

## **Nigerian Journal of Perinatal and Neonatal Care**

### **Original Article**

#### **First-Year Experience of a Newly Established Level II Neonatal Unit in Kaduna, Northwest Nigeria: High Patient Load and High Survival Despite Resource Constraints.**

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#### **ABSTRACT**

##### **Background:**

Neonatal mortality remains a major contributor to under-five mortality in Nigeria, accounting for approximately 30–40% of all under-five deaths. Although Kaduna State has recorded a decline in neonatal mortality from 63 to 47 deaths per 1,000 live births between 2018 and 2023–24, the rate remains above the national average of 41 per 1,000 live births. Strengthening facility-based neonatal care is essential to reducing preventable neonatal deaths. This study evaluated the first-year performance of a newly established Level II neonatal unit in Kaduna State, Northwestern Nigeria.

##### **Subjects and Methods:**

A retrospective descriptive study was conducted using routinely collected data from all neonates admitted to the Yusuf Dantsoho Memorial Hospital (YDMH) neonatal unit between June 2024 and May 2025. Data were extracted from

admission and discharge registers, case notes, unit logbooks, and performance reports. Variables collected included demographic characteristics, birth weight, gestational age, diagnoses, interventions received, and outcomes. Data was analyzed using descriptive statistics.

##### **Results:**

A total of 832 neonates were admitted during the study period, of whom 662 (79.6%) were referred from outside the facility (outborn). Monthly admissions ranged from 41 to 110, with an average of 76 admissions per month. The outborn ward consistently operated at full occupancy. Overall survival to discharge was 94.1%, while mortality was 5.9%. The leading causes of admission were neonatal sepsis (31.8%) and birth asphyxia (29.9%). Kangaroo Mother Care was provided to 184 low-birth-weight infants, including 160 weighing less than 2.0 kg. Twenty-three neonates received continuous positive airway pressure (CPAP), while 152 received

phototherapy and nine underwent exchange blood transfusion. Oxygen therapy was administered to 38% of admitted neonates. Successful resuscitation resulting in spontaneous breathing was achieved in 91.7% of neonates requiring support at birth. Birth asphyxia accounted for the largest proportion of deaths (36.7%)

### **Conclusions:**

The newly established Level II neonatal unit managed a high volume of admissions and achieved high survival outcomes despite significant resource constraints. The findings demonstrate that strategic investments in neonatal infrastructure, equipment, workforce development, and evidence-based clinical practices can substantially improve neonatal outcomes in resource-limited settings. Expansion of similar Level II neonatal services could contribute significantly to reducing neonatal mortality in Nigeria and comparable low- and middle-income countries.

**Keywords:** Neonatal care, Neonatal mortality, Neonatal survival, Kangaroo Mother Care, CPAP, Level II neonatal unit.

## **INTRODUCTION**

Neonatal mortality remains a major contributor to under-five mortality in Nigeria, accounting for approximately 30–40% of all under-five deaths.<sup>1</sup> Over the past three and half decades the NMR has not witnessed any appreciable decline, on the contrary, comparably, there seems to be a slight rise according to the figure of the 2023- 24 NDHS.<sup>2,3</sup> Despite ongoing global and national commitments to improve newborn survival, many states in Nigeria continue to record unacceptably high neonatal deaths. The NMR rate in Kaduna state dropped from 63/ 1000 live births in 2018 to 47 in 2023- 24 but remained higher than the national average of 41/ 1000 live births according to the respective NDHS reports.<sup>2,3</sup> Significant

