ORIGINAL ARTICLE

Determinants of Neonatal Mortality at Wesley Guild Hospital, Ilesa, Nigeria

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Abstract

Background: *More than 10 million under five children die each year of preventable and easily treatable conditions in developing countries. Of these, eight million are infants, half of whom are newborns in their first month of life. A high proportion of babies die in their first month of life, many of them during their first week. The objective of this study is to assess socio-demographic and other determinants of neonatal mortality in Wesley Guild Hospital (WGH), Ilesa, Nigeria.*

Methods: *This is a record review of 235 neonatal deaths reported at WGH from January 01 2001 to December 31 2003. Similarly, records of equal number of neonates (235) admitted to the same hospital during the same period but who were discharged alive was also reviewed for comparison. Four hundred and seventy records were reviewed. The two groups were matched for age, sex and within a 7-day period of admission. Information was collected with the aid of predesigned schedule from the patients' case notes, death registers and discharge summaries in the Records Department of the hospital. Information collected included the bio-data of the mothers, birth weight of neonates, estimated gestational age at delivery, age at death or discharge, date of admission, duration of the illness and date of discharge. Others included mode and place of delivery, maternal booking status and complications of pregnancy and birth. Data were analyzed using descriptive and inferential statistics by computer software, Epi-Info 2002.*

Results: *Teenage pregnancy, low birth weights (LBW), prematurity and neonatal tetanus were positively associated with neonatal death. Unbooked mothers, deliveries at missions and homes and low socio-economic status were also positively associated with neonatal death (P<0.05 in all cases). There was no statistically significant association between the sex of neonate, parity of mother and complications in pregnancy with neonatal death (P>0.05 in all cases).*

Conclusion: *The major determinants of neonatal deaths were teenage pregnancy, prematurity, LBW, poverty and lack of skilled attendance at delivery. Addressing the basic determinants of neonatal mortality will improve newborn survival and health and this will significantly reduce mortality among under five children in developing countries.*

KEYWORDS: Neonatal mortality; Determinant; Newborn; Health; Interventions.

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INTRODUCTION

The World Health Organization (WHO) has mounted strategies in response to the formidable challenges and great opportunities identified in the Millennium Development Goals (MDGs)[1]. The strategic direction for improving the health and development of children outlined some major areas that need to be addressed to make lasting impact. Some of these areas involve maternal and newborn health.

More than 10 million under five children die each year of preventable and easily treatable conditions in developing countries. Of these, eight million are infants, half of whom are newborns in their first month of life[1,2]. A high proportion of babies die in their first month of life and many of them during their first week. And for every baby who dies in the first week after birth, another is born dead[3,4]. Ninety-nine percent of these deaths occur in developing countries[5].

Nigeria has an estimated population of over 120 million and an annual population growth rate of 2.8%. The population of under-five children was estimated to be 20,872,000 and Gross National Income (GNI) per capital was US$320 per annum as at the year 2003. Approximately 70% of the population earns below the poverty level of$1 a day. The literacy rate for men was estimated to be 72% and for women 56% as at the year 2000. The average total fertility rate is 5.4 with average life expectancy of 51 years[6]. The Nigerian health care services are organized in a three-tier system. The provision of health services are not equitably distributed in the country and where they exist most are not functional with resultant provision of poor quality services and poor health status indicators[7]. For example, Nigeria ranks 13th position in its under 5 children mortality rate world-wide[6] with the total number of infant deaths estimated about 60 percent of all under five deaths. Among these between 50-70% were deaths in neonatal period[8,9].

Perinatal and neonatal mortalities are increasingly becoming important public health issues in many developing countries, as post-neonatal mortality rates fall[10,11]. For instance, in Nigeria, the infant mortality rate

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appears to have fallen in the last century from over 200 deaths per thousand live births to approximately 75-110 deaths per thousand live births[8,12]. While Neonatal Mortality Rate (NMR) in same country was recently estimated to be 40 deaths per thousand live births, and has changed little over the same time frame[12]. The infant mortality rate (IMR) is used throughout the world as an important health indicator. A reduction in IMR is accepted as an indication of improvement in socioeconomic status and provision of health care services in a community[13,14]. Efforts to reduce infant mortality, however, must focus on the pattern and causes of neonatal deaths[12].

