

ORIGINAL RESEARCH ARTICLE

TITLE: IMPACT OF SOCIOECONOMIC FACTORS ON NEONATAL SEPSIS IN JOS, NIGERIA

Authors:

Onyedibe K I, Utoh-Nedosa A U, Okolo M Dr. Onyedibe, Kenneth Ikenna O, Ita O I, Udoh U A, Nedosa I V, Bode-Thomas F, Egah D Z.

MBBS, PGDMgt, PGD Infectious Dss, MWACP, MMCPATH, Department of Medical Microbiology, Jos University Teaching Hospital, PMB 2076, Jos, Nigeria

Dr. Utoh-Nedosa A. U

BSc., MSc., PhD Department of Pharmacology and Toxicology, Faculty of Pharmaceutical Sciences, Nnamdi Azikiwe University, P. M. B. 5025, Anambra State, Nigeria

Dr. Okolo, Mark Ojogba

MBBS, MSc., MWACP, Department of Medical Microbiology, Jos University Teaching Hospital, PMB 2076, Jos, Nigeria

Dr. Ita, Okokon Ita

MBBS, MWACP, MMCPATH, Department of Medical Microbiology, Jos University Teaching Hospital, PMB 2076, Jos, Nigeria

Dr. Udoh, Ubong Aniefok

MBBS, MMCPATH, Department of Medical Microbiology, Jos University Teaching Hospital, PMB 2076, Jos, Nigeria

Nedosa, Ikenna Valentine

B. Tech, MSc. Department of Biotechnology, Colorado State University, USA.

Dr. Bode-Thomas, Fidelia MBBS, FWACP

Department of Paediatrics, Jos University Teaching Hospital, PMB 2076, Jos, Nigeria

Professor Egah, Daniel Zanyu

MBBS, MSc., FMCPATH. Department of Medical Microbiology, Jos University Teaching Hospital, PMB 2076, Jos, Nigeria

Corresponding Author:**Dr. Kenneth Onyedibe,**

Department of Medical Microbiology, Jos University Teaching Hospital, PMB 2076, Jos, Nigeria

E mail: kenonyedibe@yahoo.com

ABSTRACT

Background: Neonatal sepsis is very prevalent in sub-saharan Africa and contributes up to 69% to neonatal mortality in Nigeria and other parts of Africa. The objective of this study was to determine the impact of the predominant socio-economic factors that may contribute to neonatal sepsis in this environment.

Methodology: The study was a cross-sectional study conducted in Jos University Teaching Hospital (JUTH), Jos, North Central, Nigeria. Clinical and demographic data were collected from mothers, care givers and case notes of 218 neonates enrolled into the study by means of a structured interviewer administered questionnaire. Data collected were analyzed by EPI Info statistical package. Biological samples were also collected from the neonates and processed by standard methods in the microbiology laboratory of JUTH.

Results: Bacteria were isolated in 34.4% of the neonates studied. The most common isolates were *Klebsiella pneumoniae*, *Staphylococcus aureus* and *Escherichia coli*. Delivery at home had the highest percentage of culture proven sepsis (52.2%). Mothers with no formal education and those with only primary education also had high proportions of culture proven sepsis (41.1% and 58.8% respectively). Place of domicile, level of education of mother and poor feeding were factors that contributed significantly to neonatal sepsis by odds ratio.

Conclusion: The findings show that socioeconomic factors have a significant impact on neonatal sepsis. An improved standard of living, education and empowerment of women and increased provision of basic social amenities will go a long way in reducing the morbidity and mortality of neonatal sepsis in our environment.

Key words: Socioeconomic factors, impact, neonatal sepsis

Introduction

Neonatal sepsis is an invasive infection occurring in the first twenty eight (28) days of life. It could be bacterial, viral, fungal or even toxin mediated. Early signs are frequently nonspecific and subtle and do not distinguish among organisms. These signs could be multiple and include diminished spontaneous activity, less vigorous sucking, apnea, bradycardia, temperature instability, respiratory distress, vomiting, diarrhoea, abdominal distention, jitteriness, seizures and jaundice.¹ Diagnosis is clinical, with extensive laboratory testing for confirmation, monitoring and specific antibiotic therapy. Neonatal sepsis may be classified according to the time of onset of the disease as early onset and late onset.^{2, 3} The distinction has clinical relevance, as early onset sepsis is mainly due to bacteria acquired before and during delivery, and late onset sepsis to bacteria acquired after delivery (nosocomial or community sources). In the literature, however, there is little consensus as to what age limits apply, with early onset ranging from 48 hours to 7 days after delivery.⁴

