

ORIGINAL REPORT

Determinants of Survival till Discharge among Admitted Very Low Birth Weight Neonates in Zaria  
Nigeria

Authors: Abdulkadir .I<sup>1</sup>, Sobowale .AM<sup>1</sup>, Abdullahi .FL<sup>1</sup> Hassan. L<sup>1</sup>

<sup>1</sup>Neonatal Unit, Department of Paediatrics, Faculty of Clinical Sciences College of Health Sciences  
Ahmadu Bello University/ Teaching Hospital Zaria, Kaduna State, Nigeria.

Corresponding Author Email: isaburamla@yahoo.com; isaabdulkadir@abu.edu.ng  
Phone: +2348023607277

DOI

**Abstract**

**Introduction**

In comparison to babies with normal birth weight (BW), babies weighing < 2500 g at birth have increased risk of morbidity and mortality. Very low birth weight babies (BW= 1000 – 1499g) are at higher risk of intraventricular haemorrhage (IVH), sepsis, hypothermia and long term sequelae including neurodevelopmental delays and cerebral palsy. They also have a 22% chance of dying within their first year of life.

**Objective:**

To assess the determinants of survival till discharge in very low birth weight (VLBW) neonates

**Materials and Methods:** This was a retrospective review of patients' records over a 10-year period from January 2005 to December 2014 involving neonates weighing 1000 – 1499g at birth admitted into the neonatal unit of Ahmadu Bello University Teaching Hospital. Data extracted were entered into SPSS v20 and subjected to statistical analysis

**Results:**

A total of 4942 neonates were admitted over the period of which 213 (4.3%) were VLBW. The

mean birth weight was 1240 ± 150g and survival was 61.5% and ranged from 44.8 to 77.8%. A mortality of 38.5% was recorded among the 205 of the 213 who had documented outcomes while survival was higher in females (73.3%) compared to males (49%). Birth weight, gender, maternal age and duration of hospital stay significantly determined outcome.

**Conclusions:**

Survival among VLBW babies was 61.5% and was positively influenced by higher birth weight, female sex, younger maternal age and longer duration of hospital stay.

**Recommendation**

Neonates with identified factors for increased risk of poor outcome should receive more and closer monitoring while on admission

**Keywords:** Birth weight, morbidity, mortality, survival, outcome.

## Introduction

Babies who weigh less than 2500g at birth are faced with increased challenges of survival, the severity of which varies among the different categories of babies. The categories include the low birth weight (LBW), very low birth weight (VLBW) and the extremely low birth weight (ELBW) babies. The VLBW babies defined as babies weighing 1000 – 1499g at birth mainly result from preterm deliveries and intrauterine growth restriction leading to small for gestational age (SGA) babies.<sup>2, 7</sup> Globally, the incidence of preterm birth is increasing due to implementation of novel technologies and interventions which lead to better pregnancy outcomes.<sup>7</sup> Generally LBW babies are particularly susceptible to higher morbidity and mortality compared to normal birth weight ( $\geq 2500\text{g} - 3999\text{g}$ ) neonates. The VLBW babies category are at increased risk of intraventricular haemorrhage (IVH), sepsis, hypothermia and long term sequelae including neurodevelopmental delays and cerebral palsy.<sup>8, 9</sup> They also have a 22% chance of dying within their first year of life.<sup>3</sup> These make them a major contributor to perinatal and infant mortality statistics.<sup>1-6</sup> In order to improve survival, decrease morbidity and as well improve quality of life among survivors, an assessment of the factors that impact mortality/survival in VLBWs is imperative. This study aimed to assess the determinants of survival till discharge in very low birth weight neonates.

## Methods

This study was a retrospective review of patients' records of over a 10-year period from January 2005 to December 2014 involving neonates weighing 1000 – 1499g at birth admitted into the special care baby unit of a Teaching Hospital. Records for 2012 were missing and thus excluded from analysis. The institution is a tertiary healthcare facility. The 30-cot unit is manned by consultants, full complement of residents and trained specialized nurses and receives referrals from

other health care facilities within northwestern Nigeria. Ethical approval for the study was obtained from the hospital research and ethics committee. Variables extracted from the admission register records include sex, maternal age and parity, mode of delivery, category of multiplicity of gestation, duration of stay on admission and outcome. Data were entered into SPSS v20 and subjected to statistical analysis. Direction and significance of association of the various foeto-maternal factors with outcome was done using Multivariate Logistic Regression. The primary outcome of interest was survival till discharged home.

