

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

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ABSTRACT: *Neonatal mortality is a leading health problem world over and more so in the developing countries. Neonatal mortality is a major contributor to infant mortality in the developing countries accounting for up to 50% of the infant mortality rate. This paper examined the overall mortality of low birth weight neonates at the new birth unit (NBU) at the Moi Teaching and Referral Hospital (MTRH) in Eldoret, Kenya. The study was carried out among 159 neonates with a birth weight of less than 2500 grams and admitted to the NBU of MTRH. From the study findings it was concluded that the mortality rate of low birth neonates at MTRH newborn unit is quite high. The mortality is much higher compared to the developed world and also in some other 3rd world countries. Measures to reduce the incidence of birth asphyxia need to be put in place. Blood cultures should be done as a routine whenever sepsis is suspected to give a guide on the choice of antibiotics.*

KEYWORDS: Overall Mortality, Low Birth Weight Neonates, New Birth Unit, Moi Teaching, Referral Hospital, Kenya

INTRODUCTION

Neonatal mortality is a leading health problem world over and more so in the developing countries. Worldwide five million children die within the first month of life with most of these occurring in the developing countries. Neonatal mortality is a major contributor to infant mortality in the developing countries accounting for up to 50% of the infant mortality rate (WHO, 2005).

Worldwide, 20 million infants are born low birth weight accounting for 15.5% of all deliveries. Of these, 95.6% occur in the developing countries. The percentage of low birth weight neonates in the developing world is more than double the rate in the developed countries (16.5% versus 7%). In the sub-Saharan Africa, the rate has been found to be 15%. The rate in East Africa is 13.5% while that of Kenya is 11% (WHO, 2005). Low birth weight contributes to a great extent to the high neonatal mortality accounting for 28% of the deaths (Joy

& Simon, 2005). The contribution of low birth weight to neonatal admissions is also very significant accounting for 30% to 50% of admissions in most of the neonatal units in sub-Saharan Africa (Ayaya, Esamai, Rotich, & Sidle, 2001; United Nations report, 2004). The United Nations has recognized the significance of low birth weight and has put its reduction as part of the millennium development goals. To achieve this especially in the sub-Saharan Africa calls for more research to help alleviate the problem (United Nations report, 2004). The infant mortality rate in Kenya is quite high with the 2003 figures showing a rate of 77/1000. The neonatal mortality rate in Kenya currently stands at 33/1000 thereby accounting for 43% of the IMR (Central Bureau of Statistics, 2003).

Low birth weight is a very significant problem with about 60% of the neonates admitted in Kenyatta national hospital the largest referral hospital in the early 1990s being low birth weight (Kasirye-Bainda & Musoke, 1992). They also contributed to 93.5% of the total neonatal deaths. The mortality in the hospital studies is very high as evidenced by studies conducted at Kenyatta national hospital which is also a referral hospital like MTRH. The LBW mortality as of year 2000 in KNH was 574/1000 (Simiyu, 2004).

In the USA, in the years 1993 and 1994, neonates who weighed 501-1500 grams had an 83% survival rate. Survival rate was low for those who were in the 501-750 grams group (49%) as opposed to a 96% survival rate for those who weighed 1251-1500 grams. Majority of the deaths occurred within three days of birth with more males dying overall (Stevenson *et al.*, 1993). By the years 1995-1996, there was a slight improvement on these figures with a survival rate of 84% in the ELBW group. The 501-750 group had a survival rate of 54% as opposed to 97% for the 1251-1500 grams group. There was a slight increase in these figures between 1997 and 2002. Those who were 501-750 grams had a 55% survival rate and those who were between 1251 and 1500 had a survival rate of 96 % (Fanaroff, Stoll, Wright, *et al.*, 2007).

In Canada, between the survival rates for LBW neonates is almost similar to that of USA. In the years 1996 to 1997 there was a 93% survival rate among the neonates who were 28 weeks of gestation. In terms of birth weight, the survival was 54%, 79% and 96% for those weighing 600-699, 700-799 and 1000-1099 grams respectively. Lower gestation was associated with better female survival (Huw, Stella, Catherine *et al.*, 2005). In Bangladesh, a neonatal mortality of 133 per 1000 was recorded among low birth weight infants with 84% of the deaths occurring within the first 48 hours (Yasmin, Osrin, Costello, 2001).

