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A Ten-Year Review of Neonatal Deaths in the Special Care Baby Unit at the University College Hospital, Ibadan

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Summary

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Background: Neonatal mortality is a pointer to the effectiveness of the obstetric and neonatal services in any particular community and a regular auditing should help in improving the delivery of such services.

Objective: This study was carried out in order to obtain an update on the pattern of mortality among newborn babies admitted to the Special Care Baby Unit (SCBU) of the University College Hospital, Ibadan, over a ten-year period.

Methods: The case records of all neonates admitted to the SCBU from January 1991 to December 2000 were examined for the total number of admissions and all deaths that occurred in the unit. The data extracted included age at admission (hours), the gender, gestational age (weeks), birth weight (kg), mode of delivery, indication for admission, temperature on admission, cause of death and the age at death (days).

Results: The yearly mortality rate ranged between 24.6 percent and 39.2 percent with a mean annual rate of 30.8 percent. The leading causes of death were low birth weight, birth asphyxia and sepsis. A higher rate of mortality occurred among babies with admission temperatures of less than 35.5°C than in those whose temperatures were above 35.5°C ($p < 0.05$).

Conclusion: The study highlights the persistently high mortality in the neonatal unit and underscores the necessity for intensifying preventive strategies aimed especially at the leading causes. Additionally, in the prevailing circumstances of poor funding of the health care sector, low cost technologies are advocated in order to stem this high trend in mortality.

Introduction

NEONATAL mortality is a reflection of the effectiveness of obstetric and neonatal services in any particular community.[1] It contributes to about two thirds of infant mortality worldwide and most of these occur in the first week of life.[2] Worldwide, the major causes of early neonatal deaths are birth asphyxia, birth trauma, infections, prematurity and malformations, while sepsis, pneumonia, meningitis, diarrhoeal disease and tetanus account for most of the mortality during the rest of the neonatal period.[2] High neonatal mortality rate remains a problem in developing countries where the economic situation and poor planning of health services have led to little appreciable advancement in neonatal care.[3] This is in contrast to what obtains in developed countries where the technological advances in neonatal intensive care have brought about reductions in mortality among the newborns.[4] These advances include perinatal monitoring of maternal and foetal well-being and thermoregulation. The neonatal mortality rate in Nigeria is currently estimated at 50 per 1000 live births.[5] A need for a regular update of mortality has prompted this study so that priority areas requiring improved planning of neonatal services could be identified. This study therefore analyses the neonatal deaths at the Special Care Baby Unit, University College Hospital, Ibadan over a 10-year period.

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Materials and Methods

The Special Care Baby Unit (SCBU) of the University College Hospital (UCH), Ibadan cares for newborn "inborn" babies delivered in UCH, and "outborn" babies born elsewhere such as the home, church, and other hospitals. Admission to the unit is usually limited to neonates aged 48 hours and below; older babies are managed on another ward of the hospital. This age limitation is designed to limit infections that may occur in the neonatal unit, to perinatally-acquired ones.

The case records for the period, January 1, 1991 to December 31, 2000 were examined for the total number of admissions and deaths that occurred in the unit. Data extracted from the case records included age at admission (hours), the gender, gestational age (weeks), birth weight (kg), mode of delivery, indication for admission, temperature at admission, cause of death and the age at death (days). The extracted data were entered in designated forms, checked and corrected for errors; theywere then entered into a personal computer and analyzed using the *"Systat"* software package for data entries, frequencies and cross tabulation. The chi-square test was used to compare differences between proportions, and the level of significance was set at $p<0.05$.

Results

During the 10-year period, there were 2,195 admissions into the Special Care Baby Unit (SCBU). Six hundred and seventy-seven infants died, resulting in an overall mortality rate of 30.8 percent. There were incomplete records of birth weights and admission temperatures for three years (1994, 1995 and 1998); the data for these years were consequently excluded from some of the statistical analyses.

Table I shows the yearly admissions, sex distribution and annual mortality rates which ranged from 24.6 to 39.2 percent. The numbers of admissions for the years 1991 and 1992 were 347 and 376 respectively; by contrast, the numbers for 1993 and 1996 were 153 and 214, respectively. The corresponding mortalities for these years were 136 (39.2 percent), 129 (34.3 percent), 35 (29.9 percent) and 62 (29.0 percent), respectively. Higher mortality rates were recorded among female neonates in most of the years but these were not significantly different from the rates among the males ($p>0.05$).