Neonatal sepsis occurs in 0.5 to 8.0 per 1000 live births.⁵ The highest rates occur in low birth weight (LBW) infants, those with depressed respiratory function at birth, and those with maternal or perinatal risk factors such as premature rupture of membranes (PROM), maternal bleeding, toxemia, precipitous delivery, or maternal infection.^{1, 5} In most developing countries, gram-negative bacteria remain the major cause of neonatal sepsis.^{6,7} These organisms have developed increased drug resistance over the last two decades and management of neonates with sepsis has become a major problem.^{8, 9} On the other hand, Group B *Streptococcus* (GBS) has been the most frequent aetiological agent of neonatal sepsis in developed countries, being responsible for high morbidity and mortality rates.¹⁰ In Nigeria, several organisms cause neonatal sepsis and most studies in this environment documented *Staphylococcus aureus* (*S. aureus*) as the commonest bacterial aetiology of neonatal sepsis.¹¹⁻¹⁵

Neonatal sepsis is very prevalent in sub-saharan Africa and contributes up to 69% to neonatal mortality in Nigeria and other parts of Africa.¹⁶⁻²¹ In preterm infants, profound morbidity is associated with neonatal sepsis which contributes to

significant neurological damage in the neonate, undermines the quality of life of the neonate, traumatizes mothers and care givers with eventual loss of productive hours as neonates are admitted for days or weeks.²² Low socioeconomic status is known to predispose individuals to infections. This study aims to identify socioeconomic factors that may be associated with neonatal sepsis in Jos in a bid to prevent further occurrence and consequently reduce the morbidity and mortality of neonatal sepsis in our environment.

Methods

This study was a prospective cross sectional study carried out in Jos University Teaching Hospital in 2011. Specimens were collected from 218 neonates in the SCBU of the hospital and those admitted via the EPU with a clinical diagnosis of neonatal sepsis whose parents or guardians consented to participate in the study. The World Health Organisation (WHO) case definition for neonatal sepsis used in the Integrated Management of Childhood Illnesses (IMCI) criteria was used to select subjects for the study.²⁴ A clinical diagnosis of neonatal sepsis was made if a neonate presented with at least one of the signs in the tool. Clinical and demographic data were collected from mothers, care givers and case notes by means of the research instrument and analyzed. Biological samples collected include blood (218 sets), cerebrospinal fluid (192 samples), urine (207 samples), aspirates and swabs from discharging sites (14 samples). Specimens collected were processed in the laboratory by standard techniques and findings were recorded.

Results

Of the 218 neonates studied, 155 (71.1%) and 63 (28.9%) were aged less than or equal to seven days and above seven days respectively. Male neonates were 119 (54.6%) and females 99 (45.4%). Ninety nine (45.5%) of the neonates had a birth weight less than 2.5 Kilograms while 108 (49.5%) of them had birth weight of 2.5 Kilograms and above. There was neither record nor knowledge of birth weight in 11 (5%) of the neonates studied. A gestational age at birth of 37 weeks and above (term) was recorded in 155 (71.1%) of the neonates. Sixty three (28.9%) of the neonates were delivered before the 37th week of gestation (Pre-term). Hospital was the commonest place of birth with 190 (87.2%), 23 (10.6%) of the neonates were delivered at home while five (2.3%) of the neonates were delivered in the church, mosque or traditional institutions.

However, forty (33.6%) of the male neonates and 35 (35.4%) of the female neonates were found to have culture proven sepsis. Fifty one (44.3%) of the

neonates resident in urban locations, 10 (20.8%) in semi urban areas, another 10 (24.4%) in rural areas and 4 (28.6%) of those in urban slums had culture proven sepsis. In relation to the level of education of mothers of the neonates; 23 (41.1%) with no formal education, 20 (58.8%) of those with primary education, 21 (23.9%) of those with secondary education and 11 (27.5%) of mothers with tertiary education had culture proven sepsis. Sixty one (32.1%) of the neonates delivered in the hospital and 12 (52.2%) of those delivered at home had culture positive sepsis. There was a statistically significant relationship between place of domicile, poor cord care and poor feeding with positive culture result in the neonates studied ($P < 0.05$). (Table 1)

Table 1: Relationship of socio-economic factors and culture confirmed sepsis in the neonates studied in Jos University Teaching Hospital

