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ORIGINAL ARTICLE

Prospective audit of perinatal mortality among inborn babies in a tertiary health center in Lagos, Nigeria

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Abstract

Background: The perinatal mortality rate remains an important indicator of maternal care and maternal health and nutrition, and also reflects the quality of obstetric and pediatric care available. The causes of most of the perinatal deaths are preventable, thus making it important to identify the risk factors in each health environment.

Objective: The aim was to prospectively audit the perinatal mortality and associated risk factors in a tertiary health facility in a developing country.

Materials and Methods: Data for all consecutive deliveries in the labor ward complex of Lagos University Teaching Hospital (LUTH) between June 2002 and November 2002 were obtained from the patients' record and by interviewing the mothers using a questionnaire. The babies were followed up for 7 days postdelivery.

Results: There were 51 (8.5%) perinatal deaths made up of 43 (7.1%) stillbirths (15 fresh and 28 macerated) and 8 (6.1%) early neonatal deaths giving a perinatal mortality rate of 84.6/1000. Maternal factors that significantly affected perinatal deaths were maternal age, parity, antenatal care booking and the hospital where the mother was booked for antenatal care, number of previous child deaths, and complications of pregnancy. Mode of delivery and complications of labor were the significant intrapartum factors. Fetal factors that influenced perinatal deaths were fetal presentation, birth weight, and Apgar scores at 1 and 5 min. When multiple logistic regression (multivariable analysis) of perinatal mortality on possible risk factors was done, only the Apgar score at 5 min, birth weight, and parity were significant risk factors.

Conclusion: The study shows a high perinatal mortality rate with majority of perinatal deaths occurring before the delivery. Significant risk factors are a low Apgar score at 5 min, low birth weight, and high parity.

Key words: Early neonatal death, perinatal mortality, prospective, risk factors, stillbirth

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Introduction

The perinatal mortality rate remains an important indicator of maternal care, health and nutrition; it also reflects the quality of obstetric and pediatric care available.[1]

It shows the socioeconomic status of the community, as the standard of health is often low in poor communities and good in wealthy communities. In keeping with this, some developed countries have been able to achieve single-digit figures for their perinatal mortality rates.

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The WHO recommends that all fetuses and infants weighing at least 500 g at birth, whether alive or dead, should be included in the perinatal statistics because of its inherent value in improving coverage of reporting deaths of babies weighing ≥1000 g. However, it is recommended that for international comparison, 1000 g and/or 28-week gestation should be used.[2]

Ninety-eight percent of deaths in the perinatal period occur

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in developing countries and Africa remains the region with the highest perinatal mortality rates. The causes of most of these deaths are preventable.[1] This makes it important to identify the risk factors in each health environment.

Between the years 1996 and 2000, we reviewed perinatal mortality in our center, a tertiary health facility in sub-Saharan Africa and found a rate of 84.8/1000.[3] Our previous study on perinatal mortality like most others in the developing countries was a retrospective study.[4-9] In the earlier study, we only examined mortality cases so it was not possible to identify significant risk factors. In the current study, we aimed to prospectively audit the perinatal mortality and associated risk factors in a tertiary health facility in a developing country.

Materials and Methods

The study was carried out in Lagos University Teaching Hospital (LUTH), a large tertiary referral center in Lagos, Nigeria.

The calculation of the sample size was based on a prevalence rate of 6.9% observed for stillbirths in a previous study in our center. The stillbirth rate was chosen because it accounted for the majority of perinatal deaths. With an error margin of 2% and a confidence level set at 95%, a minimum sample size of 560 was calculated. Data for all consecutive deliveries in the labor ward complex between June 2002 and November 2002 were obtained from the patients' record and by interviewing the mothers using a questionnaire. The required sample size was obtained within this study period.

Information obtained for each birth included the date of birth, whether the mother booked for antenatal care or not, hospital of booking, maternal age and parity, number of children alive, estimated gestation, birth weight, sex and vital status of the baby at birth, whether the infant was a single or multiple delivery, and the type of delivery. Others were neonatal clinical diagnosis and mortality outcome after 7 days of life.

The inclusion criteria for this study were birth weight of at least 500 g and/or a gestational age at least of 20 weeks. A stillbirth was defined as intrauterine death of a fetus weighing at least 500 g after 20 completed weeks of gestation occurring before the complete expulsion or extraction from its mother. A fresh stillbirth was defined as the intrauterine death of a fetus during labor or delivery, and a macerated stillbirth was defined as the intrauterine death of a fetus sometime before the onset of labor, where the fetus showed degenerative changes such as discoloration and peeling of the skin.[1]

The live births were followed up and their outcome, whether dead or alive, was recorded after 7 days of life.