efforts and focus have been geared towards neonatal care services. Much of these efforts appear to have been impactful at the primary health care level. Evolving evidence, however, suggest lack of adequate neonatal care infrastructure and trained personnel at secondary and tertiary levels where the in- patient interventions to halt and reverse the trend of deaths resulting mainly from preventable and treatable causes such as prematurity, birth asphyxia, and infections among others are supposed to be offered.<sup>4,5</sup> In response to the gap in the secondary neonatal healthcare system services, through the Kaduna state government action with support from UNICEF, the neonatal unit of Yusuf Dantsoho Memorial Hospital Kaduna was remodeled, upgraded, fully equipped, strengthened with trained staff and commissioned in May 2024 as a Level II Neonatal Unit.<sup>6,7</sup> The unit was positioned to provide intermediate-level neonatal care, including oxygen therapy, continuous positive airway pressure (CPAP), phototherapy, parenteral antibiotics, thermal regulation, Kangaroo mother care and feeding support, partial parenteral and enteral for both inborn and referred neonates who are 35 weeks and above and moderately ill neonates who are 32- 35 weeks. The facility has the capacity to accommodate a total of 16- 20 neonates with an 8- 10 each neonatal admission capacity for the in- and out- born units. The facility also has a mothers' room, breastfeeding area, Kangaroo mother care room, admission room/ consultation office and procedure room. It also has en-suite call rooms. Both in- and out-born wards are equipped with piped oxygen, oxygen splitters, oxygen concentrators, infusion pumps, infant incubators, intensive phototherapy machines, CPAP machines, resuscitaires, point of care bilirubin assay devices, glucometers and suction devices. The unit is manned by neonatal care skills trained- medical officers and nurses under the mentoring of a neonatologist-and are supported by instrument engineers trained on

neonatal equipment and a functional central hospital laboratory. There is a need to evaluate and document performance of the facility since its operationalization to highlight the facility's case-burdens, outcomes and operational challenges, and document lessons learnt in the context of a resource-limited setting.

### **AIM.**

The study evaluates and describes the first-year experience of a newly established Level II neonatal unit in Kaduna State, Nigeria, with emphasis on neonatal admissions, morbidity and mortality patterns, service utilization, and implementation challenges.

### **SPECIFIC OBJECTIVES**

1. To describe the demographic and clinical profile of neonates admitted during the first year of operation.
2. To determine the leading causes of neonatal morbidity and mortality in the unit.
3. To assess short-term outcomes (survival, discharge against medical advice, referral) of admitted neonates.
4. To identify the operational challenges, resource limitations, and capacity gaps encountered during the first year.
5. To document lessons learnt and provide recommendations for strengthening neonatal care in similar low-resource settings.

### **SIGNIFICANCE OF STUDY**

This retrospective study will provide one of the few documented experiences of establishing and running a Level II neonatal unit in Northern Nigeria. The findings will:

1. Serve as a baseline audit for quality improvement and service evaluation.
2. Guide policy formulation and resource allocation for neonatal health at state and institutional levels.
3. Contribute to local and global literature on scalable models for improving newborn care in resource-limited settings.
4. Support advocacy for training, equipment procurement, and sustainable funding for neonatal units across similar contexts.

### **SUBJECTS AND METHODS**

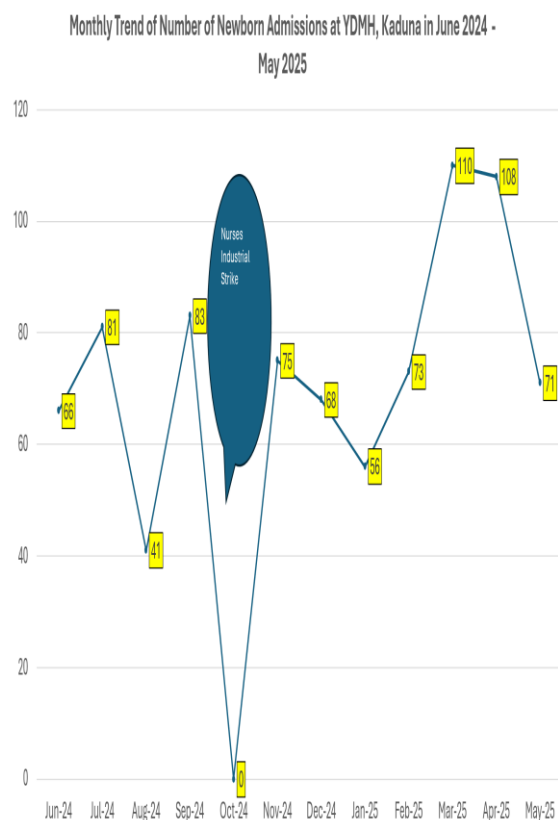
The Retrospective descriptive study was conducted at Yusuf Dantsoho Memorial Hospital Tudun Wada Kaduna (YDMH), a secondary public health facility in Kaduna State with an operational Level II neonatal unit. The monthly neonatal unit data collection was pooled over a one- year period reflecting the first 12 months of operation (1<sup>st</sup> June 2024– May 31<sup>st</sup>, 2025) and reviewed. Data were extracted from admission and discharge registers, case notes, unit logbooks, and weekly and monthly facility performance review. Information including demographics, birth weight, gestational age, diagnosis, interventions and outcomes were extracted. Information regarding challenges encountered was obtained from the unit's performance-feedback and intervention reviews. Data obtained were cleaned up and analyzed using descriptive statistics and presented using frequency tables, charts, and summarized and discussed.

