TREND AND SEASONALITY IN ADMISSION AND OUTCOME OF LOW BIRTHWEIGHT INFANTS IN GWAGWALADA-ABUJA, NIGERIA

Richard Onalo

Department of Paediatrics,

University of Abuja Teaching Hospital, Gwagwalada, Abuja.

Kudirat E. Olateju

Department of Paediatrics,

University of Abuja Teaching Hospital, Gwagwalada, Abuja.

Correspondence: Dr Richard Onalo

Email: richardonalo@yahoo.com

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Abstract

Background: Low birthweight is an important contributor to neonatal morbidity and mortality. Various interventions have been instituted toward the reduction in the incidence of low birthweight deliveries and admissions. Knowledge of the current trend and seasonality in low birthweight admission is required in the control of the condition.

Objectives: To determine the trend and seasonality in admission and outcome of low birthweight deliveries.

Methods: Retrospective review of records of babies admitted into the Special Care Baby Unit of University of Abuja Teaching Hospital, with birthweights below 2500 grams over a 5-year period, from January 2006 through December, 2010, was undertaken and the data obtained were analyzed using Epi Info version 3.5.2 software. A p value of <0.05 was set as point of statistical significance.

Results: A total of 4358 babies were admitted into the Special Care Baby Unit during the study period, out of which 502 had low birthweight. Thus the unit's prevalence of low birthweight is 11.5%. The proportion of infants admitted with low birthweight was fairly constant over the years but there was variation in monthly distribution. On the overall, survival rate steadily increased from 65.5% in 2006 to 76.0% in 2009 at an average rate of 2.6% per annum. Babies admitted during the wet/rainy season had higher mortality rate (27.6% versus 17.7%).

Conclusion: Low birthweight has continued to be one of the major reasons for admission of infants in the locale of study. Significant seasonal pattern in the outcome of infants with low birthweight exists. Reasons for seasonality in low birthweight admission and outcome are subjects of further studies.

Introduction

Low birthweight contributes a significant proportion to neonatal mortality. Efforts at reduction of low birthweight deliveries have reduced the incidence of low birthweight babies in some settings,[1] but the prevalence of the condition in Nigeria is still far beyond the average for the more developed countries of the world.[2] The National Demographic and Health Survey (NDHS, 2003)[3] classed the north-central Nigeria among zones with the highest low birthweight rate, second only to the north-east region. Although the national average[3] was 14% in 2003, a recent study[4] from Enugu reported a lower incidence of 10.3%, suggesting a gradual decline in low birthweight rate. Concerted efforts at sustaining the reduction in prevalence of low birthweight infants are encouraged. Seasonal variation in incidence of diseases and hence outcome have provided caregiver ample opportunity to strategise for the control and prevention of some childhood illnesses like asthma, allergic dermatitis and other seasonal phenomena. Few studies[5,6] have related seasonal variation with neonatal morbidity such as neonatal hypothermia and neonatal infection but with conflicting results. The study of Enabudoso et al[7] suggests a significant association between season and delivery rate which was adjudged to be due to variation in conception rate at the various months of the year. There is however paucity of data on the influence of season on the admission rate and outcome of low birthweight infants in Nigeria, knowledge of which is required in the comprehensive package for the management of this group of infants. In addition, identification of causal environmental factors may have public health implications in the development of primary prevention programs for low birth weight in developing countries. This study is structured to provide useful information on the trend and effect of season on admission and outcome of low birthweight infants in the central part of Nigeria.

Methods

A retrospective analysis of admission into the Special Care Baby Unit of University of Abuja Teaching Hospital between the months of January, 2006 and December, 2010 was conducted. The hospital, which transformed into a teaching hospital in 2006, is located in Gwagwalada, northcentral Nigeria and receives referral from different parts of the Federal Capital Territory and the neighbouring states. The unit has a bed capacity of thirty-two and admits babies brought in from the delivery suite of the hospital and those of other health facilities as well as those brought from home. On the average, about 900 babies are admitted into the unit annually. Approval was obtained from the hospital's ethics committee and consent was sought and obtained from the head of Health Information Department before extracting data from the patients' hospital records. Relevant information was obtained from admission records and patients folder with particular attention to infants weighing less than 2500 grams at birth. Extracted data included date of admission, birthweight, gestational age, place and time of delivery, important clinical conditions and outcome of management. Based on local climate, the year was divided into the following seasons: dry (November – April) and wet/ rainy (May – October).