Reports of neonatal mortality suggest that there are differences between developed and developing nations, and within developing nations in both the NMR and the causes of neonatal deaths[12,14-17]. Even in the same country, NMR differs from place to place.

The causes of perinatal and neonatal deaths are often presented as maternal, obstetric and fetal[12]. In Nigeria, there have been few analytical studies that examine the determinants of newborn deaths. In this paper, our objective was to assess socio-demographic and other determinants of neonatal mortality at WGH, Ilesa, a tertiary and referral centre in South-West Nigeria.

MATERIALS AND METHODS

Study area

Ilesa is one of the major towns that form the Ife-Ijesha zone of Osun State, South-West Nigeria. The local population is predominantly Yoruba speaking, but other tribes who speak different Nigerian Languages also reside there. The community is largely semi-urban with satellite rural communities.

Wesley Guild Hospital, Ilesa is an arm of the Obafemi Awolowo University Teaching Hospital Complex (O.A.U.T.H.C.) with over 600 beds and 3,000 staff. The Hospital is a referral and a tertiary centre for the Ife-Ijesha zone and adjoining communities and almost a thousand deliveries take place in the hospital in a year. It also offers other specialized services; among which is an intensive neonatal care service. Fees for services are charged based on user's fees system, but subsidized by the Federal government of Nigeria. The Wesley Guild hospital provides specialized neonatal care at its Hawford Ward in the form of incubator nursing and intensive care. It also provides services for feeding premature or low birth weight babies. The centre is well equipped to handle neonatal emergencies with a consultant neonatalogist, senior registrars, registrars and house officers that rotate through the neonatal unit, and several nurses trained in specialized neonatal care. Outborn babies are admitted into the same ward but in separate rooms. There are over 10 functional incubators and 30 beds; the bed occupancy rate of the neonatal unit is usually over 75%. Management of the newborns in the unit is according to standard management protocol designed by the consultant neonatalogist.

Study Design

This is a comparative study involving record review of neonatal deaths reported at WGH from January 01 2001 to December 31 2003. Four hundred and seventy records were reviewed, of which 235 were neonatal deaths and 235 were neonates admitted to the same hospital but discharged alive during the same period, giving a ratio of 1:1. The two groups were matched for age, sex, and within a 7-day period of admission. Cases of stillbirth, neonates brought dead and neonates whose mothers had life-threatening conditions (Eclampsia, severe diabetes mellitus (DM) in pregnancy, severe anaemia etc) were excluded. Information was collected with the aid of predesigned schedule from the patients' case notes, registers of deaths and discharges in the Record Department. Information collected included the bio-data of the mothers, birth weight of neonates, estimated gestational age at delivery, age at death or discharge, dates of admission and discharge/death and duration of the illness. Other information collected included mode and place of delivery, maternal booking status and complications of pregnancy and birth. Data were extracted from the case records by the investigators, and trained clerical assistants from the Records Department.

The data collected were entered and analysed with computer software Epi-Info 2002. Data were subjected to both descriptive and inferential statistical analysis.

RESULTS

Characteristics of neonatal death group and the comparison group

The maternal, foetal and obstetric factors associated with neonatal death in the study are shown in Table I and II. The age group of mothers of the dead neonates were $\leq$ 19 years (23.4%), 20-29 years (71.1%), and 30-39 years (5.5%), while mothers of live neonates were 14.1%, 80.4%, and 5.5% respectively. There is a statistical significant association between teenage pregnancy and neonatal mortality when compared with the other age groups ($x^2 = 6.86$, p-value = 0.03).

The parity of mothers after delivery which were categorized as P_1, P_2- P_4 and $\geq P_5$ were also examined. For the two groups, the majority were in category P_2- P_4, with frequencies of 133 (56.6%) and 141 (60.3%) for the neonatal death group and control group respectively. The proportion of primipara (P_1) in neonatal death group was 34.0% and in the control group 32.3%. There was no statistically significant association between parity and neonatal mortality.