Ethical approval for the study was obtained from the Health Research Ethics Committee of the Ahmadu Bello University Teaching Hospital Shika- Zaria (ABUTH/ HREC/ B23/ 2025).

## RESULTS:

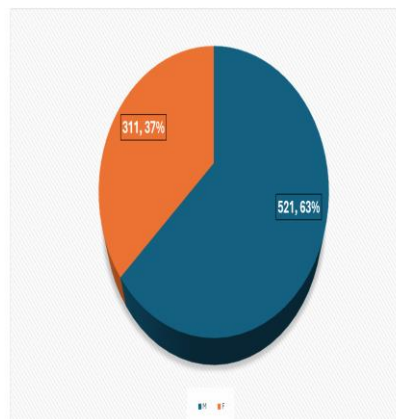
A total of 832 sick newborns were admitted between June 2024 and May 2025 with the majority 79.6% (662/832) being outborn neonates (i.e., referral cases from home, OPD, and other facilities).

High patient turnout and an increasing number of admissions were observed monthly except for the month of October 2024 when there was no admission due to Nurses strike. Monthly admissions ranged from 41- 110 with an average of 76 neonates (832/11) admitted/ month.



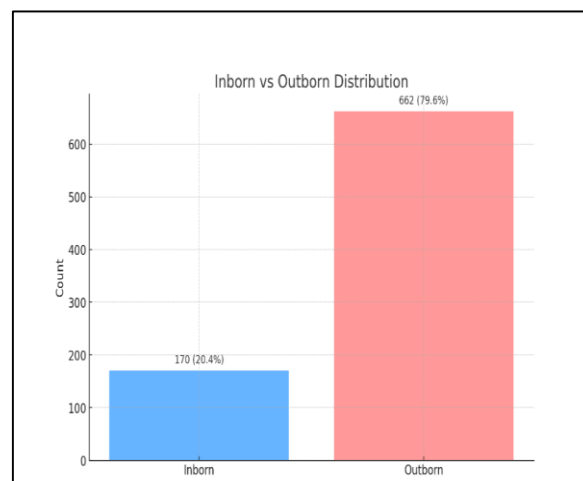
**(Figure 1) Newborn Admissions June 2024-May 2025**

% Newborn Distribution by Sex admitted at YDMH, Kaduna June 2024-May 2025



**Figure 2: Sex distribution of admitted newborns at YDMH**

The outborn unit always had a 100% occupancy rate while for the inborn ward it ranged from 25 - 75%. About 80% (662) of the admissions were outborns (Fig 3) with an inborn to outborn ratio of 1: 3.9.



**Figure 3: Bar Chart Showing Distribution of Inborn and Outborn Admissions at the YDMH**

A total of 783/ 832 of the managed neonates were discharged giving survival till discharge rate of 94.1%. The lowest and highest birth weights recorded on admission within the reporting period

were 800g and 5000g respectively. Neonates who weighed  $\geq 2500$ g constituted 60% (497/832) of the admissions while extremely low birth weight (neonates who weighed  $<1000$ g) constituted 1.7% of the admissions. Overall, 40% of the admissions had weight below 2500g. (Table I)