Data analysis

Data obtained was entered into a personal computer and analyzed using Epi info statistical software version 5.3.2 (CDC, Atlanta, 2008). Frequency tables and proportions were calculated. Seasonality of admission, morbidity and outcome were examined by creating frequency tables and line diagrams of proportion of infants admitted with birthweight below 2500 grams. Influence of delivery characteristics on outcome was also examined. Categorical variables were

tested for significance using Chi square with Yate's correction and Fisher exact tests where applicable. Statistical significance was set at $p < 0.05$.

Results

A total of 4358 babies were admitted into the Special Care Baby Unit during the study period, out of which 502 (11.5%) were recorded to have been of low birthweight (Table I). The proportion of infants admitted with low birthweight was fairly constant over the years, even though the figure fell slightly from 12.4% in 2006 to 9.4% in 2008 (Figure 1) but then rose again to 10.7% and 13.7% in 2008 and 2009, respectively. Two hundred and fifty-four (50.6%) of the LBW babies were admitted during the dry season (November-April) while the remaining 248 (49.4%) presented during the rainy/wet season (May-October).

Monthly incidence of low birthweight infant's admission. The monthly distribution of admissions of low birthweight infants as shown on Table I revealed that the proportion of babies with low birthweight varied from month to month but fluctuated between 8.3% and 15.6%. The incidence of low birthweight declined from its peak of 15.6% in January to values below 11.0% in the months of March (8.3%), April (10.9%), May (9.3%) and June (8.4%) but rose to values above 12% in the months of July (12.5%), August (14.3%) and September (13.8%).

Annual and monthly trend in outcome of low birthweight infant's admissions. The trend in the outcome of low birthweight infants is shown on Table II, Figure 1 and 2). On the overall, survival rate steadily increased from 65.5% in 2006 to 76.0% in 2009 at an average rate of 2.6% per annum. In the converse, the annual mortality pattern decreased, less predicatively, from 21.6% in 2006 to 19.0% in 2010. The year 2008 had the lowest mortality rate (12.6%), while the highest (28.6%) was recorded in 2007(Figure 1).

Seventy-one (31.6%) of the 163 LBW infants admitted (with known outcome) during the wet season (May-October) died, while 80 (36.2%) deaths occurred among the 288 babies with known outcome admitted during the dry season (November-April) (Table III). This difference was statistically significant ($x^2 = 5.51$, $p = 0.0189$). Babies delivered during the daytime (7 am-6 pm) fared better than those delivered between 7 pm and 6 am: the relative risk of death among those delivered between 7 am and 6 pm was 0.80 as against 1.25 for those delivered during the night hours (Table III), even though the observed difference fell short of statistical significance ($p = 0.3099$).

Influence of season on low birthweight infant's morbidity. Of the 502 low birthweight infants recruited, detailed day-to-day clinical notes were available for only 446 of them, thus these were the ones subjected to further analysis. The morbidity recorded among the 446 patients were numerous and varied but the common ones included jaundice, anaemia, malaria, thrombocytopenia, recurrent apnoea and symptomatic hypoglycaemia (Table IV). Few cases (7) of respiratory distress syndrome were recorded. The frequency of occurrence of these morbid conditions was slightly, but insignificantly, higher in the wet season (May-October) than in the dry season (November-April) ($p > 0.05$).

Discussion

The incidence of LBW admissions in this study (11.5%) is less than the global average (15.5%) and that of the continent of Africa (14.4%).[2] This finding is encouraging and did suggests that the community health interventions are yielding desirable results. However, that the incidence has remained fairly constant over the years indicates that a lot more needs to be done.

Although the yearly distribution of low birthweight admissions did not reveal declining incidence rate, the incidence of 11.5% recorded in the present study is lower than the 16.0% documented in the 2003 National Demographic Health Survey[3] report for the northcentral region of Nigeria but similar to the 12% for the southwest region of the country. This observation suggests that the northcentral region is probably improving in terms of literacy level and socioeconomic status, which were the predominant factors for the good health indices recorded in the southwest region of Nigeria.[3]

The monthly distribution of low birthweight admissions suggests a bimodal distribution with peaks at January- February period, being the dry season and another in the months of August-September, being the rainy season period. This finding is similar to (but for the unimodal distribution) the observation made by Rayco-Solon[8] which had higher prevalence of low birthweight admission during the rainy season (between the months of July to October).