In Kenya, studies on low birth weight mortality and morbidity have been mainly done in Kenyatta National Hospital (KNH). In 1996, the neonatal survival rate for the under 2000 grams infants was 62.6%. None of the infants below 1000 grams survived the neonatal period. Bigger infants fared better with 68% of the 1000-1499 and 78% of the 1500-1999 grams group surviving (Munz, Seufert, Schimdt, *et al.*, 2005). In the same hospital in the year 2000, the overall mortality of the low birth weight infants was 57.4%. Infants less than 1500 grams had higher mortality (83.6%) compared to the 1501-2499 grams group (30.7%). Thirty-six per cent of the deaths occurred within the first 24 hours of admission and by the end of the first week 56.5% of the deaths had occurred (Simiyu, 2004).

Problem Statement

Neonatal mortality is a very significant contributor of infant mortality in Kenya and also in the entire world. It accounts for 43% of the infant mortality in Kenya and has been shown to account for about 50% of the infant mortality in the developing world (WHO, 2005; Central Bureau of Statistics, 2003). Low birth weight is one of the three main causes of neonatal mortality in the developing world the others being neonatal infections and birth asphyxia. It accounts for 28% of the deaths (Ayaya, Esamai, Rotich, & Sidle, 2001).

The mortality of low birth weight neonates has been found to be 20 times more than the mortality of neonates with a birth weight of 2500 grams or more. Overall the mortality is higher in the developing countries than in the developed countries (WHO, 2005). In Kenya Low birth weight neonates' account for 11% of all deliveries (Stevenson *et al.*, 1993). They account for 60% of the admissions at Kenyatta National hospital and 37% of the admissions at Moi Teaching and referral Hospital. The Low birth weight neonates accounted for 93.5% of the deaths in the new born unit of Kenyatta national hospital (Ayaya, Esamai, Rotich, & Sidle, 2001; Kasirye-Bainda & Musoke, 1992; Simiyu, 2004).

Limitations of the Study

Lack of constant and adequate supply of blood culture bottles during the time of study contributed to having many patients with a diagnosis of clinically diagnosed sepsis. There was no follow-up for the neonates who were discharged before the end of the neonatal period. Some of the morbidities and mortalities that could have occurred after discharge but before the end of the neonatal period were missed out.

THEORETICAL UNDERPINNING

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The United Nations has recognized the significance of low birth weight and has put its reduction as part of the millennium development goals. To achieve this especially in the sub-Saharan Africa calls for more research to help alleviate the problem (United Nations report, 2004). The infant mortality rate in Kenya is quite high with the 2003 figures showing a rate of 77/1000. The neonatal mortality rate in Kenya currently stands at 33/1000 thereby accounting for 43% of the IMR (Central Bureau of Statistics, 2003).

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In MTRH low birth weight is a significant cause of admissions to the new born unit accounting for about 37% of the total admissions(1,14).Prematurity has also been correlated with poor outcome in the unit.The commonest morbidities have birth asphyxia and respiratory distress syndrome.These would be expected to rank high also in relation to low birth weight units(1,14). This study was an attempt to identify the overall mortality of low birth weight newborns,maternal characteristics at play and neonatal characteristics underlying the relatively high mortality peculiar to MTRH.Based on these findings relevant conclusions and recommendations on future research areas and possible interventional steps are suggested.

METHODOLOGY

The study was conducted at the newborn unit of the Moi Teaching and Referral Hospital (MTRH). The hospital is located in Eldoret town in the Rift valley province of Kenya. The town is about 300 kilometers Northwest of Nairobi the capital city of Kenya. The hospital serves as a teaching hospital for Moi University School of Medicine and other medical training institutions around Eldoret. It also serves as a referral hospital for the western part of Kenya, with a catchment population of about 13 million people. The unit mainly serves the neonates born within the hospital. The neonates born outside the hospital are usually admitted in the general paediatric wards unless they are less than 1500 grams and not more than 24 hours of age. The unit has a capacity of 20 neonates. The staff in the unit includes two neonatologists, paediatric registrars, medical officer interns, nurses and other paramedical staff. It does not have the capacity to provide mechanical ventilation and has no incubators.