The rates were calculated as follows:[1]
Perinatal mortality rate = (Early neonatal deaths + Stillbirths/Total births) × 1000
Early neonatal mortality rate = (Early neonatal deaths/ Live births) × 1000
Stillbirth rate: (Stillbirths/Total births) × 1000.

The study was reviewed and approved by the Ethics Review Committee of LUTH. Informed verbal consent was obtained from participating women.

Data were analyzed using SPSS 11.0 statistical software. The numbers of perinatal deaths was presented as a proportion of all births. To assess risk factors of the perinatal mortality outcome, cross-tabulations by each covariate were examined using chi-square tests, and statistical significance was set at $P < 0.05$. Multiple logistic regression (multivariable analysis) of perinatal mortality on possible risk factors was done using the variables that were significant on univariate analysis.

Results

Six hundred and three babies weighing ≥500 g were delivered between June 2002 and November 2002. They were 319 males and 284 females giving a male-to-female ratio of 1.1.

Characteristics of the mothers of these 603 babies showed that most (58.7%) of them had an age range from 30 to 39 years and their weight ranged from 35.8 to 137 kg with a mean of 73.7 kg. Primips among the mothers numbered 198 (32.8%). All the women except 46 (7.6%) booked for antenatal care with 94.1% of them booked in a tertiary hospital. Delivery occurred at term in 86.4%, and 94.2% of the mothers had no previous child deaths [Table 1].

The pregnancies of 95 (15.%) women were complicated with the top three problems being hypertension in pregnancy/eclampsia (43.2%), infections (12.6%), and antepartum hemorrhage and fetal distress (8.4%). Labor was complicated in 58 (9.5%) cases. The main complications of labor were premature labor (53.4%), obstructed/prolonged labor (36.2%), and fetal distress (29.3%). Others included vaginal and cervical tear with postpartum hemorrhage. Some cases had more than one complication.

The mode of delivery was spontaneous vertex in 377 (62.5%) cases and by caesarean section in 185 (30.6%) cases. Thirty six (6%) babies were products of multiple pregnancy. While 521 (86.1%) babies were born full term, 82 (13.6%) were born preterm. The birth weights of the babies ranged from 600 to 4850 g with a mean of 3100 g.

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Of the 603 deliveries, 43 (7.1%) were stillbirths, 15 fresh, and 28 macerated. Four hundred and twenty-nine (71.1%) of the total deliveries were discharged to their mothers while 131 were admitted into the neonatal unit (NNU). Of the 131 admitted into NNU, 8 (6.1%) died bringing the final mortality count to 51 (8.5%) out of the 603 deliveries in the 6-month period. This gives a perinatal mortality rate of 84.6/1000, stillbirth rate of 71.3/1000, and an early neonatal mortality rate of 14.3/1000.

The perinatal mortality rate for babies weighing ≥1000 g was 75.4/1000 with a stillbirth rate of 65.3/1000 and an early neonatal mortality rate of 14.3/1000. Out of the 597 babies weighing ≥1000 g, 564 were singletons and 43 of them died giving a perinatal mortality rate of 76.2/1000. While the stillbirth rate of the singletons weighing ≥1000 g was double that of the multips, the early neonatal mortality rate of the multips was 12 times more than that of the singletons [Table 2].

All except one neonate who died were born preterm, asphyxiated at birth, and had septicemia.

Table 1: Maternal characteristics of all deliveries within the study period

Maternal variables	Frequency	Percentage
Maternal age		
15–19	7	1.2
20–29	228	37.8
30–39	354	58.7
≥40	14	2.3
Parity		
0	198	32.8
1–4	381	63.2
5+	24	4.0
Booking status		
Booked	557	92.4
Unbooked	46	7.6
Hospital of booking		
Tertiary hospital	524	94.1
Secondary government hospital	6	1.1
Private hospital	27	4.8
Gestational age at delivery		
<37 weeks	82	13.6
≥37weeks	521	86.4
History of previous child deaths		
Present	35	5
Absent	568	94.2

Table 3 shows that the perinatal mortality rate increased as the birth weight decreased with a rate of 1000/1000 for babies weighing <1000 g and 45.2/1000 for babies who weighed ≥2500 g.