The reasons for the bimodal distribution are not known with certainty but adverse environmental conditions[9-16] has been adduced, including the effect of malaria transmission, environmental pollution and exposure to sunlight and low ambient temperatures as well as heavy maternal physical activities during pregnancy. Women are at the greatest risk of delivering low birthweight babies when they have been pregnant during most of the rainy season and deliver

towards the end of it, or at the beginning of the dry season.[10] This might have accounted for the high proportion of babies admitted with low birthweight in the months of July, August and September, period that incidentally coincide with high malaria transmission. It was predicted by Wort et al[10] that the effect of malaria on birthweight could occur three months after the malaria peak and last for five months. This could probably account for the extension of periods of high low birthweight admission into the early part of the year (January and February) in the present study. Furthermore, seasonal variation in carbon monoxide (CO) atmospheric pollution which appears to peak in December and January might have played at least a minimal role. A study by Araban et al from Iran[12] showed a significant association between exposure to carbon monoxide and low birthweight (OR = 2.08, 95% Cl: 1.70-4.60), particularly during the second trimester (OR = 3.96, Cl: 1.83-12.5). High vehicular movement during the December and January months, occasioned by the multiple holidays and festivities that characterized the period, could increase the atmospheric CO level and hence high maternal plasma CO and fetal COHb levels with consequent restriction in fetal growth and low birthweight deliveries. Similarly, high maternal physical activities during the harvest season and periods of increased household chores occasioned by the high festivity that characterized the last months of the year could be among the reasons for the high incidence of low birthweight admissions in the months of January and February.

The result of the study also showed that low birthweight infants admitted during the rainy/wet season had higher mortality rate than those in the dry season. The reasons for this observation are not known, but may not be unrelated to the high infection rate that characterized the rainy season occasioned by the high humidity.[6] Further studies are therefore recommended to determine

reasons for the relatively poorer outcome among low birthweight infants admitted during the rainy season.

Conclusion

The incidence of low birthweight admissions has remained fairly constant over the years but with monthly and seasonal variations in proportion and in outcome. Mortality is highest during the wet season. Reasons for the trend in incidence and outcome are subject of further studies.

Competing interest

None to declare

Authors' contributions

'Author RO' designed the study, performed the literature searches, wrote the protocol, wrote the first draft of the manuscript, and performed the statistical analysis. 'Author KEO' performed the data collection. Both authors read and approved the final manuscript."

References

1. Lopez NB, Choonara I. Can we reduce the number of low birthweight babies? The Cuban experience. *Neonatol* 2009; **95**: 193-7.

2. WHO, UNICEF. Low birthweight: Country, regional and global estimates. United Nation's Children Fund and World health Organisation, LBW Cr. UNICEF, New York, 2004.

3. Nigeria Demographic and Health Survey 2003. Calverton, Maryland: National Population and ORC/Macro; 2004.

4. Ezugwu EC, Onah HE, Odetunde IO, Azubuike JC. Singleton low birthweight babies at a tertiary hospital in Enugu, South East, Nigeria. Internet J Obstet Gynaecol 2010; 14

5. Mullany LC, Katz J, Khatry SK, LeClerq SC, Darmstadt GL, Tielsch JM. Incidence and seasonality of hypothermia among newborns in southern Nepal. *Arch Pediatr Adolesc Med* 2010; **164**: 71-7.

6. Shah PS, Yoon W, Kalapesi Z, Bassil K, Dunn, Lee SK. Seasonal variations in healthcare-associated infection in neonates in Canada. Arch Dis Child Fetal Neonatal Ed. 2012.doi:10.1136/fetalneonatal-2011-301276.

7. Enabudoso EJ, Okpighe AC, Gharoro EP, Okpere EE. Delivery rate in Benin City, Nigeria: are there seasonal variations? *Niger J Clin Pract* 2011; **14**: 129-31.

8. Moraes AB, Zanini RR, Giugliani ER, Riboldi J. [Trends in the proportion of low birth weight from 1994 to 2004 in Rio Grande do Sul State, Brazil: a multilevel analysis]. Article in Por. *Cad Saude Publica* 2011; **27**:229-40.

9. Amosu AM, Atulomah NOS, Olarewanju MF, Akintunde TI, Babalola AO, Akinnuga AM, Ojezele MO. Retrospective study of some factors influencing delivery of low birthweight babies in Ibadan, Oyo state, Nigeria. *Scientific Res Ess* 2011; **6**: 236-40.