Majority of deliveries reported occurred in a health facility for both neonatal death group (64.7%) and control group (60.4%). Fifty-two (22.1%) deliveries occurred at home among the neonatal death group, while 20.9% of deliveries occurred at home among the control group. Thirty-one (12.9%) deliveries occurred at missions (Churches where deliveries take place) among the neonatal death group as against 7.2% that occurred in missions among the control group. Delivery in missions was statistically significantly associated with neonatal mortality (x^2 = 4.55, p-value = 0.03, odd ratio = 1.95 or 0.51).

There is no statistically significant association between the sex of neonates and neonatal mortality as the male to female ratio was 1.22:1 for the group with neonatal deaths and approximately 1:1 for the control group.

There is a statistically significant association between maternal occupation and neonatal mortality (x^2 = 34.1, p-value = 0.001). Examining the occupation of mother between the two groups; for petty trading there are 107 (45.6%) mothers in the neonatal death group and 37.4% of mothers in the control group. Petty trading was the occupation associated with the highest frequency of neonatal mortality in the two groups. There were more teachers/typist among the control group (16.2%) than the neonatal death group 8 (3.4%).

The distribution of birth weight among the cases shows that 147 (62.6%) neonatal deaths occurred in babies with birth weight less than 2.5kg, and 88 (37.4%) neonatal deaths occurred in babies with birth weight $\geq$ 2.5kg. While among the control group, the total number of babies with birth weight $\geq$ 2.5kg was 153 (65.1%) and babies with birth weight < 2.5kg was only 82 (34.9%). There is a high statistically significant association between birth weight and neonatal death (x^2 = 35.9, p-value = 0.001, odd ratio = 3.12 or 0.32).

Among the neonatal death group 61.7% booked for Antenatal care (ANC) at the WGH, while among the control group, 80.0% booked. There is a high statistically significant association between booking status and neonatal death (x^2 = 19.1, p-value = 0.001, odd ratio = 2.83 or 0.40). Two hundred and fifteen (91.5%) mothers delivered by Spontaneous Vertex Delivery (SVD) and 8.5% by Caesarean Section (CS) for the neonatal death group compared to 78.3% and 21.7% respectively for the control group. There is a high statistically significant association between mode of delivery and neonatal death (x^2 = 15.9, p-value = 0.001, odd ratio = 2.98 or 0.34).

Twenty-seven of mothers with dead neonate compared to 23.0% of those with live babies had complications in pregnancy. The difference was not statistically significant (x^2 = 0.92, p-value > 0.05, odd ratio = 1.23 or 0.82).

Table III and figure 1 show the morbidity and mortality pattern among the neonates. This gives a summary of diagnosis made for neonatal morbidity and mortality at WGH between January 2001 and December 2003. The commonest neonatal conditions among the two groups combined were prematurity (27.7%), birth asphyxia (16.8%), neonatal jaundice (16.4), neonatal sepsis (15.5%), neonatal tetanus (9.4%) and small for date (4.4%). Figure 1 highlights the differences in the proportion of neonatal conditions in two groups.

Table I. Maternal, foetal and obstetric factors associated with neonatal death at Wesley Guild Hospital (WGH), Ilesa from January 2001 and December 2003.