## Results

A total of 4942 neonates were admitted over the period, of which 213 (4.3%) were within the weight category of VLBWs. The mean birth weight of the VLBW neonates was  $1240 \pm 150\text{g}$ . The frequency distribution by year of the VLBW neonates is shown in figure 1. In the years 2006 to 2009 less than 20 VLBW neonates were consistently admitted yearly while in 2005 twenty-five (25) VLBW neonates were admitted. From the year 2010, the number of yearly VLBW admissions remained higher than 20 with the least number (22) recorded in 2010 while 44 VLBW admissions were recorded in 2013. (Table I) The average yearly VLBW admission during the period 2005 to 2009 was 17.2 VLBW admission per year with an average of 3.2% VLBW of total admissions. From 2010 – 2014 the average yearly VLBW admissions was 31.8 while the average proportion of VLBW admissions to the total admissions was 5.8% over the same period. Of the 213 documented VLBW babies only 205 had documented outcomes with a mortality of 38.5% (Table I).

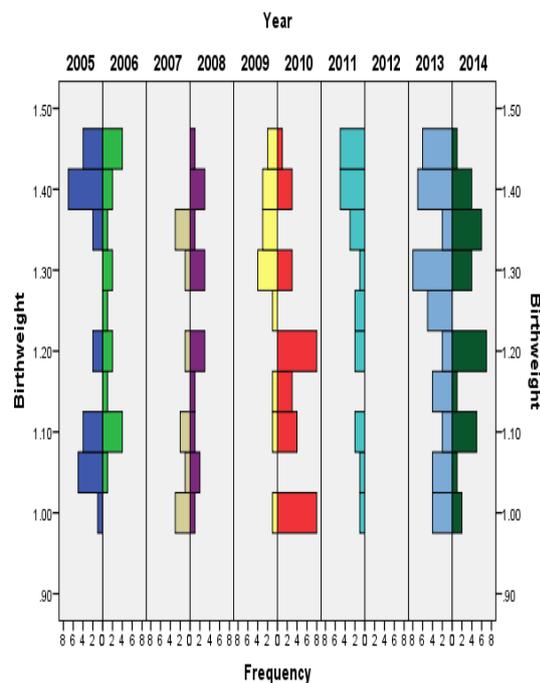


Figure 1: The frequency distribution by Year of Very Low Birth Weight Neonates.

Table I: Distribution of Admissions and Outcomes of Very Low Birth Weight Neonates

Year	VL BW	VLBW as % of Total Adm.	% Surv.	VLBW Total mortality Mort. as % of total mortality	Total Mort
2005	25	3.9(642)	68.2	7 (10.8)	65
2006	18	4.1(442)	68.8	5(7.9)	63
2007	11	2.1(519)	77.8	2(4.4)	45
2008	16	3.0(534)	68.8	5(8.9)	56
2009	16	2.9(554)	68.8	5(7.7)	65
2010	30	5.5(547)	44.8	16(22.2)	72
2011	22	3.7(602)	59.1	9(14.2)	63
2013	44	7.3(605)	63.6	16(19.5)	82
2014	31	6.2(497)	54.8	14(25)	56
<b>Total</b>	<b>213</b>		<b>61.5</b>		<b>567</b>

\*Indicates percentages obtained after excluding neonates without documented outcome. Survival was higher (73.3%) amongst females (Table II).

Table II: Outcome by Gender of the VLBW Neonates. N=205.

