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CC –BY **Availability and distribution of phototherapy services and health care providers for neonatal jaundice in three local government areas in Jos, North - Central Nigeria**

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Abstract: *Background:* Severe neonatal jaundice remains common in Nigeria. Phototherapy is the most commonly used in-hospital treatment for neonatal hyperbilirubinaemia.

Objectives: To describe the availability and distribution of phototherapy services as an essential neonatal service in hospitals in Jos, North-Central Nigeria.

Methods: This was a cross-sectional study of all secondary and tertiary level health facilities in Jos-North, Jos-South and Jos-East Local government Areas (LGAs) between January and March 2015.

Results: There were 30 (90.9%) secondary and three (9.1%) tertiary health facilities. Twenty – eight (84.8%) were privately owned. Fourteen (42.4%) of the 33 hospitals provided phototherapy services, of which 11 (78.6%) were private. Phototherapy services were available in all the tertiary facilities and in only 11 (36.7%) of the secondary level

health facilities. Most (10; 71.4%) of the hospitals with phototherapy were located in Jos-North LGA. There were 38 phototherapy units in all the 14 hospitals that offered phototherapy, consisting of 8 (21.1%) light emitting diodes (LED) and 30(78.9%) conventional units of which 25(83.3%) were locally fabricated. In all the hospitals that provided phototherapy, jaundiced neonates were managed by physicians of whom only 12% were fulltime paediatricians. All hospitals that offered phototherapy had laboratory facilities to assay bilirubin.

Conclusions: Phototherapy services in Jos, Nigeria are inadequate and are concentrated in the urban private sector. An increase in phototherapy services especially in secondary public facilities is needed.

Key words: Health Care Provider, Hyperbilirubinaemia, Jos, Neonatal Jaundice, Nigeria, Phototherapy

Introduction

Jaundice is common in the newborn affecting 60 – 80% of newborns in the first week of life.¹ Neonatal jaundice (NNJ) although usually benign, can become severe and may result in adverse outcomes when unmonitored or untreated in a timely manner.² Severe hyperbilirubinaemia (SH) occurs in 8 – 9% of infants during the first week of life.³ It is associated with substantial mortality and long-term morbidities especially in low- and middle-income countries (LMICs).⁴ Kernicterus, a complication of severe hyperbilirubinaemia occurs world-wide,^{5,6} although the burden appears to be greater in LMICs.⁷ The persistent occurrence of kernicterus has been attributed to a health systems failure in neonatal services.^{3,8}

In Nigeria, NNJ accounts for 9 – 45% of neonatal admissions⁹⁻¹² with mortality rates of 5- 14%.^{9,11,12} Studies have reported the prevalence of kernicterus in Nigeria to range from 2.3 to 3.4%^{13,14} of neonatal admissions with sometimes up to 30% of admitted jaundiced neonates having features of kernicterus.^{12, 15} This is in addition to other long term complications like hearing loss.¹⁶

The therapeutic modalities for NNJ include phototherapy (PT), exchange blood transfusion (EBT) and intravenous immune globulin (IVIG), depending on its severity and etiology. Phototherapy is the most commonly used treatment and with its widespread use, the need for exchange blood transfusion (EBT) for infants with neonatal jaundice is decreased.³ It is non- invasive and has fewer complications compared to EBT.¹⁷ Phototherapy

is therefore an essential neonatal service that should be readily available. The World Health Organization (WHO) in an interagency list of priority medical devices needed to provide essential interventions for reproductive, maternal, newborn and child health in LMICs, listed phototherapy as a priority medical device at the district level hospital.¹⁸

To the best of our knowledge, published data on availability and distribution of PT in Nigeria, especially in north-central Nigeria particularly at the secondary level of care, is at best, very scanty. The few studies on phototherapy are focused on irradiance levels, which were found to be generally inadequate. Knowledge of the availability and distribution of phototherapy services will guide health systems planning and will aid reduction of morbidity and mortality from NNJ. We therefore undertook this study to describe the availability and distribution of phototherapy services in secondary and tertiary health institutions in three Local Government Areas (LGAs) in Jos metropolis as an essential neonatal service.