The birth weight distribution of the babies admitted in relation to the mortality for 1991, 1992, 1993, 1996, 1997, 1999 and 2000 is shown in Table II. Infants whose birth weights were 2.5kg and above constituted 154, 181, 76, 90, 105, 96 and 90 of the admissions with corresponding mortality rates of 20.8 percent, 18.8 percent, 13.2 percent, 13.3 percent, 10.5 percent, 11.5 percent and 15.5 percent, respectively. Low birth weight infants (<2.5kg) constituted 55.1 percent of the admissions for these years and 78.8 percent of the deaths. Moreover, further analysis of the low birth weights showed that the mortality rate among the

Table I

Gender and Trends in Mortality Patterns in the SCBU

	Mortality/Year						
	1991 (%)	1992 (%)	1993 (%)	1996 (%)	1997 (%)	1999 (%)	2000 (%)
All Babies							
No of deaths	136	129	35	62	63	62	52
No admitted	347	376	153	214	256	218	209
	(39.2)	(34.3)	(29.9)	(29.0)	(24.6)	(28.4)	(24.9)
Male Babies							
No of deaths	75	80	18	28	31	33	25
No admitted	191	218	75	114	145	120	104
	(39.2)	(36.7)	(24.0)	(24.6)	(21.4)	(27.2)	(24.0)
Female Babies							
No of deaths	61	49	17	34	32	29	27
No admitted	156	158	78	100	111	98	105
	(39.1)	(31.0)	(21.8)	(34.0)	(28.8)	(29.6)	(25.7)
P values	0.98	0.25	0.75	0.13	0.17	0.73	0.77

Table II

Mortality at Various Birth Weights

Birthweight (kg)	*Mortality/Year*						
	1991 (%)	*1992 (%)*	*1993 (%)*	*1996 (%)*	*1997 (%)*	*1999 (%)*	*2000 (%)*
< 1.0							
No of deaths	28	9	3	9	9	9	12
No admitted	30	16	3	11	12	10	12
	(93.3)	(56.3)	(100)	(81.8)	(75.0)	(90.0)	(100)
1.0 - 1.499							
No of deaths	39	44	12	31	28	20	16
No admitted	51	54	22	48	41	40	36
	(76.5)	(81.5)	(54.5)	(64.6)	(68.3)	(50.0)	(44.4)
1.5 -2.499							
No of deaths	37	42	10	10	15	19	10
No admitted	112	125	52	65	98	50	71
	(33.0)	(33.6)	(19.2)	(15.4)	(15.3)	(38.0)	(14.1)
≥2.5							
No of deaths	32	34	10	12	11	11	14
No admitted	154	181	76	90	105	96	90
	(20.8)	(18.8)	(13.2)	(13.3)	(10.5)	(11.5)	(15.5)

Table III

Deaths According to the Clinical Diagnoses

Diagnoses	*Number of Deaths/Year*										
	1991 n (%)	*1992 n (%)*	*1993 n (%)*	*1994 n (%)*	*1995 n (%)*	*1996 n (%)*	*1997 n (%)*	*1998 n (%)*	*1999 n (%)*	*2000 n (%)*	*Total n (%)*
LBW	103 (75.7)	64 (49.6)	26 (74.3)	34 (81.0)	61 (81.3)	67 (76.0)	51 (81.0)	17 (80.9)	50 (80.6)	31 (59.6)	504 (74.4)
Birth asphyxia	34 (33.0)	32 (31.1)	9 (25.7)	8 (19.0)	21 (28.0)	16 (25.4)	16 (25.4)	6 (28.4)	10 (16.1)	11 (21.2)	163 (24.1)
Sepsis	30 (29.1)	22 (17.1)	4 (11.4)	14 (33.3)	25 (33.3)	19 (30.6)	16 (25.4)	7 (33.3)	9 (14.5)	10 (19.2)	156 (23.0)
PFO/ Con Pneum	9 (8.7)	8 (6.2)	3 (8.6)	4 (9.5)	5 (6.7)	3 (4.8)	4 (6.3)	2 (9.5)	3 (3.2)	4 (7.7)	45 (6.6)
NNJ	4 (3.9)	4 (3.1)	3 (8.6)	3 (7.1)	6 (8.0)	2 (3.2)	3 (4.8)	1 (4.8)	5 (8.1)	3 (5.8)	34 (5.0)
Con Mal	-	2 (1.6)	-	-	1 (1.3)	2 (3.2)	-	-	2 (3.2)	4 (7.7)	11 (1.6)
Birth trauma	-	2 (1.6)	-	1 (2.4)	1 (1.3)	2 (3.2)	1 (1.6)	-	1 (1.6)	2 (3.8)	10 (1.5)
Total	136	129	35	42	75	62	63	21	62	52	677

