A critical analysis of maternal morbidity and mortality in Liberia, West Africa

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\textbf{Abstract}

\textbf{Objective:} to conduct a secondary analysis of maternal death and near-miss audits conducted at the community and facility level to explore the causes and circumstances surrounding maternal mortality and severe morbidity in one rural county in Liberia, West Africa.

\textbf{Design:} a non-experimental, descriptive design utilising maternal death and near-miss audit surveys was utilised for data collection. Thaddeus and Maine’s Three Delays Model was used as a framework for analysis.

\textbf{Setting:} one rural county in north-central Liberia.

\textbf{Participants:} interviews were conducted with (1) women who suffered a severe morbidity or near-miss event, (2) family members of women who died or presented with a severe morbidity, and (3) community members or health workers involved in the care of the woman.

\textbf{Measurements:} (1) maternal mortality, (2) near-miss events, and (3) delays related to problem identification, transportation challenges and delays after reaching the referral site.

\textbf{Findings:} 120 near-miss events and 28 maternal mortalities were analysed. 16\% of all deliveries at the referral hospital were classified as near-miss events. Near-miss events were six times more common than deaths. The majority of women experiencing a near-miss event (85\%) were in critical condition upon arrival at the hospital suggesting important delays were encountered in reaching the facility.

\textbf{Key conclusions:} maternal mortality and near-miss audits allow exploration of medical and non-medical factors leading up to a severe complication or maternal death. Delays in reaching a referral hospital can have a significant impact on maternal survival rates.

\textbf{Implications for practice:} audits can stimulate a change in clinical practice and help identify areas for county health departments to focus their scant resources. Audits can be used as a quality improvement tool in facilities. Results can be used to identify communities with high rates of delay to target educational programmes.

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\section*{Introduction}

High rates of maternal mortality around the world are an unfortunate reality. Over eight million women suffer from complications of pregnancy or childbirth and over half a million women die giving birth annually worldwide (\textit{World Health Organization [WHO]}, 2004). A profound disparity exists between nations globally with the heaviest burden on low resource countries. In sub-Saharan Africa women have a one in 22 lifetime risk of dying in childbirth compared to a one in 7300 chance for women of industrialised nations (\textit{WHO}, 2007). Efforts have been made by international organisations to reduce maternal mortality rates and improve the health of women and children around the world. Millennium Development Goal Five, created by the United Nations, calls for a reduction in the maternal mortality ratio by two-thirds by 2015 (\textit{United Nations [UN]}, 2009). Unfortunately, this goal is falling short with only a minimal reduction in maternal mortality worldwide and in some areas a worsening of maternal mortality rates.

Crude numbers and statistics of how many women die or suffer a severe morbidity from childbirth related problems illustrate that maternal health is extremely poor in various countries around the world. Confidential inquiries following a maternal death have proven to be an important tool in exploring the story behind a woman’s death and can help form policy, guidelines and interventions at the community, facility, and political level when the circumstances behind a woman’s death are known. Because maternal deaths and complications are typically underreported, confidential inquiries are also vital in contributing to the accurate
collection of data. Was there a delay in reaching the facility? Did the family or birth attendant not recognise there was a problem? Was there difficulty in finding transportation to a health centre? Did the health centre have adequate supplies and trained staff available to properly treat the woman?

Examining the circumstances around a severe complication or near-miss event has the potential to provide answers to some of these questions. Severe maternal morbidity occurs in larger numbers than maternal deaths, providing additional information as the woman can tell the story herself. Near-miss audits are increasingly used to complement maternal mortality reviews (Penney and Brace, 2007). They can also provide a non-threatening way to examine and improve the quality of obstetric services (Okong et al., 2006).

The purpose of this study was to conduct a secondary analysis of data collected by Liberian nurses in 2008 from maternal death and near-miss audits done at the facility and community level to explore the causes and circumstances surrounding severe maternal morbidity and mortality. Working as consultants, the authors assisted the reproductive health supervisor of the county health team to develop a culturally sensitive audit tool. Findings from this analysis resulted in a White Paper presented to the Liberian Ministry of Health and Social Welfare (MOHSW) and the United States Agency for International Development (USAID)—Liberia to help inform policy development.

Liberia, located in West Africa, has suffered 14 years of civil conflicts consequently devastating the country’s infrastructure. The civil wars ended in 2004. Liberia is now in recovery and currently rebuilding. Maternal mortality ratios estimated in the 2008 Demographic and Health Survey are an alarming 994 maternal deaths per 100,000 (Liberia Institute of Statistics and Geo-Information Services (LISGIS), 2008), one of the highest rates in the world. Liberia also has one of the fastest growing populations in the world with a growth rate estimated at 2.6% and a total fertility rate of 5.2% (LISGIS, 2008). This coupled with 84% of Liberians living below the international poverty line (UNICEF, 2007)) contributes to an overwhelming backdrop for maternal mortality and morbidity.