This was a cross-sectional hospital based descriptive study. The study was carried out among the neonates with a birth weight of less than 2500 grams and admitted to the newborn unit of MTRH. All consecutive neonates admitted to the unit with a birth weight less than 2500 grams between 1st may 2006 and 30th November 2006 (six months) were included in the study.

The inclusion criteria targeted newborns who had: admission to the newborn unit; birth weight less than 2500 grams, and consent from the parents of the neonate. The exclusion criteria targeted those with birth weight greater than 2499 grams. The low birth weight neonates who were already admitted in the unit before the study commenced.

The data was collected between 1st may 2006 and 31st November 2006. All neonates admitted to the unit had their weights taken and those whose weight was less than 2500 grams were identified. The mothers of the neonates were identified in the post-natal ward and consent was sought from them. After obtaining the consent, a complete history and physical examination were done on the neonate. From the history and physical examination appropriate diagnoses were assigned and the appropriate investigations were commenced. A gestational assessment was

done using the new Ballard's score by the investigator or by the doctor on duty and recorded in the data collection form. The doctors working in the unit during the period of the study had been trained on gestational assessment to ensure consistency. All of the neonates who were below the 10th percentile of weight for gestational age were classified as being small for gestational age while those above the 10th percentile were classified as appropriate for gestational age. All this information was recorded in the data collection form.

Data regarding the mothers' age, marital status, place of delivery, mode of delivery and presence of any illnesses during the pregnancy was obtained from the mothers medical records. In cases where this information was missing the mother was interviewed and this was also recorded in the data collection form. Daily follow-up was done on the neonates till the time of discharge or death. Physical examination was done daily and the results of any laboratory and radiological investigations were interpreted. New diagnoses were assigned as they arose. All the patients were put on the standard care given to all the neonates in the unit.

All the neonates who were discharged were booked for follow-up in the neonatology clinic in the hospital. The outcome of death was assigned to those neonates who were found to have no cardiac and respiratory activity and also dilated and non-reactive pupils on physical examination. The outcomes and the time of death were also recorded in the data collection form. The data was analyzed using SAS institute version 9.1. A p-value of less than 0.05 was considered significant in all analyses. Descriptive statistics such as mean, standard deviation, median, range were used for the continuous variables while frequency listings were used for categorical variables. The Chi-square test was used to assess any association between a categorical variable and each of the independent variables. The Fishers exact was used where the cell count was less than 10. The odds ratio was analyzed at 95% confidence level. The multivariate logistic regression model was used to assess the association between a binary outcome and a set of variables both continuous and categorical in the same model.

RESULTS

A total of 159 neonates were recruited into the study. The median age of the mothers was 26 years (range 16-48 years); 40(25%) of the mothers' were below 20 or above 35 years. Majority of the mothers were married (80.3%) with the rest being single/divorced. Majority of the deliveries (84.9%) took place in Moi Teaching and Referral Hospital while the rest took place outside the hospital either at home or in peripheral health facilities. The commonest mode of delivery was spontaneous vertex delivery accounting for 100(62.9%) of all the deliveries. Forty-two (26.4%) of the babies were born through caesarean section while 16(8.8%) were breech deliveries. Only one baby was delivered via vacuum extraction (Fig.1).

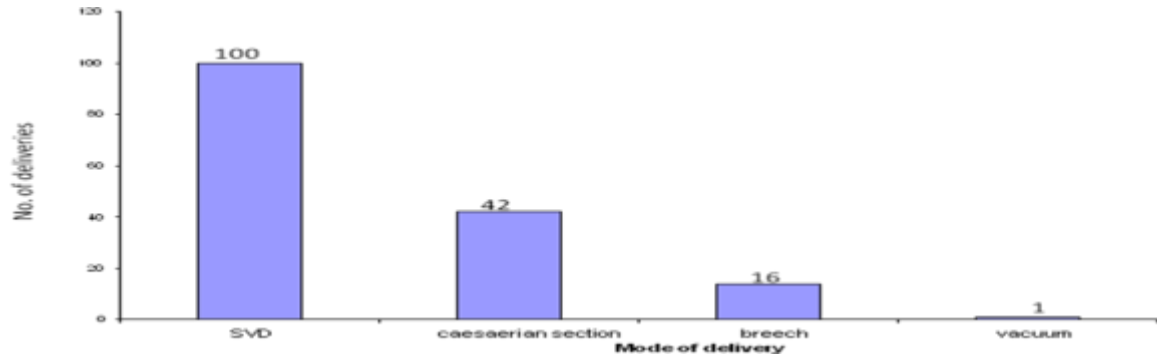


Figure 1: Mode of Delivery

The common indications for caesarean section were pregnancy induced hypertension, fetal distress, antepartum haemorrhage and malposition and malpresentations.

