units, and adequate manpower will thus reduce morbidity and mortality in the neonatal period.

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