Gender	Outcome		
	Discharged	Died	Total
Male	49 (49.0)	51(51.0)	100
Female	77 (73.3)	28 (26.7)	105
	126 (61.5)	79 (38.5)	205

Table III: Maternal Age and Outcome of Very Low Birth Weight Babies

MothersAge range (Years)	Outcome(%) Dschrgd	Total(%) Died
--------------------------	--------------------	---------------

<18	3 (2.3)	1(1.3)	4 (2.0)
19 – 24	92(73.0)	53(67.1)	145 (70.7)
25 – 35	23 (18.3)	14 (17.7)	37 (18.0)
>36	8 (6.3)	11 (13.9)	18 (8.8)
<b>Total</b>	<b>126</b>	<b>79</b>	<b>205</b>

Singleton births accounted for 80.0% of the deliveries, 19.0% and 1.0% being twin and triplet deliveries respectively. About forty-one percent of the neonates spent a week or less on admission with 66.7% of these dying while 28.9% spent between 8 – 14 days and 69.5% survived. 5% of total VLBW admission spent more than 5 weeks on admission with a 90% survival rate amongst them.

The largest proportion (71.4%) of VLBW neonates was born to mothers aged between 19 to 24 years. The highest number of survivors, 92 babies (73.6%) were also born to mothers in this age group table III. About a third (37.6%), 52.5% and 9.9% of the VLBWs were born to mothers who were primipara, multipara and grand -multipara respectively. The highest (56.0%) proportion of surviving neonates was found amongst those born to multiparous

mothers (table IV). About sixty-five of the neonates were born via vaginal delivery of which 61.2% survived.

**Table IV: Maternal Parity and Outcome of Very Low Birth Weight Babies.**

Outcome	Primipara (%)	Multipara (%)	Grand multipara (%)
Discharged	46 (36.5)	71 (56.3)	9 (7.1)
Died	31 (39.2)	37 (46.8)	11 (13.9)
<b>Total</b>	<b>77</b>	<b>108</b>	<b>20</b>

Birth weight, male gender, younger maternal age <25 years and longer duration of hospital stay significantly determined outcome in this category of neonates table V.

**Table V: Multivariate Logistic regression analysis with death as outcome and adjusted estimates of Odds Ratio (95% Confidence interval)**

Variable	Odds Ratio	95% Confidence Interval	P-value
Birth weight	0.001	0.000 - 0.011	0.000
Year	1.117	0.981 - 1.271	0.096
Gender (Male)	3.313	1.478 - 7.430	0.004
Parity	0.866	0.440 - 1.706	0.677
Maternal age	1.087	1.007 - 1.174	0.033
Mode of Delivery	1.017	0.443 - 2.336	0.968
Days on admission	0.832	0.783 - 0.884	0.000

## Discussion

The general trend showed an increase in the number of VLBW babies admitted in the later years with fewer VLBW babies admitted yearly before 2010. This is in keeping with findings from other studies where it has been documented that there is rise in low-birth-weight births due to improvement in both maternal and newborn healthcare services.<sup>3,4</sup> The increasing VLBW admission trend was however, accompanied with a recorded decrease in the percentage survival. This is explicable when viewed against the backdrop of an increase in the proportion of neonates with birth weights at the lower extreme of the very low birth weight category. Such neonates are less likely to survive considering that they are less endowed to surmount the numerous adverse newborn conditions they are at risk of compared to others with higher birth weights though still within the very low birth weight category. This is corroborated by the findings in the study which showed that in the years (2010, 2014) with lower VLBW survival, a significant proportion of admissions in the VLBW category comprised those in the lower birth weights of 1000 – 1200g as seen in Figure 1. A greater proportion (71.4%) of VLBW neonates were of mothers aged 19 – 24 years; Shinde<sup>10</sup> and his co-authors reported similar findings with 52.4% of the mothers they studied aged 25 years or below. This age represents partly a period within which fertility peaks and is likely to constitute a larger proportion of mothers and by extension complications and outcomes of pregnancy such as VLBW.