Table 1: Indications for Caesarean Section

Indication	No.	%
Antepartum haemorrhage	9	21.4%
Pregnancy induced hypertension	9	21.4%
Malpositions and malpresentations	8	19.0%
Fetal distress	6	14.3%
Previous C/S	5	11.9%
HIV infection	1	2.4%
Prolonged labour	1	2.4%
Others	7	26.7%
Total	42	100%

HIV infection and pregnancy induced hypertension were the commonest illnesses among the mothers as shown in Table 2.

Table 2: Maternal Illnesses

Diagnosis	No.	% of the total mothers
HIV/AIDS	17	10.7%
Pregnancy induced hypertension	11	6.9%
Malaria	3	1.9%
Diabetes	1	0.6%
Chorioamnionitis	1	0.6%
Other febrile illnesses	6	3.8%
Total	39	24.5%

Characteristics of the Neonates

Out of the 159 neonates, 51% were males with females being 49% giving a male to female ratio of approximately 1:1. Majority of the neonates (56.6%) were delivered at between 28 and 34 weeks of gestation as shown in Table 3. The neonates in the ELBW category (<1000 grams) were 24(15%) while those in the VLBW category (1000-1499 grams) were 38(23.9%). Those who were more than 1499 grams were 91(61.1%).

Majority of the neonates had a weight that was appropriate for their gestational age accounting for 65.4% while 34.6% were small for gestational age. All the neonates who were delivered outside the hospital did not have an apgar score as they were born in circumstances where there were no medical personnel or it was not recorded: 71.6% of the ones born in the hospital had an apgar score of 6 or more while 28.4% had an apgar score of 5 or less (Table 3).

Table 3: Neonates' Characteristics

Variable	Categories	No.	%
Birth weight	<1000 grams	24	15%
	1000-1499 grams	38	23.9%
	1500-2499 grams	91	61.1%
Gestation at birth	<28 weeks	34	21.4%
	28-34 weeks	90	56.6%
	>34weeks	35	22%
Apgar score	0-3	10	6.3%
	4-5	28	17.6%
	6-7	47	29.6%
	8-10	49	30.8%
	Not applicable	25	15.7%

DISCUSSION

This study demonstrated a very high mortality rate of 51.6%. This was quite similar to what has been reported in the only other referral hospital in Kenya (KNH) which reported a mortality rate of 57.4% in the year 2000 (Simiyu, 2004). The mortality rate was however quite high compared to other developing countries. In Nigeria in the late 1990s one university hospital recorded a mortality rate of 19(23.4%) while in Thailand a survival rate of 81% and 52% was reported among the LBW and ELBW neonates respectively (Munz, Seufert, Schimdt *et al.*, 2005).

Mortality was highly correlated with the gestational age and the birth weight. This is similar to what has been reported in other studies (Simiyu, 2004; Fanaroff, Stoll, Wright, *et al.*, 2007; Were, Mukhwana, & Musoke, 2002; Ezeaka, Ekure, Iroha, & Egri-Okwanji, 2004; Kambarani, 2002). There was no survival among the neonates with extremely low birth weight neonates. This correlates with a study done in KNH in 1996 where there was no survival among the neonates less than 1000 grams (Were, Mukhwana, & Musoke, 2002). In the same hospital the

mortality rate for neonates less than 1500 grams was 83.6%. In Nigeria, the mortality rate for neonates less than 1000 grams was 81.8 %. The mortality rates in the Nigerian study showed less mortality even in the VLBW and LBW categories compared to this study (Ezeaka, Ekure, Iroha, Egri-Okwanji, 2004). The survival rates in the developed world are far much better with 55% and 88% of the neonates between 501-750 g and 751-1000g surviving respectively in the USA (Fanaroff, Stoll, Wright, *et al.*, 2007).

A gestation of less than 28 weeks has also been associated with very mortality rates in developing countries and this study demonstrated the same trend. The threshold of viability in the developing countries has been 28 weeks as opposed to the developed countries where it has been as low as 23 weeks. The study done in KNH in the year 2000 revealed a mortality of 91% among the neonates less than 28 weeks which is comparable to a mortality of 96% in this study (Simiyu, 2004).

