

Mortality in the Special Care Baby Unit of University of Port Harcourt Teaching Hospital, Port Harcourt: why and when do newborns die?

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Abstract

Ugwu RO, Eneh AU Mortality in the Special Care Baby Unit of University of Port Harcourt Teaching Hospital, Port Harcourt: why and when do newborns die? *Nigerian Journal of Paediatrics* 2008; 35: 75.

Background: The Millennium Development Goal 4 is the reduction of under-5 mortality by two-thirds by the year 2015. However, this goal might be difficult to achieve if survival of one of the groups in the under-5 category (the newborn) is not sufficiently addressed.

Objectives: To determine the major causes of deaths in the Special Care Baby Unit (SCBU) of the University of Port Harcourt Teaching Hospital, Port Harcourt, and document the most vulnerable age at which these deaths occur.

Method: A retrospective review of the admission records of all neonates admitted into the SCBU from April 1, 2002 to March 31, 2008 was undertaken. Information extracted included gender, gestational age at delivery, place of birth, primary diagnosis, the age and diagnosis at death.

Results: A total of 5507 babies were admitted and 1329 (23.8 percent) died within the six-year period. Nine hundred and eighty-eight (75.5 percent) were early neonatal deaths, 298 (22.7 percent) were late neonatal deaths, while 23 (1.8 percent) were post neonatal deaths. Overall, the main causes of mortality were birth asphyxia (35.5 percent), infections (31.9 percent), prematurity (19.4 percent) and congenital abnormalities (6.3 percent). The main causes of mortality within 24 hours of life were birth asphyxia in 306 (23.4 percent), prematurity in 160 (12.2 percent), and congenital abnormalities in 24 (1.8 percent). Beyond 24 hours and up to seven days of life, the commonest causes of death were severe infections in 250 (17.6 percent), birth asphyxia in 122 (9.3 percent) and prematurity in 76 (5.8 percent). Seven hundred and five (53.9 percent) of those that died were delivered outside the hospital.

Conclusion: Birth asphyxia, severe infections, prematurity, and lethal congenital abnormalities were the commonest causes of death in the neonatal period. Most of the deaths occurred in the early neonatal period and in babies delivered outside the hospital.

Key words: Mortality, Newborn, Special Care Baby Unit

Introduction

Child Survival programmes have led to substantial reductions in child mortality but this reduction has not affected the newborn.¹ Newborn mortality accounts for 40 percent of all deaths in children under five years of age globally and about 50-70

percent of deaths in infancy.^{2,3} Efforts to further reduce child mortality must therefore, focus on the pattern and causes of neonatal deaths if the Millennium Development Goal 4 (MDG 4) of reducing under-5 mortality by two-thirds by 2015 is to be achieved.

The large number of newborns that die and the fact that newborn health has been grossly neglected calls for an urgent need to focus on newborn health. Moreover, some diseases or conditions that affect the newborn are associated with lifetime consequences which have impact not only on the health of the individual, but that of the family and the society. These babies survive only to carry with

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physical and mental sequelae which prevent them from assuming their rightful places as useful and productive members of the society.¹⁴

The fact that up to 70 percent of newborn deaths can be prevented by cheap, simple interventions¹⁵ makes these deaths totally unnecessary and unacceptable. Reports of neonatal mortality suggest that there are differences between industrialized and developing nations with regard to the causes of neonatal deaths.¹⁶ Knowledge of when these deaths occur and the causes of the mortality in our setting is therefore important in prioritizing interventions required to achieve a decline in neonatal mortality. The aim of the current study was to determine the major causes of neonatal deaths in the Special Care Baby Unit (SCBU) of University of Port Harcourt Teaching Hospital, Port Harcourt, and to document the most vulnerable age at which these deaths occur.

Subjects and Methods

This was a retrospective review of the admission records of all neonates admitted into SCBU between April 1, 2002 and March 31, 2008, a six-year period. The SCBU offers intensive care for sick neonates in Port Harcourt and neighbouring states in the south-south and south-east geopolitical zones of Nigeria. Information extracted included gender, gestational

age at delivery, pregnancy/delivery complications, places of birth, documented causes of death and the ages at death. A neonate is a child aged 0-28 days. A term baby is a baby delivered after 37 completed weeks while a preterm is a baby delivered before 37 completed weeks. Normal birth weight is birth weight ≥ 2500 g while low birth weight is birth weight < 2500 g. Early neonatal deaths were defined as deaths occurring within seven days of life, whereas late neonatal deaths are those occurring between the 8th and 28th day of life and post neonatal deaths after 28th day of life. Data for neonates with tetanus who are usually admitted into a designated section attached to the children's medical ward were incomplete and were therefore excluded from this analysis. Results are expressed in percentages and qualitative data was assessed using chi-square test when indicated. Probability (*p*-value) of less than 0.05 was considered statistically significant.