Methods

We undertook a cross sectional descriptive study in Jos North, Jos South and Jos East Local government Areas (LGAs) in Jos metropolis, Plateau State, North –Central Nigeria between January and March 2015. It was part of a larger study. The study area co – hosts the capital city of Plateau State and is a cosmopolitan area with some suburban outskirts. The 3 LGAs span an area of 1,821 Km² with a combined population of 951,173. Plateau State is located in Nigeria's middle belt, with an area of 26,899 Km² with subdivisions into 17 LGAs and an estimated population of 3.9 million people. Jos North and Jos South LGAs are predominantly cosmopolitan, while Jos East is predominantly rural.¹⁹ The health care system is organized into primary, secondary and tertiary levels of care in line with the Nigerian national health system structure. Healthcare is provided by Government (public) and private or non-governmental institutions. There are three tertiary hospitals in the study area which receive referrals from the rest of the state and neighboring states. Secondary health facilities are generally designed to serve people with services that are more complex, technically demanding and specialized than those available at primary care facilities, but not as specialized as those provided by tertiary facilities. Their range of services includes diagnostics, treatment (including phototherapy services, ideally), care, counselling and rehabilitation. They often have only one family physician or a non-physician practitioner; with limited laboratory services. Tertiary facilities usually have at least, one specialist and technical equipment and capacity to provide complex clinical care interventions to patients referred from the primary or secondary facilities.¹⁸ The 2014 total live births (home & hospital) in the 3 LGAs was 49,407 giving 950 births /week.²⁰

A list of all health care facilities in the three Local Government Areas in Jos was obtained from the Plateau State Ministry of Health (SMOH). The secondary and tertiary level facilities were visited by the researchers to ascertain the availability and types of phototherapy units/ devices which were sighted and tested. Other relevant information like cadre of health care personnel who managed jaundiced infants, availability of laboratory diagnosis of serum bilirubin (SB) in the health facilities was also documented. In addition, the total births and other demographic data for the LGAs were obtained from the National Population Commission (NPC). Ethical approval for the study was obtained from the Jos University Teaching Hospital (JUTH) Research and Ethics Committee (JUTH/DCS/ADM/127/XIX/5822) and permission to carry out study was obtained from the owners of the hospitals.

The data obtained was entered into a Microsoft excel sheet and was analyzed using EPI info 7.2. Simple ratios and proportions were calculated, while comparison of proportions was done using Chi square or Fisher exact Test as appropriate. A p-value of <0.05 was considered statistically significant.

Results

There were a total of 33 health facilities in the three LGAs. These consisted of 30 (90.9%) secondary and three (9.1%) tertiary level facilities. Five (15.2%) of the facilities were public, while the remaining 28 (84.8%) were privately owned (inclusive of seven faith-based facilities). All the health facilities offered obstetric and perinatal care services.

Fourteen (42.4%) of the 33 hospitals provided phototherapy services; 11 (78.6%) of which were privately owned. Phototherapy services were available in all the tertiary health institutions and in only 11(36.7%) of the secondary level facilities. Most (10; 71.4%) of the hospitals with phototherapy were located in JNLGA (Table 1).

Table 1: Availability of phototherapy services by type and level of facility and local government areas in Jos metropolis, Nigeria

Characteristics	Total N (%)	Phototherapy present n (%)	Phototherapy Absent n (%)	P
<i>Type of hospital</i>				
Public	5 (100)	3 (60)	2 (40)	0.63
Private	28 (100)	11 (39.3)	17 (60.7)	
<i>Level of care</i>				
Secondary	30 (100)	11 (36.7)	19 (63.3)	0.07
Tertiary	3 (100)	3 (100)	0 (0)	
<i>Local Govt. Area</i>				
*JNLGA	19(100)	10 (52.6)	9 (47.4)	0.37
†JSLGA	13(100)	4 (30.8)	9 (69.2)	
‡JELGA	1(100)	0(0)	1 (100)	

*JNLGA: Jos North Local Government Area;