Characteristics	Neonatal death group n = 235 Frequency (%)	Control group n = 235 Frequency (%)	Statistical indices and remark
Mothers' age groups (Years)			
≤19	55 (23.4)	33 (14.1)	?² = 6.86
20-29	167 (71.1)	189 (80.4)	df = 2
30-39	13 (5.5)	13 (5.5)	Adjusted p-value = 0.15 Not stat. sig. diff.
Parity			
P_1	80 (34.0)	76 (32.3)	?² = 0.74,
P_2- P_4	133 (56.6)	141 (60.0)	df = 2
$\geq P_5$	22 (9.4)	18 (7.7)	Adjusted p-value = 0.69 No stat. sig. diff.
Occupation			
Farmer	24 (10.2)	24 (10.2)	
Trader	107 (45.6)	88 (37.4)	
Typist/Teacher	8 (3.4)	38 (16.2)	
Artisan	68 (28.9)	46 (19.6)	?² = 34.08
Housewife	13 (5.5)	8 (3.4)	df = 6
Student	8 (3.4)	10 (4.3)	Adjusted p-value = 0.001
Nurse/Doctor	7 (3.0)	21 (8.9)	Stat. sig. diff.
Antenatal Status			
Booked	145 (61.7)	188 (80.0)	?² = 19.05, df = 1
Unbooked	90 (38.8)	47 (20.0)	Adjusted p-value = 0.001 Stat. sig. diff
Complication of Pregnancy			
Yes (Present)	63 (26.8)	54 (23.0)	?² = 0.92, df = 1
None	172 (73.2)	181 (77.0)	Adjusted p-value = 0.68 No stat. sig. diff
Place of delivery			
Health facility	152 (64.7)	142 (60.4)	?² = 3.06
Home	52 (22.1)	49 (20.9)	df = 2
Mission	31 (13.2)	17 (7.2)	Adjusted p-value = 0.51 No stat. sig. diff.
Mode of Delivery			
SVD	215 (91.5)	184 (78.3)	?² = 15.94, df = 1
CS	20 (8.5)	151 (21.7)	Adjusted p-value = 0.001 Stat. sig. diff
Sex of neonate			?² = 15.94, df = 1
Male	130 (55.3)	118 (50.2)	Adjusted p-value = 0.54
Female	105 (44.7)	117 (49.8)	No stat. sig. diff
Birth Weight			?² = 15.94, df = 1
< 2.5 kg	147 (62.7)	82 (34.9)	Adjusted p-value = 0.001
≥ 2.5 kg	88 (37.4)	153 (65.4)	Stat. sig. diff

Table II. Odd Ratios of Obstetric and Foetal Factors Associated with Neonatal Death at Wesley Guild Hospital, Ilesa from January 2001 and December 2003.

Variables		Odds ratio	95% confidence interval	Remarks
Birth Weight				
	<2.5kg			Highly significant
	≥ 2.5kg	3.12	2.10 – 4.63	Very strong association
Sex				
	Male			
	Female	1.23	0.84 – 1.79	Not significant Some degree of association
ANC	Booked			
		2.48	1.61 – 3.84	Significant
Unbooked				Strong association
Mode of delivery				
	SVD			
	CS	2.98	1.66 – 5.39	Significant
				Strong association
Complication of Pregnancy				
	Yes	1.23	0.79 – 1.91	Not significant Some degree of association
	None			

Table III. Diagnosis of Neonatal Condition at Wesley Guild Hospital, Ilesa from January 2001 and December 2003.

Diagnosis	Neonatal death group n = 235 Frequency (%)	Control group n = 235 Frequency (%)	Total (Both groups) n = 470 Frequency (%)
Prematurity	90 (38.3)	40 (17.0)	130 (27.7)
Neonatal tetanus	37 (15.7)	7 (3.0)	44 (9.4)
Birth Asphyxia	34 (14.5)	45 (19.2)	79 (16.8)
Neonatal Sepsis	33 (14.0)	40 (17.0)	73 (15.5)
Neonatal Jaundice	26 (11.1)	51 (21.7)	77 (16.4)
Small for date	7 (3.0)	13 (5.5)	20 (4.4)
Others	8 (3.4)	39 (16.6)	47 (10.0)

DISCUSSION

The findings in the study show that several factors influence neonatal mortality, which need to be addressed if newborn health and survival are to be promoted and improved. There were more deaths in babies of teenage mothers which is in support of previous studies.[18-20] This has been linked to "in-capacious pelvis, obstructed labour, low socio-economic status, lack of antenatal care and iron deficiency anaemia."[19] However, a study of teenage pregnancy in a military population in the US reported no differences in the neonatal survival among teenagers compared to other age group of mothers[21].

Another major finding from this study is the strong association between occupation of mothers and neonatal death. Women from higher socio economic status in terms of their occupation tended to record fewer neonatal deaths. This is consistent with finding from a study done by Butler et al who observed that maternal factors such as low social class was associated with greater risk of neonatal death[22].

More neonatal deaths occurred when deliveries were attended to by unskilled persons in homes and mission houses, where deliveries are not supervised by trained health care workers. This may be explained by the fact that poor labour management and failure to maintain aseptic condition is common in this type of setting.[23] Neonatal tetanus is the second commonest cause of neonatal death from this study. Hygiene of the birth attendant, the use of a clean tool in cutting the cord and lack of anti-tetanus vaccination during pregnancy have been identified as factor responsible for this[11].