Results

A total of 5507 babies were admitted within the six-year period, out of which 1309 (23.8 percent), died. There was a total of 15,930 live born deliveries in the hospital within the period and a total inborn deaths of 604 giving a neonatal mortality rate of 37.9/1000 live births. Table 1 shows the general

Table 1
Characteristics of the Babies Admitted and Those that Died

Characteristics	Admitted No	Died No (mortality %)*	OR	95% CI
Total	5507	1309 (23.8)		
Gender			1.0	0.85-1.09
Male	3136	736 (23.5)		
Female	2366	571 (24.1)		
Ambiguous	5	2 (40.0)	2.83	2.46-3.23
Gestation			1.69	1.49-1.92
Term	4236	803 (19.0)		
Preterm	1271	506 (39.8)		
Place of delivery			2.98	2.61-3.41
Inborn (booked)	2466	434 (17.6)		
Inborn (unbooked)	623	170 (27.3)		
Outborn	2418	705 (29.2)		
Birthweight				
NBW	4018	721 (17.9)		
LBW	1489	588 (39.5)		

(NBW = normal birth weight; LBW = low birth weight)

*Figures in brackets are mortality % of number admitted

OR = odds ratio; CI = confidence interval

characteristics of the babies that were admitted and those that died. The male/female ratio for admissions was 1.3:1. The difference in the deaths between the males and the females was not statistically significant (OR = 1.0; 95% CI, 0.85-1.09). Seven hundred and five (53.9 percent) of the deaths were in babies delivered outside the hospital. The mortality rate in outborns was significantly higher than in inborns (OR = 1.69; 95% CI, 1.49-1.92). When compared with the total number admitted, significantly more deaths occurred among preterm than term babies (OR = 2.83; 95% CI, 2.46-3.25) and among low birth weight babies than normal weight babies (OR = 2.98; 95% CI, 2.61-3.41) especially in those weighing between 500g-1499g (Table II).

Severe birth asphyxia with its complications was the documented cause of death in 465 (35.5 percent) neonates, followed by severe infections in 417 (31.9 percent) and prematurity in 254 (19.4 percent) (Table III).

Together, the three leading associated causes of death accounted for more than 85 percent of fatalities. Lethal congenital abnormalities were responsible for death in 83 (6.3 percent) neonates. In most cases, affected neonates had more than one abnormality. Forty-eight babies died within 24 hours after surgery and the causes of death in them were hypovolemic shock (17) electrolyte derangement (14), hypothermia (10) and cardiac arrest (7). Neonatal haemorrhage which was the cause of death in 27 (2.1 percent) were in the forms of bleeding from improperly tied umbilical stump (nine), circumcision (nine), frenulectomy (seven), and subgaleal haemorrhage (two).

Table IV shows the causes of death at various ages. Nine hundred and eighty eight (75.5 percent) of the deaths were early neonatal deaths, with over half of them dying within 24 hours, 298 (22.7 percent) were late neonatal deaths and 23 (1.8 percent) were post

Table II

Mortality in relation to Birthweights

<i>Birth weight</i>	<i>No. Admitted</i>	<i>No. of Deaths</i>	<i>Mortality % of Total Admitted</i>
500-999g	114	109	95.6
1000-1499g	354	224	63.3
1500-2499g	1021	255	25.0
2500-3999g	2542	686	19.4
>4000g	476	35	7.4
Total	5507	1309	23.8

Table III

Causes of Death in 1309 Babies admitted to the Special Care Baby Unit

<i>Causes</i>	<i>No. of Cases</i>	<i>% of Total</i>
Birth asphyxia	465	35.5
Infections*	417	31.9
Prematurity	254	19.4
Congenital abnormalities	83	6.3
Neonatal haemorrhage	27	2.1
Severe anaemia	15	1.1
Hypovolemic shock	18	1.4
Electrolyte derangements	13	1.0
Hypothermia	10	0.8
Cardiac arrest	7	0.5
Total	1309	100.0

* (include septicemia, pneumonia, diarrhoea and meningitis).

neonatal deaths. The leading causes of mortality within 24 hours of life were birth asphyxia, prematurity and congenital abnormalities. Three hundred and twelve (62.3 percent) of the deaths that occurred within 24 hours of life involved babies delivered in the hospital. Beyond 24 hours and up to seven days of life, the leading causes of death were infections, birth asphyxia and prematurity. Infections were also the major causes of death in those between eight and 28 days of age.