Key: Figures in parentheses represent percentages n = number of deaths
LBW = Low Birth Weight ConPneum = Congenital Pneumonia
PFO = Persistent Fetal Circulation NNJ = Neonatal Jaundice ConMal = Congenital Malformations

Table IV

Distribution of Mortality and Age at Death

Age at Death	*Number of Deaths/Year*										
(Days)	*1991 n%*	*1992 n%*	*1993 n%*	*1994 n%*	*1995 n%*	*1996 n%*	*1997 n%*	*1998 n%*	*1999 n%*	*2000 n%*	*Total n%*
<7	116 (85.3)	99 (76.7)	23 (65.7)	24 57.2)	43 (57.4)	45 (72.6)	36 (57.1)	13 (61.9)	40 (64.5)	40 (76.9)	479 (70.8)
7-28	17 (12.5)	23 (17.8)	8 (22.8)	14 (33.3)	25 (33.3)	17 (27.4)	19 (30.2)	7 (33.3)	18 (29.0)	1 (1.9)	149 (22.0)
Total	136	129	35	42	75	62	63	21	62	52	677

Key: Figures in parentheses represent percentages $X^2 = 69.2, p < 0.001$

Table V

Admission Temperatures and Mortality - All Babies

	Number of Deaths/Year				
Temperature (°C)	1993 (%)	1996 (%)	1997 (%)	1999 (%)	2000 (%)
< 35.5					
No of deaths	15	27	36	26	23
No admitted	25	39	56	44	30
	(60.0)	(69.2)	(64.3)	(59.1)	(76.7)
35.5 – 36.4					
No of deaths	3	17	12	10	10
No admitted	27	57	48	49	44
	(11.1)	(29.8)	(25.0)	(20.4)	(22.7)
36.5 – 37.4					
No of deaths	4	14	9	8	7
No admitted	27	49	61	56	36
	(14.8)	(28.6)	(14.8)	(14.3)	(19.4)
≥37.5					
No of deaths	1	4	7	1	2
No admitted	9	14	32	15	15
	(14.8)	(28.6)	(21.9)	(6.6)	(13.3)

Figures in parentheses represent percentages
Hypothermia (T <35.5°C) vs subnormal (T= 35.5-36.4°C) or normal temperature; p< 0.05 for each

extremely low birth weight (<1.0kg) neonates ranged from 56.3 to 100 percent. Figure 1 shows a downward trend in the mortality rates from 1991 to 1997; this appeared to have stabilised subsequently.

The common causes of death as shown in Table III were low birth weight (74.4 percent), birth asphyxia (24.1 percent), sepsis (23.0 percent), persistent fetal circulation and congenital pneumonia (6.6 percent), neonatal

Table VI

Admission Temperatures and Mortality Among LBW Infants

Temperature(°C)	*Number of Deaths/Year*								
	1993 (%)	*1994 (%)*	*1995 (%)*	*1996 (%)*	*1997 (%)*	*1998 (%)*	*1999 (%)*	*2000 (%)*	*Total (%)*
< 35.5									
No of deaths	16	21	41	43	33	9	29	16	208
No admitted	26	34	61	57	51	17	50	31	327
	(61.5)	(61.8)	(67.2)	(75.4)	(64.7)	(52.9)	(58.0)	(51.6)	(63.6)
35.5 - 36.5									
No of deaths	5	4	5	8	12	4	10	7	55
No admitted	26	34	61	57	51	17	50	31	327
	(19.2)	(11.8)	(8.2)	(14.0)	(23.5)	(23.5)	(20.0)	(22.6)	(16.8)
36.5 - 37.5									
No of deaths	3	6	9	3	5	1	7	5	39
No admitted	26	34	61	57	51	17	50	31	327
	(11.5)	(17.6)	(14.8)	(5.3)	(9.8)	(5.9)	(14.0)	(16.1)	(11.9)
≥37.5									
No of deaths	2	3	6	3	1	3	4	3	25
No admitted	26	34	61	57	51	17	50	31	327
	(7.6)	(8.8)	(9.8)	(5.3)	(2.0)	(17.6)	(8.0)	(9.7)	(7.7)