Parity was found not to have a statistically significant association with neonatal death in this study which is in contrast to the findings from a Jamaican study[24]. This might have been due partly to the sample size and the fact that more primigravida and grand multigravida are seen in tertiary centres. There were more neonatal deaths associated with SVD compared to CS. This may be explained by the fact that most SVDs take place in health facilities that can not provide services for newborn resuscitation or in places like mission houses and homes. The factor of booking for ANC at WGH was also found in this study to be associated with neonatal death. This may be explained by the fact that mothers who booked for ANC are more likely to suffer less adverse pregnancy outcome and more likely to deliver under the supervision of a trained birth attendant.

Prematurity was found to be the commonest cause of death in the neonatal period in this study. In the same light, there was a strong association between birth weight of infant and neonatal mortality. Pre-term births have been found to be associated with low birth weight (LBW)[2]. It is well documented that prematurity and LBW cause foetuses not to tolerate the process of birth well[12] and that LBW is an underlying factor in 40-70% of newborn deaths[2,25]. Prematurity causes neonatal death because this group of neonates are prone to malnutrition (absent suckling reflex)[26] sepsis, haemorrhage secondary to vitamin K deficiency[27]. In a similar study in a tertiary health care facility in Kenya to

assess the risk factors for neonatal mortality; LBW was also found to be the highest risk factor for neonatal mortality[28]. Whereas, studies have also shown that 75% of all deaths in the neonatal period occurred in preterm infants even though they constituted only a third of all LBW infants[11]. In most of the developing countries, the majority of LBW infants are small-for-date rather than preterm[29]. Previous work supports that preterm infants have a perinatal mortality rate 13 times higher than that of term infants of comparable birth weight, and twice that of infants with IUGR[30]. This calls for strategies targeted at preventing prematurity and LBW.

The limitation of this study is that it is hospital based and not population based, so it may not be possible to generalize the conclusion. Some other limiting factors include improper documentation of case notes, resulting in inability to collect some vital information such as the maternal level of education and duration of illness prior to presentation.

CONCLUSION

The study concluded that the major determinants of neonatal mortality were teenage pregnancy, LBW, prematurity, poverty and lack of skilled attendance at delivery. The leading causes of neonatal morbidity and mortality are prematurity, neonatal tetanus, birth asphyxia, neonatal sepsis and neonatal jaundice. Addressing the basic determinants of neonatal mortality will improve newborn survival and health and this will significantly reduce mortality among under five children in developing countries.