**Review of the literature**

According to van Dillon et al. (2007) the first step in reducing maternal mortality is to identify problems through the inexpensive use of audits. Audits may be used to discover sub-optimal care at national, regional and community levels in which recommendations for policy and advocacy may be formed. Using only serial mortality data does not provide a feedback mechanism by which change may be formed (Pattinson et al., 2005). Hearing the story behind a woman’s death or complications related to childbirth allows care providers, health-care administrators, policy makers and public health officials to delve deeper into circumstances and identify strengths and weaknesses of the health-care system.

Various types of audits may be used such as confidential inquiries, verbal autopsy, facility-based death reviews, clinical audits and surveys of severe morbidity (near-misses). These approaches can be tailored according to the setting (facility, community, or health centre), objectives of the study, available resources and stakeholders. The audits may be used to measure process and health outcomes as well as structural contributors to morbidity and mortality including facilities and equipment (WHO, 2004).

Most developing countries do not conduct systematic maternal mortality audits. South Africa is one exception. A formal confidential enquiry system of maternal deaths at the national level has existed since 1998. For the past 12 years, South Africa has shed much light on the causes and background of maternal deaths. Rates of maternal mortality have remained steady since confidential inquiries were implemented in the country. It has been learned through South Africa’s experience that audits are powerful tools but action is also required in order to effect change (South Africa Every Death Counts Writing Group, 2008).

Social, political, cultural, economic factors, and gender equality play a strong role in women’s health around the world and must be considered when investigating maternal deaths and life-threatening complications. Most maternal morbidity and mortality research is conducted within a biomedical perspective. A meta-analysis by Gil-Gonzalez et al. (2006) revealed political and cultural effects of maternal mortality are grossly ignored in research. Thaddeus and Maine’s (1994) Three Delays Model, a hallmark in Safe Motherhood, considers factors explored by Gil-Gonzalez et al. (2006) within its framework including the status of women, socio-economics, and cultural norms.

Near-miss reviews can be an especially useful tool, complementing maternal death reviews, to improve quality of care and provide learning experiences (Penney and Brace, 2007). They may also be less threatening to health-care providers involved in the care of the woman as she has survived the near-miss event (WHO, 2004). Near-miss audits in the facility where women arrive with complications can provide useful information about effectiveness of referral systems. Where women develop complications during their stay at the facility, near-miss audits provide a monitoring tool for quality and performance of obstetric services (Filippi et al., 2005).

In conclusion, maternal mortality and morbidity audits complement the sheer statistics of obstetric related deaths and complications. Although no data exist on the efficacy of audits from clinical trials, The Cochrane Review of critical incident audit and feedback to improve perinatal and maternal mortality and morbidity (Pattinson et al., 2005) recommends audits as a means to improve services. In the absence of clinical trials, the use of audits to learn more about maternal mortality and morbidity around the world is crucial.

**Methodology**

Record keeping and flow of information is very poor in Liberia. Beyond the Numbers (2004), a guide developed by the Department of Reproductive Health and Research at the WHO to assist health professionals, health-care planners and managers working in the area of maternal and newborn baby health, provided a practical guide in the development of an audit tool. A key premise of the WHO guide is that we know the numbers but they only tell us part of the story. The numbers tell us nothing of the faces and families behind the numbers (WHO, 2004).

Thaddeus and Maine’s (1994) Three Delays Model was used as a framework to help develop the audit questions for the survey tool. This model was familiar to the midwives and nurses we worked with in Liberia. In their seminal paper, Thaddeus and Maine described three phases of delay as operational factors contributing to maternal death: (1) delay in deciding to seek care; (2) delay in reaching an adequate health facility; and (3) delay in receiving adequate care once at the health facility.