In Table 4, it can be observed that normally formed macerated stillbirths accounted for most of the perinatal deaths in all the weight categories closely followed by the asphyxia group.

Table 5 indicates that the following maternal factors significantly affected perinatal death – maternal age, parity, antenatal care booking, and the presence of complications of pregnancy.

The mode of delivery and presence of complications during labor were the significant intrapartum factors, shown in Table 6. Babies delivered in methods other than a spontaneous vertex delivery or caesarean section such as laparatomy or instrumental deliveries had the highest perinatal deaths. Table 7 shows that fetal presentation, birth weight, and Apgar scores were the significant fetal factors influencing perinatal deaths. When multiple logistic regression (multivariable analysis) of perinatal mortality on possible risk factors was done, only the Apgar score at 5 min, birth weight, and parity were significant risk factors [Table 8].

Discussion

This study revealed perinatal mortality, stillbirth, and early neonatal mortality rates of 84.6/1000, 71.3/1000, and 14.3/1000, respectively. These are still high figures closely resembling the 84.8/1000 obtained in this institution from years 1996 to 2000.[3] For singletons in the same institution, a perinala mortality rate of 42.5/1000 was obtained three decades ago against 75.4/1000 in this study.[4] This is mostly caused by the doubling of the still birth rate from 32.5/1000 to 65.3/1000. The five year study by Abudu *et al*[4] had also shown a trend of increase with the perinatal mortality rate of the last year being 59.2% higher than in the first year of study.

WHO country estimates for Nigeria for year 2000 put the perinatal mortality, stillbirth, and early neonatal mortality rates at 86/1000, 48/1000 and 40/1000, respectively.[10] While our perinatal mortality rate is comparable to the national figure, our stillbirth rate is higher and our early

Table 2: Perinatal mortality rate for babies weighing ≥1000g

Case categories	Total number	Stillbirth rate	Early neonatal death rate	Perinatal mortality rate
All deliveries weighing ≥1000 g	597	65.6/1000	13.4/1000	75.4/1000
All singletons weighing ≥1000 g	564	63.8/1000	2.4/1000	76.2/1000
All multips weighing ≥1000 g	33	30.3/1000	30.3/1000	60.6/1000

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neonatal death rate is much lower. The higher stillbirth rate may be a reflection of the fact that our center is a tertiary institution and receives referrals of complicated cases from lower levels of care. The center also has better facilities to care for newborn babies than majority of lower level care facilities that take deliveries in the country thus accounting for the lower early neonatal mortality rates.

Table 3: Birth-weight-specific perinatal death

Weight (g)	Number of births	Stillbirths	Early neonatal deaths	Alive and discharged to mother	Perinatal mortality ratea
<1000	6	6	0	0	1000
1000–1499	18	4	6	8	555.6
1500–1999	19	5	1	13	315.8
2000–2499	51	6	0	45	117.6
≥2500	509	22	1	486	45.2
Total	603	43	8	552	

aRates = Number/1000.

Table 4: Wigglesworth classification of perinatal deaths

Birth weight (g)	Normally formed macerated stillbirths (SB)	Lethal congenital malformations (SB/NND)	Conditions associated with immaturity (NND)	Asphyxial conditions (SB/NND)	Other specific conditions	Total
<1000	4	–	–	2	–	6
1000–1499	3	1	2	4	–	10
1500–1999	3	–	–	3	–	6
2000–2499	5	–	–	1	–	6
>2500	10	2	–	11	–	23
Total	25	3	2	21	0	51

SB: Stillbirths; NND: Neonatal deaths.

Table 5: Maternal factors in relation to perinatal deaths

Maternal variable	No. of perinatal deaths (%)	Number of babies alive at the end of the perinatal period (%)	Total (%)	*P*-value
Maternal age (years)				
15–19	3 (42.9)	4 (57.1)	7 (100)	0.008
20–29	20 (8.9)	208 (91.2)	228 (100)	
30–39	26 (7.3)	328 (92.7)	354 (100)	
≥40	2 (14.3)	12 (85.7)	14 (100)	
ANC booking				
Booked	32 (5.7)	525 (94.3)	557 (100)	0.0001
Unbooked	19 (39.6)	27 (60.4)	46 (100)	
Type of hospital booked for ANC				
Tertiary hospital	27 (5.2)	497 (94.8)	524 (100)	0.06
Secondary government hospital	1 (16.7)	5 (83.3)	6 (100)	
Private hospital	4 (14.8)	23 (85.2)	27 (100)	
Parity				
0	16 (8)	182 (92)	198 (100)	0.012
1–4	29 (7.6)	352 (92.4)	381 (100)	
5+	6 (25)	18 (75)	24 (100)	
Previous child death				
Present	3 (8.6)	32 (91.4)	35 (100)	0.584
Absent	48 (8.5)	520 (91.5)	568 (100)	
Complications of pregnancy				
Present	17 (17.9)	78 (82.1)	95 (100)	0.0007
Absent	34 (6.7)	474 (93.3)	508 (100)	

