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A CASE SERIES STUDY OF PERINATAL DEATHS AT ONE REFERRAL CENTER IN RURAL POST-CONFLICT LIBERIA

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Abstract

Objectives—The overall objective of this study was to further our understanding of the factors contributing to the high perinatal mortality rates at a busy rural, referral hospital in Liberia. The specific aims were to: 1) analyze the records of women who experienced a perinatal loss for both medical and nonmedical contributing factors; 2) describe the timing and causes of all documented stillbirths and early neonatal deaths; and 3) understand the factors surrounding stillbirth and early neonatal death in this context.

Methods—This case series study was conducted through a retrospective hospital-based record review of all perinatal deaths occurring at the largest rural referral hospital in north-central Liberia during the 2010 calendar year.

Results—A record review of 1656 deliveries identified 196 perinatal deaths; 143 classified as stillbirth and 53 were classified as early neonatal death. The majority of stillbirths (56.6%) presented as antenatal stillbirths with no fetal heart tones documented upon admission. Thirty-one percent of cases had no maternal or obstetrical diagnosis recorded in the chart when a stillbirth occurred. Of the 53 early neonatal deaths, 47.2% occurred on day one of the infant's life with birth asphyxia/poor Apgar scores being the diagnosis listed most frequently.

Conclusions—Clear and concise documentation is key to understanding the high perinatal death rates in low resource countries. Standardized, detailed documentation is needed to inform changes to clinical practice and develop feasible solutions to reduce the number of perinatal deaths worldwide.

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Keywords

Perinatal mortality; stillbirth; early neonatal death; post-conflict; Liberia

Purpose

Background

At least half of all stillbirths occur during labor or birth (1), with over two million during the third-trimester; an additional three million neonatal deaths occur worldwide each year. Ninety-eight percent of stillbirths occur in low and middle income countries with 55% from rural sub-Saharan and Asian countries (2). Although limited access to skilled care significantly contributes to perinatal mortality, an increasing body of literature highlights stillbirth rates and early neonatal deaths are being driven by less apparent, potentially preventable factors (2,3,4).

The risk of stillbirth is 24 times higher for an African woman than a woman from a high income country (5) and several studies have examined stillbirth and neonatal deaths in low resource countries (6,7,8,9). A study from the Democratic Republic of the Congo found the perinatal death rate 7-fold above that of high income countries (6). Higher rates of delay in seeking care, delay in transfer from the referring hospital, delay in receiving care at the hospital, inadequate intrapartum monitoring, and inappropriate clinical management are often cited (7,8,9). Risk factors vary dependent on the information available at individual facilities, with no degree of standardization enabling comparison within and between countries.

Despite the high numbers of stillbirth and neonatal deaths in low resource countries, a dearth of information exists regarding incidence and prevalence; indeed, stillbirths are not counted in the world-wide data collection for tracking the Millennium Development Goals (10). And because of poor surveillance in many countries, perinatal deaths often go unreported. Since 2000, WHO has led an initiative to reach a consensus on standardized metrics to drive data based decision-making for health systems in low resource countries. Development of these indicators and related management strategies has been supported by case studies within countries with limited resources (11). Yet despite this initiative, very little data exist on the prevalence, timing, and circumstances associated with stillbirth or neonatal deaths in developing countries.

Understanding the contributing factors to stillbirths and early neonatal deaths has important programmatic and resource implications for low resource settings (8). The research questions for this study developed directly out of earlier work by members of the research team (12,13) with input from Liberian hospital personnel and clinical leaders. Research ideas were discussed with hospital staff and gaps in knowledge were identified. Given the recognition of a high perinatal mortality rate at the study facility and a massive undertaking to rebuild health services post-conflict, this study provides baseline data to enhance the mapping of perinatal mortality and improve clinical services in Liberia. Indeed, data on fetal and neonatal deaths can assist facilities and local geographic regions to mobilize their communities and prioritize strategies for targeted populations (14).