Table V compares the prevalence of various pregnancy/delivery complications among mothers of inborn survivors and non-survivors. The majority of inborn survivors had no complications. Pregnancy/delivery complications were significantly more common in non-survivors ($\chi^2=988.99$; $df=1$; $p=0.0000$)

Discussion

The mortality of 23.8 percent obtained in the current study compares with the 27.1 percent reported by Njokuanna and Olarewaju¹¹ in Sagamu, but was higher than the 19.4 percent reported by Ezechukwu *et al*¹² in Nacwi. Approximately three-quarters of neonatal deaths occurred in the first week of life in keeping with reports

from other parts of the world.^{23,24} The first 24 hours of life appears to be the most vulnerable age for neonatal deaths. In this study, 38.3 percent of the deaths occurred in the first 24 hours of life. While Fonsaka *et al*⁵ reported a lower rate of 28.6 percent in Sri Lanka, Onyiruka¹⁵ and Njokuanna and Olarewaju¹¹ reported higher values of 58.7 percent and 61 percent in Benin city and Shagamu, Nigeria respectively. The difference may be explained by the variation in the subjects studied. Whereas Fonsaka *et al*⁵ considered only singleton births, this study considered both singleton and multiple births and complications are known to be higher with multiple births. Onyiruka¹⁵ analyzed only cases with birth asphyxia which is associated with a high mortality within 24 hours of life.

The main causes of neonatal deaths in the present series were birth asphyxia, infections, prematurity and congenital abnormalities. This finding was somewhat similar to an earlier report from our centre involving only term babies¹⁰ in which the major causes of neonatal mortality were birth asphyxia and congenital malformations.¹⁰ In comparison with studies from other centres within^{11,12} and outside Nigeria,^{5,12,13} the causes of death were similar but with differences in the relative

Table IV

Causes of Death at Various Ages

Causes	≤ 24 hrs	> 24 hrs-7 days	8-28 days	> 28 days	Total
	No (%)	No (%)	No (%)	No (%)	No (%)
Birth asphyxia	306(23.4)	122(9.3)	37(2.8)	0(0)	465(35.5)
Prematurity	60(12.2)	76(5.8)	16(1.2)	2(0.2)	254(19.4)
Congenital abnormalities	24(1.8)	34(2.6)	22(1.7)	3(0.2)	83(6.3)
Infections	2(0.2)	230(17.6)	174(13.3)	11(0.8)	417(31.9)
Neonatal haemorrhage	7 (0.5)	12(0.9)	8(0.6)	0(0)	27 (2.1)
Severe anaemia	0(0)	0(0)	13(1.0)	2(0.2)	15(1.1)
Hypovolemic shock	0(0)	5(0.4)	10(0.8)	3(0.2)	18(1.4)
Electrolyte derangements	0(0)	3(0.2)	8(2.6)	2(0.2)	13(1.0)
Hypothermia	2(0.2)	2(0.2)	6(0.4)	0(0)	10(0.8)
Cardiac arrest	0(0)	3(0.2)	4(0.3)	0(0)	7(0.5)
Total	501(38.3)	487(37.2)	298(22.7)	23(1.8)	1309(100)

Table V

Pregnancy/Delivery Complications in Mothers that delivered in UPIH (n=3089)

Complications	Survivors	Non survivors
	No (%)	No (%)
Obstructed labour	124(5.0)	151 (25.0)
PROM/chorioamnionitis	51(2.1)	72(11.9)
PIH/eclampsia	25(1.0)	92(15.2)
Antipartum haemorrhage	15(0.6)	79(13.1)
Diabetes mellitus	60(2.4)	16(2.6)
Rhesus isoimmunization	6(0.2)	1(0.2)
Premature ROM/Prolonged labour	23(0.9)	27(4.5)
Malpresentation	9(0.4)	10(1.7)
None	2021(81.3)	121(16.7)
Not Known	151(6.1)	55(9.1)
Total	2465 (100)	604 (100)

PIH—pregnancy-induced hypertension

PROM—prolonged rupture of membrane, ROM—rupture of membrane

importance of individual factors. Thus, while infections predominated in some reports,^{21,22} prematurity was the leading cause in others.¹¹

Lethal malformations which accounted for 6.3 percent of all neonatal deaths in this study, was the cause of death in 37 percent of all neonatal deaths in United Arab Emirates²³ possibly because of the high incidence of consanguineous marriages in their population and specific syndromic malformations with autosomal recessive mode of inheritance which are known to be high in cases of consanguinity.