REFERENCES

1. World Health Organization (WHO). Department of child and Adolescent Health and Development. WHO CAH Progress Report 20002001. World Health Organization 2002. Geneva. *WHO/FCH/CAH/02.19*:1- 2.
2. Global Forum for health Research.Davey S (ed). *The 10/90 Report on Health Research 2001-2002*. Global Forum for health Research, WHO, Geneva 2002: 181-2.
3. Tinker A. "Integrating Essential Newborn Care into Health System" (Presentation given at the World Bank, Washington, DC, Sept. 16, 2002.
4. Tinker A, Ransom E. "Healthy mother and Healthy Newborns: The vital link". Population reference Bureau Washington, DC, 2002.
5. World Health Organization (WHO). Partnership for Maternal, Newborn and Child Health. LIVES: Partnership for Safe Motherhood and Newborn Health. World Health Organization, Geneva 2005.
6. United Nations Children's Fund (UNICEF): State of the World Children (SOWC) 2005. United Nations Children's funds. UNICEF, New York 2004: 105 - 142.
7. Olowu D, Abarsh E, Awotokun AM, Erero EJ, Okotoni MO, Soetan RO, Wunsch J. World Health Organization WHO Report on Local Govt. and Health Sector Decentralization: The Nigerian Experience. April, 2000 World Health Organization, Geneva: 35.
8. United Nations Children's Fund (UNICEF): State of the World Children (SWOC) 2003. United Nations Children's funds. UNICEF, New York 2002: 84 - 113.
9. Population Reference Bureau (PRB). 2002 World population Data Sheet. Population Reference Bureau Washington, DC, 2002.
10. Costello A. Perinatal health in developing countries. *Transactions of the Royal Society for Tropical Medicine and Hygiene* 1993, 87: 1 - 2.
11. Yesmin S, Osin D, Paul E, Costello A. Neonatal mortality of low-birth-weight infants in Bangladesh. *Bull World Health Organ*, 2001 79 (7): 608-14.
12. World Health Organization (WHO). Perinatal mortality. A listing of Available information. World health Organization, Geneva 1996: 17 *WHO/FRH/MSM/96.7.*
13. Save-the-children/Population Reference Bureau (PRB). Why invest in Newborn health? Policy perspective in newborn health. Population Reference Bureau Washington, DC, 2003.
14. World Health Organization (WHO). Development of indictors for monitoring progress towards health for all by the year 2000. World Health Organization Geneva, 1981.
15. Dawodu AH, Al-Umran K, Al-Faraidy A. Neonatal vital statistics: a 5-year review in Saudi Arabia. *Annals of Tropical Paediatrics* 1988, 8:187 - 92.
16. Njokanma OF, Olanrewaju DM. A study of neonatal deaths at the Ogun State University Teaching Hospital, Sagamu, Nigeria. *Journal of Tropical Medicine and Hygiene* 1995, 98 (3):155 - 60.
17. Owa JA, Al-dabbous I, Owoeye AA. Weight specific morbidity and mortality rates among LBW infants in two developing countries. Nigerian Journal of Paediatrics 2004; 31: 19 - 24.
18. Iloki LH, Koubaka R, Itoua C, Mbemba Moutounou GM. Teenage pregnancy and delivery: 276 cases observed at the Brazzaville University Hospital, Congo. *J Gynecol Obstet Biol Reprod (Paris)*. 2004;33 (1 Pt 1):37-42.
19. Cooper LG, Leland NL, Alexander G. Effect of maternal age on birth outcomes among young adolescents. *Soc Biol*. 1995;42 (1-2): 22 - 35.
20. Conde-Agudelo A, Belizan JM, Lammers C. Maternal-perinatal morbidity and mortality associated with adolescent pregnancy in Latin America: Cross-sectional study. *Am J Obstet Gynecol* 2005; 192 (2):342 - 9.
21. Yoder BA, Young MK. Neonatal outcomes of teenage pregnancy in a military population. *Obstet Gynecol* 1997; 90 (4 Pt 1):500 - 6.
22. Butler B, Bonham DC. The first report of the 1958 British perinatal mortality survey. Edinburgh, Churchill

Livingstone 1963: 7 - 10.
23. McDermott J. Stekettee R., Wirima J. Perinatal Morbidity in rural Malawi. *Bull World Health Organ* 1996; 74 (2): 165 - 17.
24. Mc-Caw Benns A, Greenwood R, Coard K, Ashley D, Golding J. Perinatal deaths as a result of immaturity in Jamaica. *Paediatric and Perinatal Epidemiology* 1994:Suppl 1: 110 - 18.
25. Ekure EN, Iroha EO, Egri-Okwaji MR, Ogedengbe OK. Perinatal mortality at the close of the 20th century in LUTH. Nigerian Journal of Paediatrics 2004; 31: 14 - 8.
26. World Health Organization (WHO). Perinatal mortality: A listing of available information. World health Organization 1996: 17 WHO/FRH/MSM/96.7.
27. World Health Organization (WHO). *Management of the sick newborn*. Geneva, World Health Organization, WHO/FRH/MSM/96.12. 1996: 1-3.
28. Kambarami RA, Matibe P, Pirie D. Risk factors for neonatal mortality: Harare Central Hospital Neonatal Unit-Zimbabwe. *Cent Afr J Med* 1999; 45 (7):169 - 73.
29. Villar J., Belizan J. The relative contribution of prematurity and foetal growth retardation to low birth weight in developing and developed countries. *American Journal of Obstetrics and Gynaecology*, 1982, 143: 793 - 798.
30. Barros P. Comparison of the causes and consequences of prematurity and Intra-Uterine Growth Retardation: A longitudinal Study in southern Brazil. *Paediatrics* 1992; 90: 238 - 44.