**Table I: Birth weight of neonates admitted at the YDMH June 2024 to May 2025.**

| BirthWeight (g) | Freq | Percentage (%) | Cumulative Frequency |
|-----------------|------|----------------|----------------------|
| $< 1000$        | 14   | 1.7            | 14                   |
| 1000- 1499      | 78   | 9.4            | 92                   |
| 1500- 1999      | 108  | 13.0           | 200                  |
| 2000- 2499      | 135  | 16.2           | 335                  |
| $\geq 2500$     | 497  | 59.7           | 832                  |
| Total           | 832  | 100            | -                    |

Term neonates (GA  $\geq 37$  weeks) constituted 42.7% of the admissions. Moderate to late preterm neonates (GA- 32  $<$  37 weeks) contributed 33.9% of the admissions and represented the largest proportion [282/477 (59.1%)] of the preterm (GA  $<$  37 weeks) neonates. Extremely Preterm neonates (GA  $<28$  weeks) constituted 3.1%. Overall, about 60% of the admissions were preterm. (Table II)

**Table II: Gestational Age Frequency Distribution of admitted neonates in YDMH June 2024 to May 2025**

| Gestational age (Weeks) | Frequency  | Percentage (%) |
|-------------------------|------------|----------------|
| $< 28$                  | 26         | 3.1            |
| 28- $<$ 32              | 169        | 20.3           |
| 32- $<$ 37              | 282        | 33.9           |
| $\geq 37$               | 355        | 42.7           |
| <b>Total</b>            | <b>832</b> | <b>100</b>     |

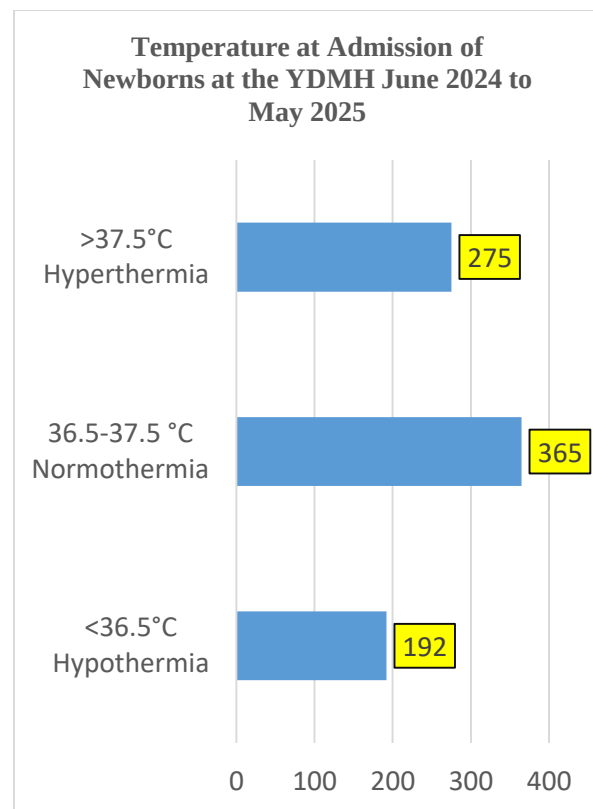
Infections (sepsis), perinatal complications (asphyxia), prematurity and jaundice were dominant reasons for neonatal admissions. The leading cause of admission was Neonatal Sepsis (32%), followed by Birth Asphyxia (30%) and Neonatal Jaundice (16%) respectively. (Table III)

**Table III. Distribution of Causes of Neonatal Admission June 2024-May 2025 at YDMH, Kaduna**

| Causes of Admission | Frequency | Percentage (%) |
|---------------------|-----------|----------------|
| Neonatal Sepsis     | 344       | 31.8           |
| Birth Asphyxia      | 323       | 29.9           |
| Neonatal Jaundice   | 172       | 15.9           |
| Prematurity         | 164       | 15.2           |
| Low birth weight    | 39        | 3.6            |
| Others              | 39        | 3.6            |
| Birth defects       | 0         | 0.0            |
| Total               | 1081*     | 100            |