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Table 6: Intrapartum factors that influenced perinatal deaths

Variable	No. of perinatal deaths (%)	Number of babies alive at the end of the perinatal period (%)	Total (%)	*P*-value
Mode of delivery				
SVD	22 (5.8)	355 (94.2)	377 (100)	0.0001
Caesarean section	20 (2.5)	165 (97.5)	40 (100)	
Others	9 (22)	32 (78)	41 (100)	
Complications of labor				
Present	28 (14.2)	169 (85.8.2)	197 (100)	0.001
Absent	23 (5.7)	383 (94.3)	406 (100)	
Time of delivery				0.465
6.01–18.00	25 (7.6)	302 (92.4)	327 (100)	
18.01–6.00	26 (9.4)	250 (90.6)	276 (100)	

Table 7: Fetal factors that influenced perinatal death

Fetal variable	No. of perinatal deaths (%)	Number of babies alive at the end of the perinatal period (%)	Total (%)	*P*-value
Gestation				
Multiple	5 (13.9)	31 (86.1)	36 (100)	0.217
Single	46 (8.1)	521 (91.9)	567 (100)	
Fetal presentation				
Cephalic	41 (7.4)	512 (92.6)	553 (100)	0.006
Others	10 (20.0)	40 (80.0)	50 (100)	
Birth weight				
<1000	6 (100)	0 (0)	6 (100)	0.0001
1000–1499	10 (35.6)	8 (44.4)	18 (100)	
1500–1999	6 (31.6)	13 (68.4)	19 (100)	
2000–2499	6 (11.8)	45 (88.2)	51 (100)	
≥2500	23 (4.5)	486 (95.5)	509 (100)	
Sex				
Male	27 (8.5)	292 (91.5)	319 (100)	0.89
Female	24 (8.5)	260 (91.5)	284 (100)	
Apgar score at 1 min				
0–3	46 (71.9)	18 (28.1)	64 (100)	0.000000001
4–6	4 (5.9)	64 (94.1)	68 (100)	
7–10	1 (0.2)	470 (99.8)	471 (100)	
Apgar score at 5 min				
0–3	43 (97.7)	1 (2.3)	44 (100)	0.000000001
4–6	6 (25)	18 (75)	24 (100)	
7–10	2 (0.4)	533 (99.6)	535 (100)	

Reports from studies in Nigeria in the late 1970s and early 80s reported perinatal mortality rates below 50/1000.[4,5] In contrast, recent studies show higher figures.[11,12] A recent study from another tertiary institution (Enugu) in the country with a similar setting which recruited babies weighing ≥500 g reported perinatal mortality, stillbirth, and early neonatal rates of 133.94/1000, 68.06/1000, and 64.46/1000, respectively.[7]

In affluent communities with good perinatal care, the stillbirth and early neonatal mortality rates are about equal giving a stillbirth-to-early neonatal death (SB:ENND) ratio of about 1. However, in poor communities, with inadequate perinatal care, the stillbirth rate is usually at least double the early neonatal death rate.[13] The ratio in the current study was 4.6, a clear indication of poor perinatal care.

One factor that may partly explain the high figures obtained in the current study is the fact that it is hospital based. The study center is a tertiary care institution catering for high-risk patients and receiving referrals from other centers often after adverse events have occurred. Mortality statistics would therefore be invariably higher than would be obtainable from an all-inclusive community-based study in

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Table 8: Multiple logistic regressions (multivariable analysis) of perinatal mortality on possible risk factors