10. Wort UU, Hastings IM, Carlstedt A, Mutabingwa TK, Brabin BJ. Impact of El Niño and malaria on birthweight in two areas of Tanzania with different malaria transmission patterns. *Int J Epidemiol* 2004; **33**: 1311–19.

11. Nkhoma ET, Kalilani-Phiri L, Mwapasa V, Rogerson SJ, Meshnick SR. Effect of HIV infection and Plasmodium falciparum parasitemia on pregnancy outcomes in Malawi. *Am J Trop Med Hyg* 2012; **87**: 29-34.

12. Araban M, Kariman N, Tavafian SS, Motesaddi S, Alavimajd H, Shokravi FA. Air pollution and low birth weight: a historical cohort study from Tehran. *East Mediterr Health J* 2012; **18**: 556-60.

13. World Health Organization. Air Quality guidelines: Carbon monoxide. WHO Regional Office for Europe, Copenhagen, Denmark, 2000 4 available online at http://www.euro.who.int/__data/assets/pdf_file/0020/123059/AQG2ndEd_5_5carbonmonoxide.PDF.
14. Rousham EK, Gracey M. Seasonality of low birthweight in indigenous Australians: an increase in pre-term birth or intrauterine growth retardation? *Aust N Z J Public Health* 1998; **22**: 669-72.

15. Strand LB, Barnett AG, Tong S. The influence of season and ambient temperature on birth outcomes: a review of the epidemiological literature. *Environ Res* 2011; **111**: 451-62.

16. Torche F, corvalan A. Seasonality of Birth Weight in Chile: Environmental and Socioeconomic Factors. *Ann Epidemiol* 2010; **20:** 818–26.

17. Dwarkanath P, Muthayya S, Vaz M, Thomas T, Mhaskar A, Mhaskar R, Thomas A, Bhat S, Kurpad A. The relationship between maternal physical activity during pregnancy and birth weight. *Asia Pac J Clin Nutr* 2007*;* **16***:* 704-10.

Table I: Yearly and monthly distribution of low birthweight infants studied

Year of admission	Number of newborns admitted N(% of total)	Number of low birthweight infants n(% of N)	Number of low birthweight infants that survived (% of n)	Number of low birthweight infants that died (% of n)	Number of low birthweight with unknown outcome (% of n)
2006	937 (21.5)	116(12.4)	76(65.5)	25(21.6)	15(12.9)
2007	826 (19.0)	77(9.4)	50(64.9)	22(28.6)	5(6.5)
2008	1009 (23.2)	103(10.2)	73(70.9)	13(12.6)	17(16.5)
2009	886 (20.3)	121(13.7)	92(76.0)	20(16.5)	9(7.4)
2010	700 (16.1)	85(12.1)	64(75.3)	16(18.8)	5(5.9)
Total	4358(100.0)	502(11.5)	355(70.7)	96(19.1)	51(10.2)
January	307(7.1)	48(15.6)	28(58.3)	15(31.3)	5(10.4)
February	371(8.5)	57(15.4)	43(75.4)	9(15.8)	5(8.8)
March	434(10.0)	36(8.3)	23(63.9)	9(25.0)	4(11.1)
April	414(9.5)	45(10.9)	29(64.5)	6(13.3)	10(22.2)
May	376(8.6)	35(9.3)	24(68.6)	10(28.5)	1(2.9)
June	359(8.2)	30(8.4)	17(56.7)	10(33.3)	3(10.0)
July	271(6.2)	34(12.5)	28(82.3)	4(11.8)	2(5.9)
August	406(9.3)	58(14.3)	44(75.9)	10(17.2)	4(6.9)
September	349(8.0)	48(13.8)	38(79.2)	6(12.5)	4(8.3)
October	453(10.4)	43(9.5)	32(74.4)	5(11.6)	6(14.0)
November	319(7.3)	41(12.9)	27(65.8)	9(22.0)	5(12.2)
December	299(6.9)	27(9.0)	22(81.5)	3(11.1)	2(7.4)
Total	4358(100.0)	502(11.5)	355(70.7)	96(19.1)	51(10.2)