†JSLGA: Jos South Local Government Area;

‡JELGA: Jos East Local Government Area

The total number of phototherapy units/devices in all the 14 hospitals that offered phototherapy was 38, consisting of 8 (21.1%) light emitting diodes (LED) and 30 (78.9%) conventional units using 'blue light'. Twenty five (83.3%) of the conventional units were locally fabricated, while five (16.7%) were imported. Fourteen (36.8%) of the phototherapy units were in the tertiary hospitals, while the remaining 24 (63.2%) were in 11 secondary level hospitals. Most of the units (27; 71.1%) were in the private health facilities and were concentrated in JNLGA (29; 76.3%). The remaining 9 (23.7%) were in JSLGA.

In all the 14 hospitals that offered phototherapy services, the jaundiced neonates were managed by trained physicians who were mainly concentrated in JNLGA. There were only three (12%) full time trained paediatricians involved in the management of jaundiced babies in Jos metropolis and they were all in the tertiary facilities, Table 2.

All the 14 hospitals that offered phototherapy had laboratory facilities to assay bilirubin in the jaundiced babies.

Table 2: Distribution and cadre of physicians providing care for jaundiced neonates in hospitals in Jos metropolis, Nigeria

Characteristics	Full time paediatricians n (%)	Full time trainee paediatricians n (%)	Part time paediatricians n (%)	Full time family physicians n (%)	Full time trainee family physicians n (%)	Medical officers n (%)	Total n (%)
Total	3 (12)	3 (12)	10 (40)	3 (12)	4 (16)	2 (8)	25 (100)
<i>type of hospital</i>							
Public	2	3	1	1	2	0	9
Private	1	0	9	2	2	2	16
<i>Level of care</i>							
Tertiary	3	3	0	1	3	0	10
Secondary	0	0	10	2	1	2	15
<i>Local Govt. Area</i>							
Jos North	3	3	6	2	4	1	19
Jos South	0	0	4	1	0	1	6
Jos East	0	0	0	0	0	0	0

Discussion

This study aimed at describing the availability and distribution of phototherapy services in secondary and tertiary health facilities in Jos metropolis. Our findings showed that less than half of all the health institutions offer phototherapy services. Also, we found that all tertiary health care facilities provided phototherapy services with fulltime specialist paediatricians or family physicians providing care. A large proportion of the secondary facilities (which were mostly public) did not have phototherapy. Physicians managed the jaundiced babies in the hospitals in Jos; however, the number of fulltime specialist paediatricians providing care for jaundiced babies is relatively small. Furthermore, most of the phototherapy services were concentrated in private health institutions and were mainly in the Jos North LGA. This followed the pattern of distribution of other specialist services, providers and resources, where there was a concentration of these in the more cosmopolitan Jos North and parts of Jos South LGA.

The fact that less than half of all the institutions offer phototherapy services is unsatisfactory considering the fact that all these hospitals take deliveries, and also serve as referral hospitals to the primary health clinics in these LGAs, the rest of the state and neighbouring states. Phototherapy should be readily available and accessible to families after delivery in view of the fact that NNJ is a major cause of readmission of babies after dis-

charge.³ In the USA, the American Academy of Pediatrics (AAP) Subcommittee on Hyperbilirubinemia recommended that all nurseries and services treating infants should have the necessary equipment to provide intensive phototherapy.²¹ Similarly, the WHO recommended phototherapy as a priority medical device needed to provide essential interventions at district level hospitals for reproductive, maternal, newborn and child health in LMICs.¹⁸ The findings in our study do not meet these standards. If this is the status in the capital of the state, the situation may be worse in the peripheral rural areas.

There was a lack of data to compare our study with, as most of the studies on phototherapy are on irradiance and not availability or distribution. Nevertheless, the number of devices in our study (38 devices in 14 hospitals) appears to be fewer than that in these studies. For example, Owa et al²² evaluated phototherapy irradiance in 63 devices in the newborn units of twelve secondary and tertiary hospitals in Nigeria. However, the areas were not specified. Similarly, Cline et al²³ evaluated the irradiance 76 PT devices in 16 hospitals selected by convenience sampling across 4 Nigerian states and the Federal Capital Territory. The sampled 16 urban and semi-urban hospitals included both public and private facilities, but the distribution of these hospitals were not stated. The number of phototherapy devices in our study also appears to be fewer than the report by Ferreira, et al.²⁴ in Maceio, Brazil where the authors evaluated the irradiance of 36 phototherapy devices in 6 maternity wards.