Variable	Unstandardized coefficients		Standardized coefficients	T	Sig.	95% CI for B	
	B	Std. error	Beta			Lower bound	Upper bound
Constant	1.809	0.081		22.366	0.000	1.650	1.968
Maternal age	0.003	0.010	0.007	0.318	0.750	−0.017	0.024
Parity	0.037	0.011	0.071	3.410	0.001*	0.016	0.058
Antenatal care booking	0.042	0.022	0.040	1.918	0.056	−0.001	0.86
Pregnancy complications	0.029	0.020	0.049	1.434	0.152	−0.012	0.051
Fetal presentation	−0.014	0.021	−0.14	−0.656	0.512	−0.056	0.028
Mode of delivery	0.011	0.015	0.023	0.698	0.486	−0.019	0.040
Labor complications	0.029	0.020	0.049	1.434	0.152	−0.011	0.068
Apgar score at 1 min	0.008	0.006	0.076	1.493	0.136	−0.003	0.019
Apgar score at 5 min	−0.095	0.005	−0.903	−18.176	0.000*	−0.106	−0.085
Birth weight (kg)	−0.034	0.008	-0.091	−4.020	0.000*	−0.050	−0.017

*Significant

which favorable outcomes from average risk patients would mitigate the concourse of high-risk patients managed in a teaching hospital. Thus, it is not surprising that perinatal mortality rates of 34 per 1000 in Pakistan to 9 per 1000 births in Argentina[14] emanating from community-based studies in developing countries were much lower than those reported herein.

Our study showed that 84.3% of perinatal deaths were accounted for by stillbirths and that nearly two-thirds of the stillbirths were macerated following the same trend as in the previous study reported in 2004 where 82.2% of 573 perinatal deaths were stillbirths. This figure is much higher than WHO estimates that half of perinatal deaths are stillbirths.[1]

Stillbirths if fresh indicate intrapartum deaths but if macerated could be because of pregnancy complications, maternal disease, or unknown cause. A study from Zimbabwe, another African country, in the 1990s showed a similar trend of a high frequency of stillbirths, especially macerated stillbirths.[9] All cases of perinatal deaths in babies weighing >2500 g were stillbirths in our study. This indicates the need to ensure that women receive good antenatal care through health education, and antenatal care should be made affordable and accessible. To achieve the SB:ENND ratio of 1 in our environment, all efforts must be made not only to reduce SB drastically but also to keep ENND to a bare minimum.

Almost all neonates who died were born preterm, asphyxiated at birth, and had septicemia indicating that the biggest challenge to overcome in reducing the early neonatal mortality rate in this environment is providing requisite facilities to care for the high-risk newborns.

Abudu *et al.*[4] more than two decades ago in our center identified trauma, low birth weight, antepartum hemorrhage, toxemia of pregnancy, and the mature, cause unknown, group as the major clinical causes of perinatal mortality. The limitation of that study was that it was retrospective and only looked at records of perinatal deaths and not all deliveries. This hindered the ability to test the significance of the risk factors. Their classification of trauma included prolonged and obstructed labor, breech, ruptured uterus, cord prolapsed, and forceps delivery. Our study has been able to test and identify the significant risk factors. Although several risk factors were identified, when multivariable analysis of the factors was done, only the Apgar score at 5 min, birth weight, and parity were significant risk factors for perinatal mortality.

These risk factors show that improved early neonatal care will reduce perinatal mortality but not significantly without adequate maternal care to ensure an adequate birth weight at the delivery. Women need to be educated on what role they can play in ensuring that their babies survive particularly in the area of planned conception. Quality antenatal care is the most crucial tool for reducing perinatal mortality in this environment. When appropriate neonatal care is preceded by this, our rates will begin to drop. A community program that seeks out the pregnant woman, offers her basic antenatal care, and refers her for specialist care when necessary may be required. A program that will also ensure that all births are attended by a skilled health worker is also needed.

This has to go along with hospitals that meet minimum required standards for maternal and newborn care. Many institutions in the developing countries grapple with identified problems of the absence of health-care providers, outdated knowledge and inadequate skills, lack of essential medicines, supplies and equipment, overcrowding, and inadequate hygiene.[1] The countries need to rise up to the challenges of building a viable health system that meets the needs of the increasing number of women and their infants.

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One obvious limitation of the current study is that it is hospital based. In an environment where many babies are born outside the health facility, it is not an appropriate source for mortality calculation. However, it helps highlight the perinatal problems in our environment.

The study findings showed that babies born with low birth weight, having low Apgar scores at 5 min, and born to women with high parity (>5) are more at risk of perinatal death. Good obstetric and perinatal care remains the much needed tool for reducing perinatal mortality.

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