The variation in the relative contribution of various causes of death depend partly on availability of adequate care during pregnancy and childbirth, and the level of sophistication of neonatal care services available. In developed countries, LBW/preterm births and malformations play a larger role, whereas in developing countries, the contributions of asphyxia and infections are greater.^{1,22} However, even in developing countries, the risk of death from prematurity/LBW is still very high. In the present study, there was a three-fold greater odds of death for preterm and LBW babies than for term and normal birth weight babies. Low birth weight and prematurity may contribute to mortality in a number of ways like increasing the risk of birth asphyxia, infection and anaemia. The contribution of the causes to mortality is also related to the age at which these deaths occur. Early neonatal deaths are mostly due to

complications during pregnancy or childbirth, preterm birth and malformations.^{2,10,21} In the present study, birth asphyxia, severe infections, prematurity and congenital malformations were the main causes of early neonatal deaths. This was similar to the findings by Chavan *et al.*²⁴ After the first week of life, infectious coxistants the main cause of neonatal deaths in many countries.^{2,6,21} These are mostly acquired either in hospital as a complication of treatment for other perinatal conditions, or at home. It was not surprising therefore that in this study, severe infections were responsible for over half of the neonatal deaths occurring after seven days of life.

Obstetric complications are important risk factors for neonatal mortality.^{2,10,20,21} Among the important risk factors are those associated with prolonged labour and intrapartum accidents. The commonest pregnancy/delivery complications in mothers of inborn non-survivors was prolonged obstructed labour. This may have accounted for the high incidence of birth asphyxia in this study. Prolonged labour and prolonged rupture of membranes (PROM) predispose to infections in mothers and babies. It is estimated that 26 percent of newborn infants who die, do so as a result of infections that occur around birth.¹⁰ In the current study, 11.9 percent of mothers had PROM/chorioamnionitis which might have increased the risk of infections among the neonates.

Pregnancy induced hypertension, antepartum haemorrhage and premature rupture of membrane/ preterm labour which was documented in 15.2 percent, 13.1 percent and 4.5 percent respectively of the mothers of inborn non-survivors are important risk factors in perinatal delivery and together contributed to the high incidence of prematurity in this study. Considering that pre-eclampsia and eclampsia are associated with 13 percent²⁰ and 28 percent²⁰ risk of perinatal mortality respectively, it is not surprising that pregnancy induced hypertension was associated with a high proportion of perinatal deaths.

The major limitation of this study was the hospital-based nature, and so may be an under-estimation of what obtained at the community level as many deliveries and deaths are known to occur outside the hospital setting and are not registered and hence would not get into any statistics. Establishing the exact numbers and causes of neonatal deaths is therefore difficult. It is also likely that multiple aetiologies operated in several newborns (eg. infection/birth asphyxia and prematurity or neonatal sepsis and jaundice or birth asphyxia/ infection and congenital abnormality) whereas we primarily ascribed the dominant aetiology as the cause of death in our analysis. The exclusion of cases with neonatal tetanus is also a limitation as their inclusion might have helped to better understand the impact of infection as a cause of neonatal deaths among outborn infants in the community. There was also incomplete documentation of the maternal pregnancy and delivery history especially in unbooked mothers to properly identify risk factors. Despite these limitations however, hospital based data are still pertinent in planning interventions and evaluation of hospital services, as well as providing records for epidemiological surveillance.

In conclusion, birth asphyxia, severe infections, prematurity, and lethal congenital abnormalities were the commonest causes of death in the neonatal period in Port Harcourt and its environment and are largely preventable. Three-quarters of the deaths were early neonatal deaths with over 50 percent of them occurring in the first 24 hours of life. The major contributors were low birth weight, prematurity, outborn delivery and obstetric complications in the mother. Without specifically targeting these causes and contributors to neonatal mortality, MDG-4 may be difficult to attain. We recommend improved obstetric management of high-risk pregnancies, skilled attendants at every delivery, adequate resuscitation of asphyxiated babies, hygienic delivery and cord care practices, early initiation of exclusive breastfeeding and kangaroo mother care (KMC) for the preterm as steps towards ensuring the survival and good health of the newborn infants; these will form an essential step towards reducing under-five mortality

in Nigeria. A community-based study is also urgently needed to understand the enormity of this problem.