Related to the need for better birth data, six key lessons emerged from an analysis of Liberia's 2007 National Health Policy including a need for better information systems and data management at all levels of the health system (16). The country's infrastructure and health system were devastated during the war resulting in substantial unmet needs for data to inform policy. The National Health Policy and Plan for the next decade is to develop a

robust national database to enable ongoing quality improvement at the facility and county levels as well as assist policymakers in decision-making (16). Data from rural facilities is paper-based and fragmented making data collection and accurate reporting extremely difficult.

The purpose of this study was to describe the factors contributing to the high perinatal mortality rates in north-central rural Liberia in 2010, seven years after the end of the civil wars. The specific aims were to: 1) analyze the records of women who experienced a perinatal loss for both medical and nonmedical contributing factors at one referral hospital in north-central rural Liberia; 2) describe the timing and causes of all documented stillbirths and early neonatal deaths; and 3) understand the factors surrounding stillbirth and early neonatal death. For this study, the World Health Organization (WHO) definition of perinatal mortality was used and refers to the sum of deaths occurring after 28 completed weeks gestation and during childbirth (defined as stillbirth), and up to seven completed days of life (defined as early neonatal death) (15).

Methods

This case series examining perinatal mortality was conducted through a hospital-based retrospective record review on all cases identified as a stillbirth or early neonatal death occurring at one rural referral hospital. Logbooks from one calendar year, January - December, 2010, were examined and full records on all perinatal mortalities were reviewed. The standardized definition from the WHO for perinatal mortality was used as the inclusion criteria for this study (15).

Institutional review board approval was obtained from the University of Michigan, Health Sciences and Behavioral Sciences Review Board. Written permission for data collection was also obtained from the Hospital Administrator and County Health Officer directly responsible for oversight of the facility in Liberia.

Setting

Liberia, situated in West Africa, has some of the highest rates of perinatal mortality on the continent. In the aftermath of the devastating 14-year civil and rebel wars, Liberia's health system was dismantled. The country was left with a shattered infrastructure and some of the poorest health statistics on the continent. Basic public health services including hospitals, clinics, electricity, and potable water were ravaged by rebel forces. Liberia's overall rate of perinatal mortality is 38 per 1,000 pregnancies (17). One thousand six hundred and fifty six deliveries were recorded in 2010 at the rural referral hospital where data was collected. At the time of data collection the hospital was the only facility providing emergency obstetric and newborn care services in the county for 333,481 residents (18). According to the 2007 Liberia Demographic Health Survey only 37% of deliveries take place in a health facility. The health infrastructure remains severely hampered since the end of the civil conflict in 2003. By 2010, the number of health facilities (hospitals and clinics) identified as functioning was set at 550 – 378 public and 172 private facilities (19). Most of the increase was seen in private facilities in the greater metropolitan area of Monrovia.

Data Collection

After identifying all perinatal mortalities documented in the labor and delivery, admission, and emergency room logbooks for 2010, the medical record numbers were used to retrieve the charts from the hospital's central record room. Using the WHO definition and a standardized data collection form, data were extracted from the charts by one research assistant, BO, on the following indicators for stillbirths: date of delivery, cause of death as

documented by the provider, age of mother, gestational age, gravidity, parity, mode of delivery (caesarian section, vacuum assisted, vaginal birth), birth weight, fetal heart tones on admission, referral if indicated, and reason for referral. Cause of death for stillbirths was assigned based on the broad categories of antenatal or intrapartum stillbirth using documentation of fetal heart tones on admission. Data were then sorted by sub-categories of congenital abnormalities, maternal disease (sepsis and malaria), and obstetrical complications (obstructed labor, cord prolapse, malpresentation, uterine rupture, eclampsia, bleeding, and preterm labor). Stillbirths were also identified as macerated or not, indicating death 12–24 hours before delivery.

The data on early neonatal deaths was more challenging to retrieve as these data were in a new chart created for the infant with fewer indicators reported. Indicators collected on neonatal deaths included date of delivery, cause of death as documented by the provider, age of neonate at death, and any additional comments to help clarify the cause of death. Due to a lack of standardized charting, data on cause of death was taken verbatim from the diagnosis documented by the provider at the time of death. Early neonatal deaths were then further divided in subcategories of prematurity, poor feeding, birth asphyxia, and infection (pneumonia, sepsis, tetanus, and malaria).