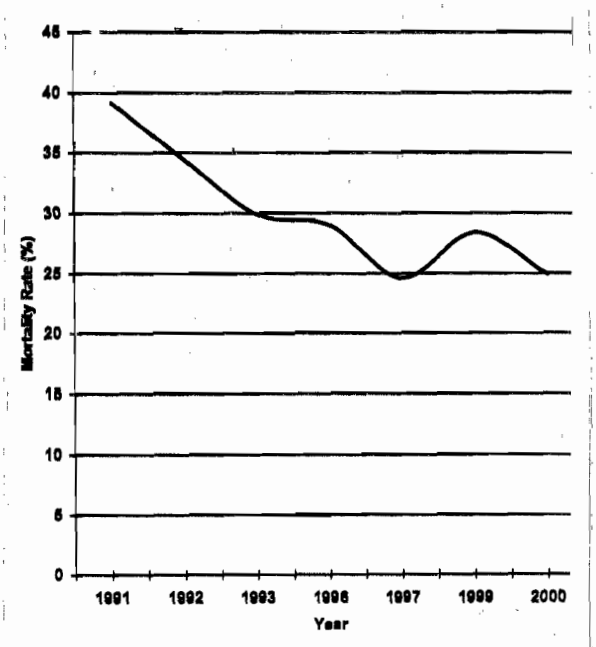

Figure 1: Trend of Mortality Rate in SCBU UCH Ibadan 1991 - 2000

jaundice (5.0 percent), congenital malformations (1.6 percent) and birth trauma (1.5 percent). Table IV shows that 479 (70.8 percent) babies died in the first six days of life while 149 (22.0 percent) deaths occurred between the seventh and twenty-eighth days ($p < 0.0001$ for each year); the remaining 49 deaths (7.2 percent) occurred beyond the neonatal period.

The admission temperatures of the infants for the years 1993, 1996, 1997, 1999 and 2000 are shown in Table V. Mortality rates among the babies admitted with hypothermia (temperatures below 35.5°C) ranged from 59.1 to 76.7 percent. The death rate among babies admitted with hypothermia was significantly ($p < 0.05$) higher than those whose temperatures were subnormal (35.5°C - 36.4°C) or normal (36.5°C - <37.5°C). Further analysis of the admission temperatures shown in Table VI revealed that 63.6 percent of the deaths among the low birth weight babies occurred in babies with temperatures below 35.5°C. Table VII lists the conditions encountered among the dead low birth weight babies; these were sepsis (23.3 percent), birth asphyxia (18.6 percent), respiratory distress (7.5 percent),

Table VII

Diagnoses and Mortality Among Low Birth Weight Babies

Diagnoses	*Number of Deaths/Year*										
	1991 n (%)	*1992 n (%)*	*1993 n (%)*	*1994 n (%)*	*1995 n (%)*	*1996 n (%)*	*1997 n (%)*	*1998 n (%)*	*1999 n (%)*	*2000 n (%)*	*Total n (%)*
LBW	51 (49.5)	38 (59.4)	14 (53.8)	12 (35.3)	14 (23.0)	17 (29.8)	21 (41.2)	4 (23.5)	30 (60.0)	14 (45.2)	215 (43.5)
LBW + Sepsis	22 (21.1)	10 (15.6)	3 (11.5)	12 (35.3)	21 (34.4)	178 (31.6)	14 (27.5)	6 (35.3)	5 (10.0)	4 (12.9)	115 (23.3)
LBW + Birth asphyxia	18 (17.5)	8 (12.5)	4 (15.4)	4 (11.8)	14 (23.0)	15 (26.3)	10 (19.6)	6 (29.4)	6 (12.0)	7 (22.6)	92 (18.6)
LBW + RDS	8 (7.8)	8 (6.3)	2 (7.7)	3 (8.8)	5 (8.2)	3 (5.3)	4 7.8)	1 (5.9)	3 (6.0)	2 (6.2)	37 (7.5)
LBW + NNJ	4 (3.9)	2 (3.1)	3 11.5)	3 (8.8)	6 (9.8)	2 (3.5)	2 (3.9)	1 (5.9)	4 (8.0)	2 (6.5)	29 (5.9)
LBW + ConMal	-	2 (3.1)	-	-	1 (1.6)	2 (3.5)	-	-	2 (4.0)	2 (6.5)	9 (1.8)
Total	103	64	26	34	61	57	51	17	50	31	494

RDS = Respiratory Distress NNJ = Neonatal Jaundice

jaundice (5.9 percent) and congenital malformations (1.8 percent).