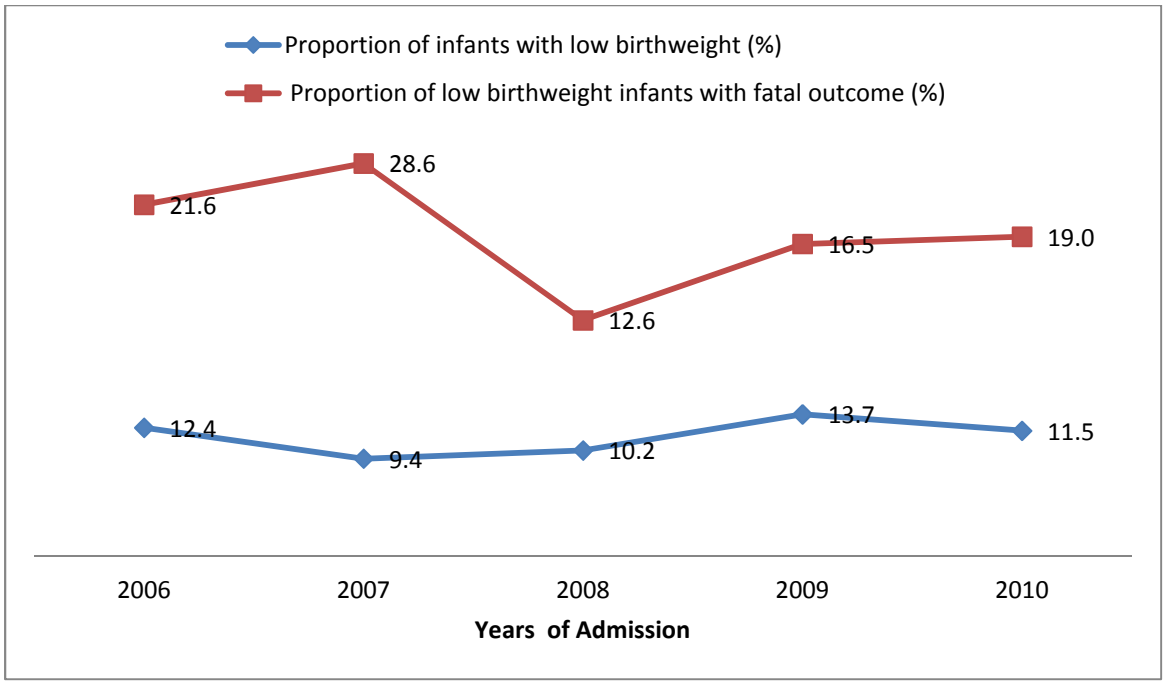

Figure 1: Trend in the yearly admission and outcome of low birthweight infants

Table II. Monthly and yearly rates of survival of low birthweight infants in percentages

Months	Rates of low birthweight survival					Overall
	Years of study					
	2006	2007	2008	2009	2010	
January	76.9	80.0	66.7	53.8	88.8	**58.3**
February	55.5	100	80.0	92.8	80.0	**75.4**
March	75.0	66.7	60.0	77.8	75.0	**63.9**
April	66.7	50.0	81.8	100	100	**64.5**
May	73.7	25.0	66.7	No LBW	100	**68.6**
June	81.8	50.0	0	57.1	66.7	**56.7**
July	90.0	80	100	90.9	66.7	**82.3**
August	72.7	66.7	100	70.0	87.5	**75.9**
September	50.0	100	100	81.8	91.7	**79.2**
October	100	85.7	88.8	100	50.0	**74.4**
November	75.0	75	80.0	80.0	66.7	**65.8**
December	80.0	80	100	100	66.7	**81.5**
Overall	**65.5**	**64.9**	**70.9**	**76.0**	**75.3**	**70.7**