\*Some neonates had more than one diagnosis

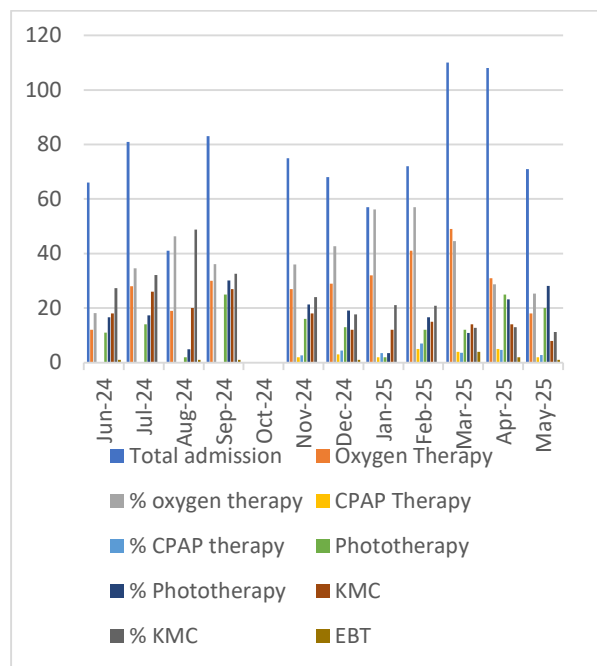
Temperature recordings at admission showed that majority (43.9%) presented with normothermia (T-36.5–37.5 °C), while approximately one-third (33.0%) had pyrexia (T >37.5 °C), and Hypothermia (<36.5 °C) was observed in 23.1% of the neonates. (Figure 4)



**Figure 4. Distribution of Temperature at admission of neonates admitted on to the Neonatal Unit of YDMH**

Twenty-four of the 135 neonates (17.8%) who weighed 2000g and above but less than 2500g and 160 of the 200 (80%) who weighed less than 2000g received Kangaroo mother care (KMC). Twenty-three of the total 832 (2.8%) admitted neonates had moderate to severe respiratory distress (Downes score  $\geq 4$ ) and received CPAP respiratory support. The first CPAP intervention was recorded in November 2024, six months into the operationalization of the unit and thereafter a range of 2- 5 neonates received CPAP monthly. A hundred and fifty- two (88.4%) of the 172 neonates with jaundice received phototherapy while the others were below phototherapy threshold. Only 9 (5.9%) of the 152 neonates with significant jaundice had EBT. Overall, 38% (316/832) received oxygen therapy at any one point during admission. (Fig 5). Resuscitation

was successful in establishing spontaneous breathing in 91.7% of cases who required help to breathe at birth.



**Figure 5: distribution of care offered to neonates admitted into the YDMH**

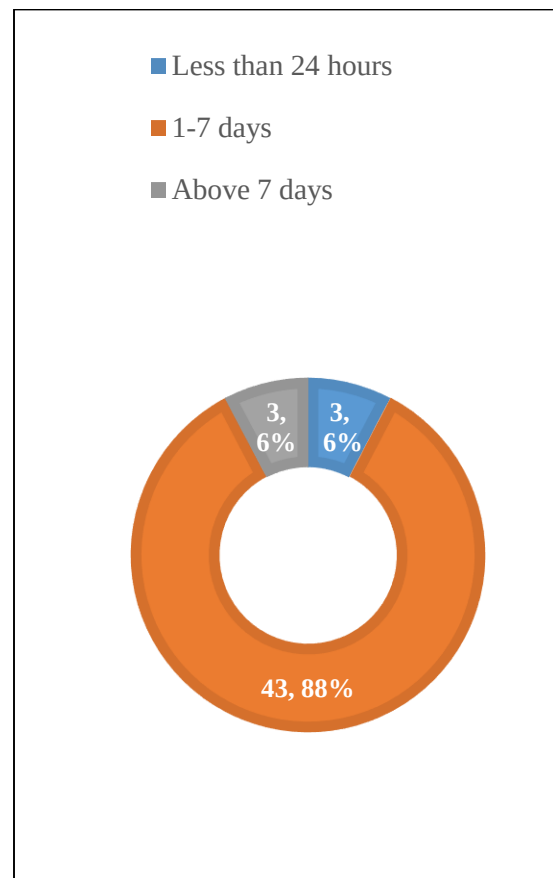
The overall mortality rate was 5.9% while the leading cause of death was birth asphyxia contributing approximately 37% of the death burden. Severe neonatal jaundice accounted for 4.1% of the deaths. (Table IV)