The culturally sensitive audit tool developed allowed for an in-depth exploration of maternal mortality and near-miss events. Working with Liberian partners, we constructed an audit tool appropriate to the local context using examples from the literature that could be used in both in-patient and community settings. Inclusion criteria were adapted from WHO (1992) and Filippi et al. (2005) with data collected during the 2008 calendar year (January 1–December 31). A wide net within the county was cast for data collection in order to better understand why maternal deaths and near-miss events were happening and how to prevent them.
The secondary analysis was IRB exempt by the University of Michigan Institutional Review Board. The original intent of this research was to assist the Ministry of Health and Social Welfare and the county health team to examine the complex factors contributing to maternal morbidity and mortality in post-conflict Liberia. At the time of the study no ethical review board existed in Liberia. The study had approval and human ethics oversight by the Liberian MOHSW and official permission for data collection from the medical director of the regional hospital and county health team in Liberia. The findings of this analysis resulted in a White Paper presented to the Reproductive Health Division of the MOHSW in Liberia as well as county and hospital administrators with the goal of providing data for programmatic decisions to address the high rate of maternal mortality and morbidity.

Setting

The maternal mortality and near-miss audits were conducted in one rural county in Liberia. Farming is the main industry of the county and major crops include cocoa, rubber, palm oil and coffee. Located in north central Liberia, the county has a population of 328,919 making it the third largest county in Liberia (LISGIS, 2008). According to the Liberian 2008 census, there are twelve districts within this rural county. This study was designed prior to the publication of the 2008 census and was based on nine districts using the United Nations Development Program map. This county experienced some of the heaviest fighting and destruction during the most recent civil war when Charles Taylor led his rebel army into Liberia from the Ivory Coast to overthrow the government of Samuel Doe (Swiss et al., 1998).

There are numerous rural clinics in the county with one major referral hospital. The hospital is capable of providing emergency obstetric and newborn care (EmONC) services. During 2008, a total of 1386 deliveries were recorded in the logbook at the referral hospital. It is estimated that only 39% of births occur within facilities in Liberia (LISGIS, 2008).

Definition of terms

The following definitions were used as inclusion criteria. Maternal mortality was defined by the International Classification of Diseases, 10th edition (ICD-10) as ‘the death of a woman while pregnant or within 42 days (or one year for late maternal death) of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes’ (WHO, 1992).

Near-miss events were defined as any pregnant or recently delivered woman (within six weeks after termination of pregnancy or childbirth) who experienced complications that immediately threaten her survival but did not lead to her death; who arrived at the hospital or clinic in a critical condition or developed a critical complication after admission (WHO, 2004; Fillippi et al., 2005). Five main diagnostic areas were included the following: (1) haemorrhage leading to shock, emergency hysterectomy and/or recommended blood transfusion, (2) hypertensive diseases of pregnancy including eclampsia and severe pre-eclampsia, (3) dystocia resulting in uterine rupture, (4) infections with fever or a clear source of infection and clinical signs of shock, and (5) severe anaemia with haemoglobin levels ≤ 6 g/dl.

Data collection

Using the audit tools developed, data were collected on all maternal deaths and near-miss events which met the inclusion criteria. The tools included sections for gathering demographic data as well as information from chart reviews. In addition, to facilitate a better understanding of the circumstances surrounding the death or near-miss event, interviews using open ended questions were conducted with women who suffered a severe morbidity or near-miss event as described in the inclusion criteria, family members of women who died or presented with a severe morbidity and community members or health workers involved in the care of the woman.

Two Liberian nurses, actively involved in prior research and Safe Motherhood programming in the country and familiar with interview techniques and data collection methods, conducted interviews from January to December 2008. Both midwives and nurses were fluent in both English and Kpelle, the two major languages of the region. Audits took place over the course of the year occurring as cases were identified at the referral hospital or in the community by the reproductive health division of the county health team (CHT). Certified midwives in rural clinics report data from their catchment area on a monthly basis to the CHT. When a maternal death is reported from any of the catchment communities by a traditional midwife or family member, the clinic staff immediately reports the incident to the CHT for further investigation.

For data collected at the hospital level, the midwives visited the labour and delivery ward as well as the emergency department daily during the work week. One of the midwives was working as a reproductive health supervisor for the county and was skilled with conducting confidential death inquiries at the community level. Interviews were conducted in the participant's choice of Kpelle or English language with responses immediately recorded onto the audit tool in English. Prior to data collection, the purpose of the interview, to understand the factors contributing to the high rates of maternal morbidity and mortality, was explained. Confidentiality was assured and verbal informed consent was obtained. Participants were informed they could decline to answer any questions or end the interview at any time. Each interview took between 30 and 60 min and was conducted as soon after the event as possible, usually within seven days, depending on the severity of the woman's condition in order to minimise recall bias. Data from the interviews were concomitantly transcribed onto the audit forms by the data collectors to capture the voices of the participants. Data were also collected from hospital or clinic records when available.

Data analysis

The initial data analysis was conducted in country. Each audit was analysed by the county health team to identify causes of morbidity and mortality and identify regions within the county for targeted interventions. These data were added to the reproductive health statistics collected county-wide. All results were reviewed by the MOHSW.