IMPLICATION TO RESEARCH PRACTICE

Future research should be geared towards prevention of low birth weight and factors that are associated with mortality in this category of births. More research should also be done on how to enhance the institutional capacity of tertiary hospitals (such as MTRH) to provide optimal care for low birth weight neonates.

CONCLUSION

The mortality rate of low birth neonates at the Moi Teaching and Referral Hospital newborn unit is quite high. The rates are comparable to those of the only other public referral hospital Kenya (KNH). The mortality is much higher compared to the developed world and also in some other 3rd world countries. Measures to reduce the incidence of birth asphyxia need to be put in place. Blood cultures should be done as a routine whenever sepsis is suspected to give a guide on the choice of antibiotics. A study that follows up all low birth weight neonates admitted in the hospital up to the end of the neonatal period should be carried out.

FUTURE RESEARCH

Recommendations on future research:

- a) Given the very high mortality rates this studies (and previous studies) have found further research needs to be conducted to unravel the factors responsible for pre-term deliveries focusing especially on intervention that would mitigate against it.
- b) Since the overall mortality of LBW is very high in developing countries as compared to developed countries research needs to be conducted to identify the factors that underlie this sorry state. Interventions need to be identified that would reduce this to a minimal.

REFERENCES

Ayaya S.O., Esamai F.O., Rotich J. & Sidle J. (2001). Perinatal morbidity at Moi teaching and Refferal Hospital, Eldoret. *East Afr. Med. J.* 2001; 78 (10): 544-549.

- Central Bureau of Statistics (2003). Kenya Demographic health survey. Ministry of health, Kenya medical research institute, Kenya. Kenya Demographic health survey. 2003.
- Ezeaka V. C., Ekure E. N., Iroha E.O. & Egri-Okwanji M.T. (2004). Outcome of low birth weight neonates in a tertiary health care centre in Lagos Nigeria *Afri. J. Med. Sci.* 2004Dec;33(4); 209-303 .
- Fanaroff, A.A., Stoll .B.J. & Wright L. L. (2007). Trends in neonatal morbidity and mortality for very low birth weight infants. *Am. J. Obstet. Gynaecol.* 2007 Feb;196(2):147-8
- Huw, P.J., Stella, K.. & Catherine, M.G. (2005). Actuarial survival of a large Canadian cohort of preterm infants. *BMC Pediatrics* 2005 5:40
- Joy E.L., and Simon C. (2005). Neonatal survival 1:4 million neonatal deaths. *Lancet.*2005
- Kambarani, R. A. (2002). Levels and risk factors for mortality in infants with birth weight between 500-1800 gms. In a developing country: A hospital based study. *Cent. Afri. J. Med.* 2002 Nov-Dec;48(11-12):133-136
- Kasirye-Bainda and Musoke R. N. (1992). Neonatal morbidity and mortality at Kenyatta National Hospital. *East Afr. med. J.* 1992; 69:360-365.
- Munz W., Seufert R. & Schimdt W. (2005). Perinatal outcomes of infants weighing less than 1500 g. *Z Geburtshilfe Neonatol.* 2005;209(1): 29-33.
- Simiyu D.E. (2004). morbidity and mortality of low birth weight infants in the NBU, Kenyatta National Hospital. *East Afr. Med. J.*2004; 81(7): 367-374.
- Stevenson et .al. (1993). Very low birth weight outcomes of the national institute of child health and human development neonatal research network Jan1993-Dec1994. *American J. of Ob. and Gyn.* Dec 1993; 179: 1632-9.
- United Nations report (2004). SAHIMS. Reducing maternal and newborn mortality. A United Nations report.2004.
- Were, F.N., Mukhwana, B.O. and Musoke, R.N. (2002). Neonatal survival of infants less than 2000 grammes born at Kenyatta National Hospital. *East Afr. Med. J.* 2002; 79(2): 77-79.
- WHO (2005). Low birth weight: country regional and global estimates 2005. WHO publication.
- Yasmin, S., Osrin, D. & Costello, A. (2001). Neonatal morbidity of low birth weight infants in Bangladesh. *Bulletin of World Health Organization.*2001.; 79:608-614.