**Table IV. Distribution of Causes of Neonatal Death June 2024-May 2025**

| Cause of Death                         | Frequency | Percentage (%) |
|----------------------------------------|-----------|----------------|
| Birth Asphyxia                         | 18        | 36.7           |
| Prematurity                            | 14        | 28.6           |
| Neonatal Sepsis                        | 8         | 16.3           |
| Low Birth Weight                       | 5         | 10.2           |
| Severe Neonatal Jaundice (Kernicterus) | 2         | 4.1            |
| Others                                 | 2         | 4.1            |
| Total                                  | 49        | 100            |

About ninety percent (87.8%) of the deaths occurred within the 1- 7 days of admission. (Fig

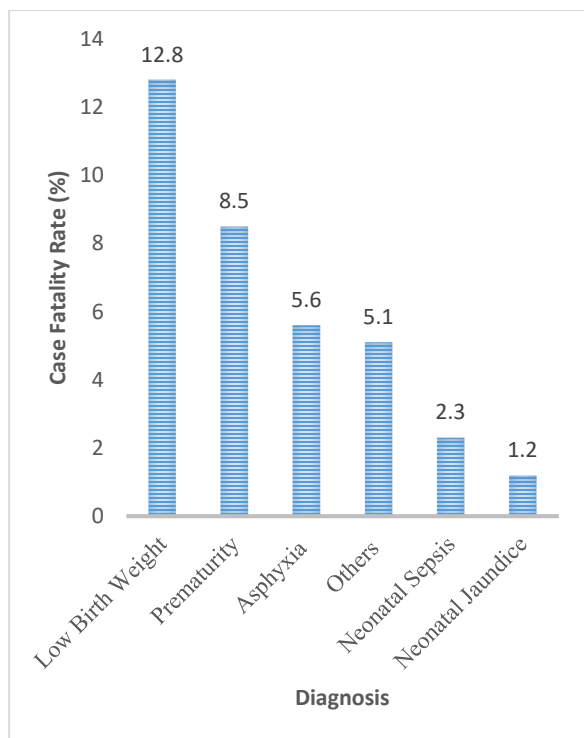
6). Inborn deaths accounted for 24. 5% (12/49) of the overall deaths while deaths among outborns constituted 75.5%. Mortality among inborn and outborn were 7.1% and 5.6% respectively.



**Figure 6. Proportion of Neonatal Deaths Occurring According to Days on Admission**

The case fatality rate among Low-birth-weight neonates was 12.8% while among cases of prematurity and neonatal jaundice the rates were 8.5% and 1.2%. (Fig 7)





**Figure 7: Case fatality rates of conditions diagnosed among neonates admitted to the YDMH**

## DISCUSSION

Over the one- year post- operationalization of the YDMH Level II neonatal unit a monthly average of 76 neonates were managed. This is comparable to volume of admissions in several tertiary level Neonatal units<sup>8,9</sup> and comparably higher than in some.<sup>10-17</sup> Most of the reports were mainly from tertiary facilities<sup>8-17</sup> with only one report from a secondary healthcare facility<sup>17</sup>

A hundred percent occupancy rate in the outborn unit and with a four times inborn volume load suggests awareness of the facility's capabilities and depicts the strategic, pivotal role the unit plays in provision of neonatal care in the state thus, the overwhelming referrals to the unit. This may also suggest insufficient neonatal bed capacity in the state with limited options to refer neonates who require in- patient, specialized neonatal care.

The facility also had a high preterm admission rate of about 60%. When this is juxtaposed on the background that four times the number of inborns were admitted from other facilities, it becomes imperative that many more preterm neonates were referred to the unit for further care. As these cases had no other facility to access care, about 22% preterm (< 32 weeks GA) who should by protocol receive care at a higher level (III or IV) facility, received care at the YDMH neonatal unit. These preterm categories, nevertheless, may not have received appropriate level care and may have had below expected outcomes. They were not referred to for further care possibly because there was limited higher facility to refer to and thus, they had to be managed in the facility.