Another way of assessing availability of phototherapy in our study may be by comparing the number of babies

that may develop jaundice to the total number of phototherapy devices. Based on the total live births (49,407 births/year or 950 births/week) in the 3 LGAs and assuming that 8 – 10%^[3] of these infants may have severe hyperbilirubinaemia; this will give 76 – 95 neonates requiring treatment per week. This gives an average of 2 -3 jaundiced neonates / phototherapy unit/ week. This implies that either 1-2 jaundiced babies will be without phototherapy/ week, or 2-3 babies will have to share the same PT unit; a practice which is discouraged. These figures may be higher if we include babies from other parts of the state and neighbouring states since these hospitals are referral centres.

The reduced availability of phototherapy services in our study may be due to limited resources which may be presumed by the finding that most of the devices were locally fabricated. Or on the other hand, it may be due to the fact that NNJ may not have been made a priority by the health policy makers. Unavailability of phototherapy may result in delay in treatment of babies with NNJ, high rates of EBT and increased neonatal mortality in addition to long term sequelae.

Another finding of our study was that the phototherapy services were mainly available in the private health institutions. This implies that the private sector is a significant contributor to neonatal health services and so should be carried along in health related programmes. It also corroborates the fact that government alone cannot provide all the health care for the entire population. Government therefore must provide an enabling environment for the private sector to complement its efforts. The disadvantage of this may be that these services though available physically, may not be accessible to the general population because of cost. Thus the Government still needs to ensure that these facilities are available in the public health facilities and should be accessible to all. The fact that all the tertiary facilities in Jos provided phototherapy services is therefore commendable.

Most of the phototherapy services were concentrated in the urban JNLGA. This appears to be due to the availability of health care delivery personnel, electricity and other social amenities in urban areas as compared to suburban and rural areas. The use of solar powered phototherapy devices or filtered-sunlight phototherapy may be an alternative in areas with poor electricity supply.²⁵ There were few fulltime trained paediatricians involved in the management of jaundiced babies in Jos. This is

not surprising as the Paediatric Association of Nigeria (PAN) in a previous publication found that the number of paediatricians in Nigeria is grossly inadequate; and there was also an uneven distribution of paediatricians with more in the southern states.^[26] It was also found that higher child-to-paediatrician ratio was significantly associated with higher under-fives mortality rates (U5MR). The paucity of paediatricians involved in the management of jaundiced babies in our study may result in increased morbidity and mortality from NNJ as even amongst practitioners, paediatricians were found to manage jaundiced babies better.²⁷ There is therefore a need for more trained paediatricians and to promote their distribution to the various areas within the LGAs. Additionally, in view of the high burden of NNJ in Nigeria, there is a need to train other health workers/ new born practitioners on NNJ.

This study is limited by the relatively small sample size of the hospitals surveyed. A more elaborate picture of the status of phototherapy services will have been surmised if we had studied all the health facilities in the state, however, this was limited by funding. Also, we did not assess the irradiance of the phototherapy devices to determine their effectiveness. This should be an area for further study. The actual number of jaundiced babies in the population was not determined. The fact that we did not have literature to compare our findings with may also limit its application. However, in spite of these limitations, the findings of this study will have application for health planning for neonatal services.

Conclusion

Phototherapy services in Jos are inadequate and are mainly concentrated in the urban private sector. There are few full time paediatricians involved in the care of babies with NNJ.

Concerted efforts should be made to ensure that all secondary level health facilities should offer phototherapy with distribution especially to JELGA and to the public facilities. The need for more paediatricians and their distribution to the secondary public sector and suburban areas is advocated. These may reduce jaundice related neonatal morbidity and mortality.

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