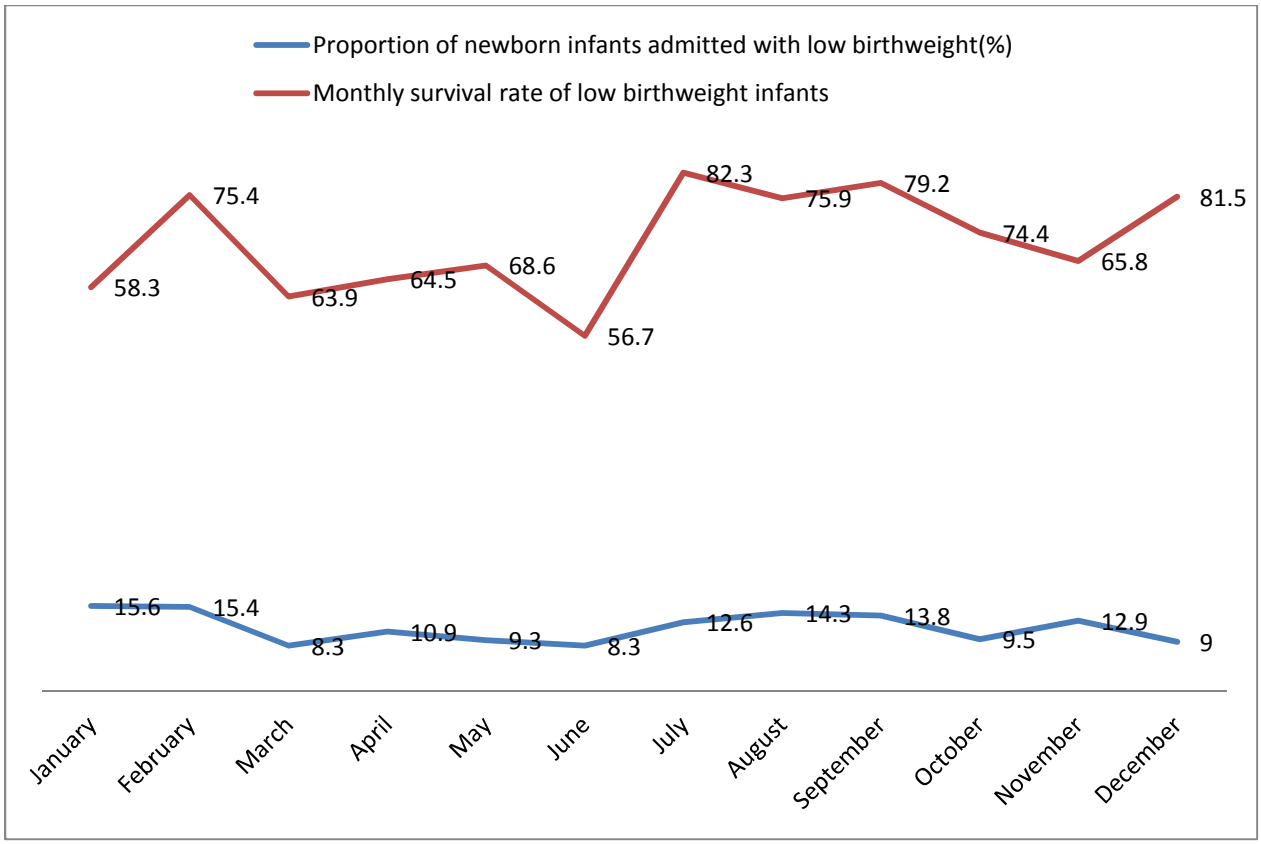

Figure 2: Trend in the monthly admission and outcome of low birthweight infants

Table III: Interplay of seasons and time of delivery on outcome of low birthweight infants

Variables	**Outcome**		**RR (95% CI of RR)**	**p**
	Died (% of n)	Survived (% of n)		
Season				
Wet (n = 163)	45 (27.6)	118 (87.2)	1.56 (1.10-2.22)	0.0189
Dry(n = 288)	51 (17.7)	237 (82.3)	0.64 (0.45-0.91)	
Time of delivery				
7am-6pm (n = 172)	37 (21.5)	135 (78.5)	1.25(0.85-1.84)	0.3099
7pm-6am (n = 156)	42 (26.9)	114 (73.1)	0.80(0.54-1.17)	

Wet season = months of May to October, dry season = months of November to April

Table IV: Relationship between season and common morbidity among low birthweight infants

Conditions	Season				
	Wet (n=225)	Dry (n=221)	Total N=446	RR(95% CI)	P
Jaundice	84 (37.3)	69 (31.2)	153 (34.3)	0.87(0.71-1.07)	0.2078
Anaemia	33 (14.7)	32 (14.5)	65 (14.6)	1.06(0.65-1.59)	0.9370
Thrombocytopenia	30 (13.3)	22 (10.0)	52 (11.7)	1.34(0.60-2.25)	0.3350
Malaria	26 (11.6)	22(10.0)	50 (11.2)	1.06(0.63-1.75)	0.9340
Recurrent apnoea	18 (8.0)	13 (5.9)	31 (7.0)	1.35(0.68-2.71)	0.4883
Symptomatic hypoglycaemia	7 (3.1)	6 (2.7)	13 (2.9)	1.15(0.39-3.36)	0.9738
Respiratory distress syndrome	10 (4.4)	9(4.1)	19 (4.3)	1.09(0.45-2.63)	0.9681

Wet season = months of May to October, dry season = months of November to April