References

1. World Health Organization. World Health Report 2005. Make every mother and child count. Geneva: World Health Organization; 2005.
2. Fikree FF, Azam SL, Berendes HW. Time to focus child survival programmes on the newborn: assessment of levels and causes of infant mortality in rural Pakistan. *Bull World Health Organ* 2002; 80:271-6.
3. Fonseka P, Wijewardene K, I Larcandra de Silva DG, Goonaratna C, Wijeyasiri WA. Neonatal and post neonatal mortality in the Galle district. *Ceylon Med J* 1994; 39:82-5.
4. Sathikumar N, Yakubu AM. Cerebral palsy in Zaria, northern Nigeria—is it preventable? *J Trop Pediatr* 1987; 33:263-5.
5. Lawn JE, Zupan J, Begocyan G, Knippenberg R. Maternal and neonatal conditions newborn survival. In: Jamison DI, Breman JG, Measham AR, Alleyne C, Clancy M, Evans DH, Jha P, Mills A, Musgrove P, eds. *Disease Control Priorities in Developing Countries*. New York: Oxford University Press, 2006:531-49.
6. Jones C, Stacey RW, Black RE, Bhatia ZA, Morris SS, The Bellagio Child Survival Study Group. How many child deaths can we prevent this year? *Lancet* 2003; 362: 65-71.
7. Dawodu AI, Effiong CE. Neonatal mortality: effects of selective antibiotic interventions. *Pediatrics* 1985; 75:51-7.
8. Bang AI, Bang RA, Bairule SB, Reddy MH, Deshmukh MD. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *Lancet* 1999; 354: 995-61.
9. Duke Y, Willie L, Mgoni JM. The effect of introduction of minimal standards of neonatal care on in-hospital mortality. *PNG Med J* 2000; 43:127-36.
10. World Health Organization. Neonatal and perinatal mortality: country, regional and global estimates. World Health Organization, Geneva; 2006.
11. Njikanma OR, Okunrewaju DM. A study of neonatal deaths at the Ogun State University Teaching Hospital, Sagamu, Nigeria. *J Trop Med Hyg* 1995; 98:155-60.
12. Ezeabaku CC, Ugochukwu EF, Egbunu I, Chukwuka JO. Risk factors for neonatal mortality in a regional tertiary hospital in Nigeria. *Nig J Clin Pract* 2004; 7:50-2.

13. Lawn JB, Cousens S, Zupan J; Lancet Neonatal Survival Steering Team. 4 million neonatal deaths: where? Where? Why? *Lancet* 2005; 365: 891-900.
14. Hill K, Choi Y. Neonatal mortality in the developing world. *Demographic Research* 2006; 14:429-52.
15. Oyinusi AN. Birth asphyxia in a mission hospital in Benin City, Nigeria. *Nig Trop J Obst Gynaec* 2006; 23:34-9.
16. Ozuamabo RS. Mortality in infants of birthweight 2500g and above: a hospital-based review in Peri Harcourt, Nigeria. *West Afr J Med* 1993;12:34-8.
17. Kaushik SL, Parmar VR, Grover N, Kaushik R. Neonatal mortality rate: relationship to birth weight and gestational age. *Indian J Pediatr* 1998;65:429-33.
18. Costello A, Francis V, Byrne A, Claire P. The State of the World's Newborns. Washington: Save the Children Fund, 2001.
19. Dawodu A, Varady E, Verghese M, al-Gazali LI. Neonatal death in the United Arab Emirates: a country with a rapidly developing economy. *East Mediterr Health J* 2000;6:55-64.
20. Zupan J. Perinatal mortality in developing countries. *N Engl J Med* 2005;352: 2047-8.
21. Chavan YS, Dattal MS, Khadilker W, Kshirsagar VY, Walimbe AV, Shetti SB. Causes of early neonatal mortality. *Indian Pediatr* 1992;29:781-3.
22. Kinoti SN. Asphyxia of the newborn in east, central and southern Africa. *East Afr Med J* 1993;70:422-33.
23. Roy I, Jain A, Kumar M, Agarwal SK. Bacteriology of neonatal septicemia in a tertiary care hospital of northern India. *Indian J Med Microbiol* 2002;20: 156-9.
24. Hossain MM, Afroza S, Shirin M, Chowdhury NA, Saha SK. Bacterial aetiology of neonatal sepsis in a tertiary care hospital in Bangladesh. *Rang J Child Health* 2004;28: 81-5.
25. Airde AT. Neonatal septicemia in an African city of high altitude. *J Trop Pediatr* 1992; 38:189-91.