Data Analysis

Data were sorted and analyzed using IBM SPSS Statistics 19.0. Descriptive statistics were computed for all variables of interest. Frequencies were established to examine the documented causes of stillbirths and neonatal deaths and data were stratified by month to assess for seasonal patterns and a Pearson's chi-square test of independence was performed. A logistic regression with a dichotomized live birth variable (live birth = 0, stillbirth = 1) was performed. Variables found to be significantly associated with stillbirth in bivariate analysis were entered into a multivariate model.

Results

One thousand six hundred and fifty six deliveries occurred at the referral hospital during the 2010 calendar year. A total of 196 perinatal deaths met the inclusion criteria; 143 classified as stillbirth and 53 classified as early neonatal death. The stillbirth rate was calculated at 86 per 1,000 deliveries and the early neonatal death rate at 32 per 1,000 live births. The overall perinatal mortality rate was 118 per 1,000 live births. Select demographic data and mode of delivery for mothers experiencing an early stillbirth and the comparison group of mothers experiencing a live birth at the facility during the same time period is shown in Table 1.

Women experiencing a live birth had fewer pregnancies than those women experiencing a stillbirth ($p<.05$). Additionally, the mean infant birth weight was significantly higher in live births than in stillbirths ($p<.001$). No other differences between the groups were found.

A dummy variable for low birth weight was created by coding all infants with a birth weight below 2500 grams as low birth weight. Infants born with low birth weight were, in general, more likely to be stillborn. We found the odds of having a stillbirth where almost three times greater (odds ratio [OR]: 2.77, 95% confidence interval [95% CI]: 1.89–4.08, $p< .001$) if the infant was low birth weight.

Stillbirths

Eighty-one cases (56.6%) of the 143 stillbirths in our study presented as antenatal stillbirths with no fetal heart tones detected by the provider on admission to the labor and delivery unit. Thirty-seven (25.9%) had documented fetal heart tones upon admission with the stillbirth occurring during the intrapartum period. There was no documentation of presence

or absence of fetal heart tones in 25 of the stillbirth records (17.5%). Ten cases presented with a macerated fetus.

Forty-four cases (31%) had no maternal or obstetrical diagnosis recorded in the chart in the case of a stillbirth. Eighteen separate diagnoses were listed associated with a stillbirth outcome (Table 2). Thirteen women (9%) presented with two or more diagnoses. The majority of stillbirths were associated with an obstetrical complication. The three conditions presenting most often with a stillbirth included: 1) obstructed labor (14%); 2) abnormal presentation (13%); and 3) ruptured uterus (11%). Maternal disease (sepsis, malaria, and sickle cell disease) accounted for less than 4% of the reported stillbirths in our study.

Forty-seven stillbirths (33%) had recorded weights defined as low birth weight (< 2500gm) although only 10 births (7%) were given the diagnosis of preterm by the recording birth attendant. Thirty-five women (24.5%) experiencing a stillbirth in our study were primigravidas and 29 (20.3%) were teens between the ages of 15–20 years.

The greatest number of stillbirths, n=20, occurred in the month of April (14%) when there were 166 deliveries followed by 11.9% (n=17) in August when there were 133 deliveries. The fewest, (n=6), occurred in November (2%). A Pearson's chi-square test of independence was performed to detect whether there was a significant association between individual months and stillbirth $\chi 2$ (1) =11.883, p=.372. From the data, no significant difference could be attributed to seasonal variation.

Early Neonatal Deaths

Fifty-three early neonatal deaths were reported during 2010. Twenty-five (47.2%) early neonatal deaths occurred on day one of the infant's life. The largest single contributor to early neonatal death in our sample was birth asphyxia identified by poor apgar scores (< 4 at 5 minutes). Seventeen of the 53 early neonatal deaths (32%) were due to birth asphyxia and low apgars. Twenty-six percent of the deaths were reported due to sepsis. Other causes of early neonatal deaths recorded included tetanus, preterm birth, pneumonia, malaria, and poor feeding (Table 3).