Discussion

Although there was a downward trend in the mortality pattern among the babies admitted into our neonatal unit over the ten-year period, the annual mortality rate still ranged from 24.1 to 39.2 percent compared with 16.8 to 36.2 percent reported from the same unit in a previous review.[6] This lack of improvement in mortality rates in the present series, could be accounted for, by the inadequacy of equipment needed for monitoring and nursing high risk neonates, this being a result of the poor economic situation in the country. The number of staff in the neonatal unit has also not improved. There were sixteen nursing personnel, consisting of one principal nursing officer, six senior nursing officers, and nine staff nurses and midwives during the period of this study. This contrasted with twenty nursing officers consisting of seven senior nursing sisters and thirteen staff nurses in 1977 to 1980.[7] During the year 1977, Dawodu and Effiong[7] reported increased neonatal survival which was attributed to improved neonatal care. This improvement was made possible by the availability of resuscitation equipment such as adequate ventilators and blood gas analyzers as well as early identification and effective management of neonatal septicaemia, and adequate number of incubators that led to improved care of LBW infants. The subsequent poor funding of the health sector has resulted in a decline in the quality of health care delivery system. Thus, there was inadequate staffing, non-provision and/or non-functioning of equipment needed to manage these high-risk neonates, especially the low birth weight ones. Although there was an apparent improvement in the trend of mortality rate between 1991 and 1997 as demonstrated in Figure 1, thereafter, the rate remained fairly stable at lower but still high levels.

The relationship that has consistently been reported

between low birth weight and higher risk of mortality[4-6,8] was also demonstrated in this study. A high prevalence of low birth weight babies in disadvantaged populations of developing countries occurs as a result of poor diet, lack of quality antenatal care, low socio-economic status and increased prevalence of infections.[9] Therefore, pregnant women in these populations should be given priority for the nutritional and health interventions available.

The high mortality recorded in the first week of life has been reported previously.[7] This is usually due to a combination of factors including inadequate perinatal care to prevent intrapartum asphyxia, cardiovascular monitoring, and prevention of infections, jaundice and hypothermia. It reflects the quality of neonatal care these babies were offered. It is therefore necessary that care be focused on the first week of life. More than half of the dead infants had hypothermia with admission temperatures less than 35.5°C. It is a proven fact that without adequate monitoring and warmth, the LBW baby has very little chance of survival.[2,3,8,10] Hence, a thermoneutral environment must always be provided for these infants.

With the prevailing circumstances of continuing poor funding of health care in Nigeria, inadequate water supply, insufficient incubators and neonatal resuscitation equipment, it does not appear that the level of advancement in neonatal care attainable in the developed world, will be enjoyed locally in the nearest future. Therefore, the preventive strategies to reduce neonatal mortalities have to be intensified and appropriate low cost technologies[10,11] need to be devised in the interval. Alternative ways of providing warmth for LBW babies other than in incubators should be sought. This would include the use of heated water mattresses, warming of the nursery with room heaters, use of hot water bottles, and the "Kangaroo Mother Care" which involves early, prolonged and continuous skin-to-skin contact between a mother and her diaper-clad LBW newborn both in the hospital and after discharge, until at least, the 40th week of post-conception age.[11] Exclusive breastfeeding whenever possible, and proper follow-up should also be incorporated.

There should be an increased effort at awareness programmes on health matters concerning pregnancy, childbirth and care of the newborn. Mothers should be counselled at every opportunity during visits to health facilities and places of worship utilized by pregnant mothers, on the importance of safe deliveries, while management of high risk pregnancies in specialized centres cannot be overemphasized. Traditional birth attendants (TBAs) at home or places of worship and maternity centres should be made aware of their limitations and the benefits of referring complicated cases promptly and preferably *in-utero*.

Technological advances may bring opportunities for improved care of babies to a neonatal unit, but the pursuit of such advances by themselves may not be useful when there is high mortality from sepsis. Providing adequate water and soap to promote thorough hand washing and asepsis during procedures still remain the best methods of preventing and reducing infection in the neonatal unit.[12] The staff strength in the neonatal unit needs to be improved while there should be a regular and continuous training programme for the staff on the proper handling of the sick newborn. It is hoped that this review will stimulate ideas on ways of reducing morbidity and mortality in local neonatal units and those in other developing countries.

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