Socioeconomic factors	Total No. Examined	Culture		Odds Ratio	95% C.I	P value
		Positive Freq (%)	Negative Freq (%)			
Age (Days)						
≤ 7 (Early onset)	155	61 (39.4)	94 (60.6)			
> 7 (Late onset)	63	14 (22.2)	49 (77.8)	2.27	1.16-4.44	0.016
Gender						
Male	119	40 (33.6)	79 (66.4)			
Female	99	35 (35.4)	64 (64.6)	0.78	0.44-1.40	0.412
Place of domicile						
Urban	115	51 (44.3)	64 (55.7)			
Semi-Urban	48	10 (20.8)	38 (79.2)			
Rural	41	10 (24.4)	31 (75.6)			
Urban slum	14	4 (28.6)	10 (71.4)	2.27	1.01-5.11	0.047
Level of education of mother						
None	56	23 (41.1)	33 (58.9)			
Primary	34	20 (58.8)	14 (41.2)			
Secondary	88	21 (23.9)	67 (76.1)			
Tertiary	40	11 (27.5)	29 (72.5)	2.19	0.56-8.55	0.260
Place of delivery						
Hospital	190	61 (32.1)	129 (67.9)			
Home	23	12 (52.2)	11 (47.8)			
Others	5	2 (40.0)	3 (60.0)	0.58	0.24-1.39	0.221
Good cord care						
Yes	98	31 (31.6)	67 (68.4)			
No	87	44 (50.6)	43 (49.4)	0.42	0.25-0.82	0.009
Poor feeding						
Yes	75	46 (61.3)	29 (38.7)			
No	143	29 (20.3)	114 (79.7)	6.24	3.37-11.53	0.000

CI = Confidence Interval

Discussion

Studies on neonatal sepsis are very important in this region as five million neonatal deaths occur worldwide every year, 98% of which occur in developing countries, particularly in Asia and Africa.²⁵

Amongst the socioeconomic factors that could predispose neonates to sepsis in this environment, there were higher rates of confirmed sepsis amongst neonates born to mothers who had only primary education and those with no formal

education; both of whom are categorized in the lower socio-economic class. This relationship of culture proven sepsis and lower socio-economic status has been identified in other studies.^{23, 26} The reasons for the increased rate of sepsis in this group may include poor hygiene, overcrowding in homes, lack of clean portable water for bathing the neonate and preparation of feeds, poor cord care, inability to adequately vaccinate the neonate and an inability to attend antenatal care clinics (ANC) which are common attributes amongst the lower socio-economic group. Neonates that were delivered at home also had a higher rate of culture confirmed sepsis than those that were delivered in the hospital which is in agreement with the findings in related studies carried out in Southwestern, Nigeria^{13, 23} and other parts of Africa.^{21, 27} Home deliveries attracts more neonatal sepsis for reasons such as using unsterilized instruments during delivery and separation of cord; lack of proper hand washing procedures, dirty and unhygienic delivery environment as well as improper cord hygiene after birth which exposes the neonate to infective pathogens. There was a statistically significant relationship between culture positive sepsis and the birth weight of the neonates as evidenced by higher culture positivity amongst low birth weight neonates. The fact that the baby was born with a low birth weight could be due to maternal complications such as eclampsia or pre-eclampsia, PROM or maternal infections. However, in the context of this study; low birth weight could also be as a result of maternal malnutrition and recurrent maternal illnesses compounded with inaccessibility to healthcare facilities for ANC and management of the recurrent maternal illnesses. This finding is similar to that reported by Ogunlesi and co-workers in Sagamu²³ and Motara and co-workers in Johannesburg.²⁷

Poor feeding of the neonate is a significant feature of sepsis and can worsen the prognosis in neonates due to the further impaired immunity arising from inadequate nutrients received by the neonate and the reduced maternal antibodies transferred from the mother to the neonate. Such neonates are also predisposed to hypoglycaemia which has been identified as an important predictor of neonatal mortality as documented in some Nigerian and Ugandan studies.^{21, 26}

Conclusions

The findings in this study confirm that socioeconomic factors contribute significantly to neonatal sepsis in Jos, Nigeria and by extension

other environments where there are individuals within the lower socioeconomic class. An improved standard of living, education and empowerment of women and increased provision of basic social amenities will go a long way in reducing the morbidity and mortality of neonatal sepsis.