The early neonatal deaths were more evenly spread out over the year than the stillbirths. The highest number occurring in one month was seven early neonatal deaths (10.8%) in April, while the least number of early neonatal deaths, two (3.1%) occurred in August.

Discussion

While the purpose of this case series study was to further understand the factors contributing to the high perinatal mortality rates in north-central rural Liberia, the research process also uncovered another issue: the dearth of information available to inform decision makers, both at the national and local levels in Liberia. at the facility and country level. Findings from this study provide a snapshot into the urgent need for standardized data collection. Over 17% of admissions resulting in a stillbirth had undocumented fetal heart tones on admission, therefore it was impossible to know if the woman arrived with a fetal demise or if an event occurring during labor contributed to the mortality. Because of minimal charting and poor documentation, diagnoses were assigned based on those provided by the birth attendant. The majority of early neonatal deaths (58%) were linked to intrapartum events with the diagnoses of birth asphyxia/low Apgar scores and sepsis. Very little information was noted on the charts related to immediate newborn resuscitation. Maternal characteristics and demographic data related to infants with early neonatal death could not be recovered from the records available. The need for improved data collection to analyze fetal and infant mortality is clearly evident.

The perinatal mortality rates for Africa range from 34 per 1000 in Northern Africa to a high of 76 per 1000 in Western Africa (15). The perinatal death rate in our study of 118 per 1000 live births is higher than the WHO-reported average for West Africa and also higher than the overall perinatal mortality reported for the country (17). A potential explanation could be the characteristics of our sample and the fact our sample was drawn from a large referral center providing care for the highest risk women and the sickest babies. Seven years after the end of the civil wars rural Liberians continue to have limited access to life-saving health care (20).

Fifty-six percent of stillbirths in our study occurred during the antepartum period, prior to the woman arriving at the hospital in labor; higher than reported by Edmond et al. from their study in Ghana where 33% of stillbirths occurred prior to the onset of labor (9). Twenty-six percent of women in our study presented with audible fetal heart tones on admission and went on to deliver a stillborn. We were not able to draw any conclusion from our sample about the 25 women (17.5%) who presented with no documentation of the presence or absence of fetal heart tones on admission due to limited detail in the records.

The incidence of stillbirths in our study was 86 per 1000 total births. Similar studies report a wide variation in overall stillbirth rates from 33 per 1000 in the Democratic Republic of the Congo to 89 per 1000 in Nigeria (6, 21). Our findings exceed even these reports and would be expected from one of the busiest rural referral hospitals in the country. At the time of this study, it was the only hospital providing emergency obstetrical and newborn care in a large geographic area where roads and transportation options are severely limited.

A considerable proportion of stillbirths in our study, 133 (93%) were fresh. Only 10 (7%) were macerated, a number much lower than other reports (8, 22). Our finding suggests fewer deaths were from insults in utero during the antenatal period, increasing the likelihood that women in our study sought timely emergency care.

The majority of factors associated with stillbirths were linked to obstetrical complications mirroring other studies. The finding of a 46% cesarean delivery of stillbirths could potentially be explained by the vast majority (38%) identified with a diagnosis of prolonged labor, abnormal lie, and ruptured uterus making vaginal delivery dangerous for the mother. This regional hospital also has a variety of visiting medical teams from outside the country which may account for the variability in the monthly cesarean section rate.

Limitations

This study has several limitations. Being a retrospective analysis from logbooks and charts, we were unable to examine any information related to prenatal care, socio-economic indicators such as formal education of the mother, or distance from the hospital. Missing data in records, such as fetal heart tones on admission, further obscured our ability to draw conclusions from the data. Thirty-three percent of the stillbirths in our study were infants weighing less than 2500 gms. Due to the lack of detailed charting, it was impossible to determine whether infants under 2500 gms were premature births or caused by intrauterine growth restriction.

Conclusion and Recommendations

Nearly 30% of stillbirth deliveries in our sample had documented fetal heart tones on admission. One potential source of preventable error is the monitoring of fetal heart tones throughout labor in order to apply appropriate corrective measures. A standardized approach to fetal heart tone monitoring to determine the need for immediate operative intervention is recommended on all labor wards. By employing a standardized, systematic approach to care

of the laboring woman, labor wards can minimize the likelihood that critical elements will be overlooked. Routine surveillance of listening and documenting FHTs every 30 minutes during active labor and every 15 minutes during second stage for low risk women could allow corrective actions to be taken early.