The demographics of the admitted newborns were in keeping with reports from other studies. Majority of studies report male preponderance<sup>8, 12-17</sup> and as well preponderance of preterm neonates. Preponderance of preterm neonate admissions may be attributed to increasing availability of specialized care targeting better outcomes in this category of neonates and the rising prevalence of preterm deliveries resulting from increasing success in assisted conceptions. It may also be related to changing life and social pattern or styles associated with variable increases in stress among pregnant women and their families. The common causes of morbidity (Sepsis, Asphyxia, Jaundice and prematurity) remained comparable to those from other studies<sup>10- 17</sup> and though, the leading cause, sepsis, differed from that reported from some facilities,<sup>9- 12</sup> it aligned with the report from some other neonatal units.<sup>13, 16</sup> The skewedness of the pattern of admission with about 80% being outborns, many of whom would have been home births or contaminated enroute referral could explain the finding of sepsis as the prevalent morbidity.

The survival till discharge was remarkably high (94.1%), suggesting 9 out of 10 neonates admitted to the unit survived till discharge. Report of



survival among other cohorts ranged from 60-85%.<sup>10- 18</sup> Similarly high survival till discharge was recorded by Boma et al<sup>12</sup> from a private Level III facility with highly selective, specialized care and comparably low patient load. The only secondary facility<sup>16</sup> reviewed in this study reported a mortality of 12.8% (survival of 87.2%) which was about two times higher than the 5.9% reported in this study. The Benin secondary health facility operated a level I neonatal facility. Put together the high survival till discharge and low mortality rate we attribute to provision of appropriate- level quality care hinged on implementation of protocols by trained, skillful care providers.

The main cause of death was asphyxia even as neonatal resuscitation was successful in establishing spontaneous respiration in 9 out of 10 neonates who required resuscitation, and neonates went on to receive appropriate post resuscitation respiratory support in form of either oxygen only or with CPAP. Other reports have also implicated Asphyxia as a leading cause of neonatal mortality<sup>11, 15</sup> while some other studies have implicated other neonatal morbidities including neonatal sepsis or prematurity.<sup>9, 10, 13, 14</sup> The study did not disaggregate deaths by time of death, place of birth, whether or not the deaths occurred while on respiratory support, and the series of event leading to death. This limits the potential to speculate the extent to which further respiratory support succeeded in improving the neonates' condition and outcome.

A notable proportion of patients presenting with abnormal body temperatures underscores the importance of routine temperature assessment. Early identification and management of temperature abnormalities can influence diagnostic decisions, guide infection control measures, and improve patient outcomes.

The provision of Level II appropriate care services including CPAP and KMC which were hitherto not available or accessible would have

contributed to high survival till discharge. Despite training, supportive supervision and mentoring it took about 6 months into operationalization of the unit before CPAP services could be offered and sustained thereafter. To the best of the authors' knowledge no other public secondary level healthcare facility has reported use of CPAP. Reports from tertiary level facilities have shown the usefulness and import of CPAP services among other neonatal care interventions towards optimal neonatal care limiting morbidity and sequelae as well as improving outcome.<sup>17- 19</sup>

## **CONCLUSION**

The Level II neonatal unit at Yusuf Dantsoho Memorial Hospital successfully provided care for many critically ill newborns during its first year of operation, the majority of whom were referred from outside the facility. Despite operating within a resource-constrained environment and experiencing persistent bed occupancy pressures, the unit achieved a high survival-to-discharge rate and a low mortality rate. These outcomes highlight the effectiveness of targeted investments in neonatal infrastructure, equipment, workforce capacity building, and implementation of standardized clinical protocols.

## **RECOMMENDATION:**

The experience from YDMH demonstrates that high-quality neonatal care can be delivered successfully at secondary-level facilities in low-resource settings. It is recommended that the YDMH neonatal unit should be maintained and sustained to deliver affordable and accessible appropriate Level II neonatal care services. Scaling up similar Level II neonatal care services across Kaduna State and other parts of Nigeria may contribute substantially to reducing preventable neonatal morbidity and mortality.

**Competing interests:** The authors declare no competing interests and have nothing to disclose

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