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References

1. Infection in the neonate, *Merck manual online* 2005. Available at: www.merckmanual.com. Accessed 5th February, 2010.
2. Kaftan H and Kinney JS. Early onset neonatal bacterial infections. *Seminar Perinatology*. 1998; **22**:15-24.
3. Vergnano S, Sharland M, Kazembe P, Mwansambo C and Heath PT. Neonatal Sepsis: an international perspective. *Archives of Diseases in Children. Fetal and Neonatal Ed*. 2005; **90**: 220-224.
4. Haque KN. Defining common infection in children's and neonates. *Journal of Hospital Infection*. 2007; **65**:110-114.
5. Anderson-Berry AL, Bellig LL and Ohning BL. Neonatal Sepsis. Available at: www.medscape.com. Last updated October 20, 2009. Accessed 5th February, 2010.
6. Anwer SK, Mustafa S, Pariyani S, Ashraf S and Taufiq KM. Neonatal sepsis: an etiologic study. *Journal of Pakistan Medical Association*. 2000; **50**:91-94.
7. Joshi SG, Ghole VS and Niphadkar KB. Neonatal gram negative bacteremia. *Indian Journal of Pediatrics*. 2000; **67**:27-32.
8. Bhutta ZA and Yusuf K. Early-onset neonatal sepsis in Pakistan: a case control study of risk factors in a birth cohort. *American Journal of Perinatology*. 1997; **14**:577-81.
9. Musoke RN and Revathi G. Emergence of multi-drug resistant gram negative organisms in a neonatal unit and the therapeutic implications. *Journal of Tropical Pediatrics*. 2000; **46**:86-91.
10. Freedman RM, Ingram DL, Gross I, Ehrenkranz RA, Warshaw JB and Baltimore RS. A half century of neonatal sepsis at Yale. *American Journal of Diseases in Children*. 1981; **135**:140-144.
11. Bode-Thomas F, Ikeh EI, Pam SD and Ejeliogu EU. Current aetiology of neonatal sepsis in Jos University Teaching Hospital. *Nigerian Journal of Medicine*. 2004; **13**(2):130-135.
12. Ako-Nai K, Adejuyigbe J, Ajayi V and Onipede A. The Bacteriology of Neonatal Septicaemia in Ile-Ife, Nigeria. *Journal of Tropical Pediatrics* 1999; **45**(3):146-151.
13. Fadero FF, Aboderin AO, Onigbinde MO and Ako-Nai AK. Bacterial Pathogens and Antibiotic Sensitivity in Neonatal Septicaemia at the Ladoke Akintola University Teaching Hospital, Osogbo, Southwestern Nigeria. *International Journal of Tropical Medicine*. 2007; **2** (1): 21-24.
14. Mokuolu AO, Jiya N, Adesiyun OO. Neonatal septicaemia in Ilorin: bacterial pathogens and antibiotic sensitivity pattern. *African Journal of Medicine and Medical Sciences*. 2002; **31**(2):127-30
15. Anah MU, Udo JJ, Ochigbo SO and Abia-Bassey LN. Neonatal Septicaemia in Calabar, Nigeria. *Tropical doctor* 2008; **38**(2): 126-128
16. Okechukwu AA and Achonwa A. Morbidity and mortality patterns of admissions into the Special Care Baby Unit of University of Abuja Teaching Hospital, Gwagwalada, Nigeria. *Nigerian Journal of Clinical Practice*. 2009; **12** (4): 389-394
17. Adeyokunnu AA, Taiwo O and Antia AU. Childhood mortality among 22,255 consecutive admissions in the University College Hospital, Ibadan. *Nigerian Journal of Paediatrics*. 1980; **7**: 715.
18. Fagbule D and Joiner KT. Pattern of childhood mortality at the University of Ilorin Teaching Hospital, Ilorin. *Nigerian Journal of Paediatrics*. 1987; **14**: 16.
19. Ibrahim M, Udomah MG, Abdulwahab I. Infant mortality at Usmanu Danfodiyo University Teaching Hospital, Sokoto. *Nigerian Journal of Paediatrics*. 1993; **20**: 1720
20. Ibe BC. Neonatal infections in Azubuike JC, Nkangineme KEO, Textbook of Paediatric and Child Health in the Tropical Region. 2nd ed. University of Port-Harcourt Press Ltd, 2007; 197-204
21. Mugalu J, Nakakeeto MK, Kiguli S and Kaddu Mulindwa DH. Aetiology, risk factors and immediate outcome of bacteriologically confirmed neonatal septicaemia in Mulago hospital, Uganda. *African Health Sciences*. 2006; **6** (2): 120-126

22. Stoll BJ, Hansen NI and Adams-Chapman I. Neurodevelopmental and growth impairment among extremely low-birth-weight infants with neonatal infection. *Journal of American Medical Association* 2004; **292**(19):2357-2365.
23. Ogunlesi TA, Ogunfowora OB, Osinupebi O and Olanrewaju DM. Changing trends in newborn sepsis in Sagamu, Nigeria: Bacterial aetiology, risk factors and antibiotic susceptibility. *Journal of Paediatrics and Child Health* 2011; **47**: 511
24. The WHO multicentre study group. Clinical prediction of serious bacterial infections in young infants in developing countries. *Pediatric Infectious Diseases Journal*. 1999; **18**:2331
25. Baltimore RS. Neonatal sepsis: epidemiology and management. *Paediatric Drugs*. 2003; **5**:723-740.
26. Ogunlesi TA and Ogunfowora OB. Predictors of Mortality in Neonatal Septicemia in an Underresourced Setting. *Journal of the National Medical Association*. 2010; **102** (10)915-920
27. Motara F, Ballot DE and Perovic O. Epidemiology of neonatal sepsis at Johannesburg Hospital. *Southern African Journal of Epidemiology and Infections*. 2005; **20**: 90-93.