The overall survival of VLBW neonates was 61.5% (44.8% – 77.8%). The survival of VLBW infants worldwide varies considerably among regions, countries and over period of review. Ballot *et al* showed that survival among VLBW babies in India is 63% while it rose from 75% in 1983 to 90% in 1995 in the Netherlands.<sup>11</sup> In Johannesburg survival of 85.8% was reported in

2010 covering the period from 2006- 2007 representing a rise from 71% in the 2000- 2002 period.<sup>11</sup> In Kenya varying rates have been reported with VLBW survival rates as high as 68% reported from Nairobi while in Eldoret<sup>4</sup>, a sharp contrast, an 83% mortality was reported among VLBW neonates. In Port Harcourt, Nigeria Ugwu and Eneh reported a survival of 39.3% amongst VLBWs seen in a tertiary facility over an eight year period from 2002 - 2009.<sup>12</sup> These variations are the outcome of the preponderant forces resulting from the intricate interplay between poor outcome determining factors on one hand and the availability, affordability and accessibility to proficient and optimal care on the other hand. Factors determining survival are numerous and act in combination or individually to influence outcome in newborns. The study found that birth weight (OR = 0.001), as documented by other studies,<sup>11-14</sup> was an important factor which determined the fate of newborns such that the risk of death decreased with increasing birth weight and vice versa. Birth weight, a reflection of a complication free and completed gestation period, is among the important determinants of newborn maturity a precept for survival. The duration of stay in SCBU also significantly impacts on outcome as a baby is more likely to survive till discharge after surviving the first week as reports have shown that most neonatal deaths (75%) occur within the first week of life.<sup>15</sup> Male neonates and the babies born to older mothers were more likely to die. Other studies have documented that male sex, is associated with poor outcome and increased risk of death.<sup>13-17</sup> This has been variously associated with favourable immune competence of the female neonate compared to their male counterpart such that exposure to sepsis, a common cause of neonatal morbidity, may result in more risk of male neonatal deaths. Other studies, in explaining the increased risk of death from hyaline membrane disease, a common morbidity among preterm neonates, have

suggested that higher levels of prolactin in female neonates are associated with lower incidence of respiratory distress syndrome in contrast to males in whom androgen delays maturation of lungs.<sup>13-17</sup> The results of relationship between maternal age and neonatal death has varied between studies.<sup>18-20</sup> This study found that maternal age 19-24 years was a significant determinant of neonatal survival in keeping with the study of Sharma *et al.*<sup>18</sup> Teenage motherhood has been associated with numerous challenges ranging from economic, psychosocial to physiological issues including growth and developmental attainments. These determine the quality of health status of such mothers during pregnancy and the newborn care they can offer.<sup>18-21</sup> At the other extreme, advanced maternal age (> 35 years) has also been shown to be associated with increased risk of neonatal death as a result of increased risk of medical conditions which expose the foetus and neonate to increased morbidity and risk of death.<sup>19,20</sup>

### Conclusion:

Two third of very low birth weight babies survived up until discharge from hospital and survival was positively influenced by larger birth weights, female sex, longer duration of hospital-stay and maternal age 19-25 years.

### Recommendation

Efforts at maintaining pregnancies to achieve larger birth weights alongside closer monitoring of neonates with identified factors associated with increased risk of poor outcome while on admission in order to provide optimal care could reduce risk of death and improve chances of survival.

### Limitations

This study being a retrospective cross-sectional review of admission records did not review the complications encountered by the subjects which could be multiple, nor did it review the

interventions all of which will influence outcome. A prospective longitudinal study will address this inherent challenge.

### References

1. Anthony S, Ouden L, Brand R, Verloove-Vanhorick P, Gravenhorst J. Changes in perinatal care and survival in very preterm and extremely preterm infants in the Netherlands between 1983 and 1995. *Eur J Obstet Gynecol Reprod Biol.* 2004;112:170-7.
2. Bhatnager P. Study of low birth weight neonates. *MJAFI.* 2000;56: 293-5.
3. Child Trends Databank. (2015). Low and very low birthweight infants. Available at: <http://www.childtrends.org/?indicators=low-and-very-low-birthweight-infants>
4. Njuguna FM, Kiptoon P, Nyandiko W. An assessment of the overall mortality of low birth weight neonates at the new birth units of the Moi teaching and referral hospital in Eldoret, Kenya. *European Journal of Biology and Medical Science Research* 2014;2(3):56-64.
5. Sutan R, Mohtar M, Mahat AN, Tamil A. Determinant of Low Birth Weight Infants: A Matched Case Control Study *Open Journal of Preventive Medicine.* 2014;4:91-9
6. UCSF. Very Low and Extremely Low Birthweight Infants. California: 2004.
7. Ohlsson A, Shah P. Determinants and Prevention of Low Birth Weight: A Synopsis of the Evidence. Alberta: Institute of Health Economics, 2008.
8. Mancini MC, Barbosa NE, Banwart D, Silveira S, Guerpelli JL, Leone CR. Intraventricular hemorrhage in very low birth weight infants: associated risk factors and outcome in the neonatal period. *Rev Hosp Clin Fac Med Sao Paulo.* 1999;54(5):151-4.

