

**ORIGINAL RESEARCH ARTICLE**  
**TITLE: IMPACT OF SOCIOECONOMIC FACTORS ON NEONATAL SEPSIS  
IN JOS, NIGERIA**

**Dr. Onyedibe, Ken**

**Authors:**

**Onyedibe K I, Utoh-Nedosa A U, Okolo M**

**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** *Faculty of Health Science, Jos University, P. M. B. 5025, Anambra State,  
BSc., MSc., PhD Department of Pharmacology and Toxicology, Faculty and T*

**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, Fort Collins, CO, USA*

**Dr. Bode-Thomas, Fidelia** *MBBS, FMCPATH, 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 is a leading cause of 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 a rural environment.

**Methodology:** The study was a cross-sectional study conducted in Jos (JUTH), Jos, North Central, Nigeria. Clinical and demographic data were obtained from the medical records of 218 neonates enrolled into the study by their mothers. A questionnaire was administered to the mothers. Data collected were analyzed by EPI-INFO. Blood and stool samples were also collected from the neonates and processed by standard microbiological methods in the 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*. The overall percentage of culture proven sepsis was 52.2%. Mothers with no formal primary education also had high proportions of culture proven sepsis. Place of domicile, level of education of mother and poor feeding were significantly associated with 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 provision of social amenities will go a long way in reducing the morbidity and mortality associated with neonatal sepsis in a rural 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.<sup>1</sup> 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.<sup>2, 3</sup> 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.<sup>4</sup>

Neonatal sepsis occurs in 0.5 to 8.0 per 1000 live births.<sup>5</sup> 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.<sup>1, 5</sup> In most developing countries, gram-negative bacteria remain the major cause of neonatal sepsis.<sup>6,7</sup> These organisms have developed increased drug resistance over the last two decades and management of neonates with sepsis has become a major problem.<sup>8, 9</sup> 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.<sup>10</sup> 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.<sup>11-15</sup>

Neonatal sepsis is very prevalent in sub-saharan Africa and contributes up to 69% to neonatal mortality in Nigeria and other parts of Africa.<sup>16-21</sup> 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.<sup>22</sup> 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.<sup>24</sup> 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 37<sup>th</sup> 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 (%)			
<b>Age (Days)</b>						
≤ 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
<b>Gender</b>						
Male	119	40 (33.6)	79 (66.4)			
Female	99	35 (35.4)	64 (64.6)	0.78	0.44-1.40	0.412
<b>Place of domicile</b>						
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
<b>Level of education of mother</b>						
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
<b>Place of delivery</b>						
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
<b>Good cord care</b>						
Yes	98	31 (31.6)	67 (68.4)			
No	87	44 (50.6)	43 (49.4)	0.42	0.25-0.82	0.009
<b>Poor feeding</b>						
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.<sup>25</sup>

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.<sup>23, 26</sup> 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<sup>13, 23</sup> and other parts of Africa.<sup>21, 27</sup> 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 Sagamu<sup>23</sup> and Motara and co-workers in Johannesburg.<sup>27</sup>

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.<sup>21, 26</sup>

## 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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