Many common sources of delay occur on labor units. A checklist of standard operating procedures should be posted and available to all personnel. Additionally, all personnel should be trained in resuscitation techniques and updated annually. Health facilities need to be adequately equipped with both trained personnel and supplies including essential drugs. Although individual clinical judgment cannot be replaced, having the appropriate tools and standards available can help support clinicians in hospitals that are often severely understaffed.

A systematic approach to understanding perinatal deaths in urgently needed. In 2004, WHO identified priority interventions for strengthening health information systems at the national level within Africa (23). Included is the need for reliable, quality health data to inform management strategies and operational decisions. The resource constraints of post-conflict Liberia will impact how quickly a thorough documentation system can be put into place and the human resources to manage it. A data management infrastructure has been outlined in the National Health Policy and Plan to bring Liberia closer to the WHO concept of a national health information system (16). As the plan unfolds, changes can be made at the local level to begin collecting essential health indicators. Clear standards of care could diminish preventable errors. Developing a consistent method of data collection and documentation on all laboring women and newborns is critical and will provide the necessary data to aid the country in crucial decision-making. Accurate data collection has significant implications to develop both local and global strategies to reduce perinatal mortality (4). Accurate data collection could help inform changes to clinical practice. The return on investment in a system of accurate, standardized data collection would pay off for millions of families in post-conflict Liberia.

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TABLE 1

Select demographic and mode of delivery for women experiencing a stillbirth or live birth

Select Demographics	Women Experiencing a Stillbirth n=143	Women with a live birth[a] n= 1513
Mean maternal age (range)	26.7 years (15–44 years) SD 7.2	24.9 years (13–47years) SD 7.1
Number of pregnancies mean (range)	4 (1–14) SD 3.0	3.4* (1–15) SD 2.6
Number of living children mean (range)	2.3 (0–12) SD 2.3	2.1 (0–13) SD 2.1
Cesarean section	66 (46%)	643 (42.5%)
Vaginal delivery	74 (52%)	831 (54.9%)
Vacuum assisted delivery	3 (2%)	29 (1.9%)
Vaginal delivery for twin A followed by cesarean section for twin B	0	6 (0.4%)
Mean infant weight (SD)	2805 g (837 g)	3019** (626 g)

[a] Documentation on mode of delivery missing from four births.

* p<.05

** p<.001

TABLE 2

Diagnoses associated with stillbirths.

Diagnosis	Number of Cases* n=143 (%)
Obstetrical Complications	
Obstructed Labor	20 (14%)
Abnormal Presentation	18 (13%)
Ruptured Uterus	16 (11%)
Placental Abruption	11 (8%)
Preterm	10 (7%)
Prolapsed Cord	10 (7%)
Eclampsia	6 (5%)
Antenatal Bleeding	5 (4%)
Nuchal Cord	3 (2%)
Prolonged Rupture of Membranes	2 (1%)
Shoulder Dystocia	2 (1%)
Congenital Anomalies	2 (1%)
Placenta Previa	1 (<1%)
Fetal Distress	1 (<1%)
Maternal Complications	
Sepsis	2 (1%)
Malaria	3 (2%)
Sickle Cell Anemia	1 (<1%)
Unknown	44 (31%)

*Totals are greater than 143 and 100%. Thirteen women with a stillbirth presented with more than one diagnosis (11 women with 2 diagnoses and 2 women with 3 diagnoses).

TABLE 3

Diagnoses associated with neonatal deaths.

Diagnosis	Number of Cases* n=53(%)
Birth Asphyxia/Poor Apgar (5 min apgar ≤ 4)	17 (32%)
Sepsis	14 (26%)
Tetanus	8 (15%)
Preterm	10 (19%)
Pneumonia	4 (6%)
Malaria	4 (6%)
Poor Feeding	2 (4%)
Unknown	2 (4%)

*Totals are greater than 53 and 100%. Eight infants had more than one diagnosis listed.