9. Trotman H, Bell Y. Neonatal sepsis in very low birth weight infants at the University Hospital of the West Indies. *West Indian Med J.* 2006;55:165 - 9.
10. Shinde R, Haridas K, Nagar P, Parakh H. A study of survival of very low birth weight neonates in a tertiary care hospital. *Int J Contemp Pediatr* 2019;6:857-62.
11. Ballot DE, Chirwa TF, Cooper PA. Determinants of survival in very low birth weight neonates in a public sector hospital in Johannesburg. *BMC Pediatrics.* 2010;10(30):30.
12. Ugwu R, Eneh A. The Proportion Of Low Birth Weight Babies Due To Small For Gestational Age (SGA) And Prematurity In Port Harcourt, South-South Nigeria Changing Trends. *The Internet Journal of Pediatrics and Neonatology.* 2010;13(1). 1-6
13. Tsou KI, Tsao PN, Taiwan Infant Development Collaborative Study Group. The morbidity and survival of very-low-birth-weight infants in Taiwan *Acta Paediatr Taiwan.* 2003; 44:349-55.
14. Menezes AM, Barros FC, Victora CG, et al. Risk factors for perinatal mortality in Pelotas, a southern city of Brazil, 1993, *Rev Saude Publica* , 1998, vol. 32 (pg. 209-16)
15. Sankar MJ, Natarajan CK, Das RR, Agarwal R, Chandrasekaran A, Paul VK. When do newborns die? A systematic review of timing of overall and cause-specific neonatal deaths in developing countries. *Journal of Perinatology* 2016; 36: S1–S11
16. Stevenson DK, Verter J, Fanaroff AA, et al. Sex differences in outcomes of very low birthweight infants: the newborn male disadvantage, *Arch Dis Child Fetal Neonatal Ed* , 2000, vol. 83 (pg. F182-5)
17. Filomena Bernardes de Mello Maria Fernanda Branco de Almeida Amélia Miyashiro Nunes dos Santos Helenilce de Paula Fiod Costa Milton Harumi Miyoshi Eduardo Rahme Amaro. Factors Associated with Survival of Very-low-birth-weight Infants in a Brazilian Fee-paying Maternity in the 1990s. *Journal of Tropical Pediatrics*, 2007 Volume 53, Issue 3, 1 June, Pages 153–157,
18. Sharma V, Katz J, Mullany LC, et al. Young Maternal Age and the Risk of Neonatal Mortality in Rural Nepal. *Archives of pediatrics & adolescent medicine.* 2008;162(9):828-835. doi:10.1001/archpedi.162.9.828
19. Bacak SJ, Baptiste-Roberts K, Amon E, Ireland B, Leet T Risk factors for neonatal mortality among extremely-low-birth-weight infants. *Am J Obstet Gynecol.* 2005;192: 862-7.
20. Kai-Ti Tseng, Chun-Chih Peng, Jui-Hsing Chang, Chyong-Hsin Hsu, Chia-Ying Lin, Wai-Tim Jim, Hung-Yang Chang. The impact of advanced maternal age on the outcomes of very low birth weight preterm infants *Medicine (2019)* 98:5(e14336) doi: 10.1097/MD.00000000000014336.
21. Najati N, Gojazadeh M. Maternal and neonatal complications in mothers aged under 18 years. *Patient preference and adherence.* 2010;4: 219- 22.