We conducted a secondary data analysis of both quantitative and qualitative data collected at the facility and community level. Quantitative data were transcribed into an excel spreadsheet for analysis and qualitative data were typed from copies of the original de-identified audits for analysis. Qualitative data were analysed within the framework of the Three Delay Model (Thaddeus and Maine, 1994).

Findings

During 2008, 176 audits were conducted of which 148 met the inclusion criteria. Of the total cases (n = 148), 120 were categorised as near-miss events and 28 as maternal mortalities. The average age of women with a near-miss event was 25 years with the greatest number between 20 and 24 years (29.4%). Average
educational level was 3rd grade but the majority of women had no education (56.5%). Nearly 61% of women had one to three pregnancies with an average of three pregnancies. Select demographic data are shown in Table 1.

**Maternal mortality**

The causes of all eight maternal mortalities occurring in the community were identified as haemorrhage with one death listed as cause unknown. These eight women died either in the home or on route to the referral hospital. A broad range of causes was listed for women (n = 20) who died at the hospital. Fig. 1 presents the causes of death for the facility based mortalities.

**Near-miss events**

As expected, all near-miss events were identified at the referral facility. During 2008, 16% of all deliveries at the referral hospital were classified as near-miss events. Near-miss events were six times more common than deaths. The majority of women experiencing a near-miss event (85%) were in critical condition upon arrival at the hospital suggesting that important delays were encountered in reaching the facility. Nearly half (49%) were referred from another facility, usually a rural clinic or facility without EmONC capabilities. Of the 120 near-miss events, 102 (85%) occurred before the woman reached the referral facility and 18 (15%) suffered severe complications after arrival. The most common causes of the severe morbidity, near-miss events were haemorrhage (42%) and severe anaemia (21%) followed by sepsis (14%) and eclampsia (11%). Causes of near-miss events are shown in Fig. 2.

**Causes of delay**

Using the Three Delays Model as a framework, we examined the qualitative data for evidence related to problem identification, transportation challenges and delays after reaching the referral site. Eleven women (9%) with near-miss events experienced more than one delay in reaching the referral facility and one woman experienced all three delays. Three women who died at the facility had more than one delay and two women who died in the community experienced two delays.

**First delay**

The first delay is the decision to seek care by the woman and/or family. This level of delay is one of the most complex as it involves many layers of socio-cultural factors such as education level, women’s status, cultural beliefs and perception in illness severity. All of these elements play a role when a woman and her family and birth attendant (if present) decide to seek skilled care. Distance from a health centre, quality of care expected at the health centre and ability to pay for services also can affect the decision to seek care (Thaddeus and Maine, 1994).

A delay in the recognition of obstetric complications among women, family members and community members including traditional midwives was the most common in the data when examining for each delay. A total of 45 women with near-miss events (38%) experienced this delay. In addition, a delay in the decision to seek care was reported in connection to eight women who died at the facility and six women who died in the community.

Other factors contributing to the first delay included keeping a problem hidden from others and trying self-treatment or traditional remedies before seeking care. Women were often referred to multiple levels of providers before seeking care at the tertiary care level. One participant said the following:

> I was in labour at home for very long hours, about 13 hours, when I started feeling very weak and unable to push my baby. That was the time I told Aunty I am not able to have the baby here at home. Take me to the hospital. I was given country herbs to drink. My stomach was rubbed with chalk. I was very restless and my stomach became very tense and tender.

Her family waited to seek help from a trained provider until the situation worsened despite the woman’s desire to find help sooner:

> At 6 am when I could not push the baby I was very tense and restless. It was the time the certified midwife was called to see me. Myself and the certified midwife made the decision. But I made the decision at first but no one listened to me.

**Second delay**

Reaching an adequate health facility is the second delay in the Three Delays Model. Access to health facilities, adequate infrastructure for transportation and distribution of appropriate health facilities are
all logistical factors in causing a delay for a woman and her family (Thaddeus and Maine, 1994).

Reaching an appropriate facility ranged from 10 minutes to one full day for participants. Various modes of transportation were used including walking, wheelbarrows or hammocks on poles to carry the woman, taxis and market trucks. Seventeen women with near-miss and five women who died at the facility (15%) experienced some delay in transfer to a health facility including difficulty in finding money for transportation, living in remote villages with no transportation available and seeking assistance during the night when people did not want to travel on unsafe roads.

One woman stated, “It took almost 2 hours to get to reach the hospital because … the driver refused to bring me, so we have to look for extra money to pay another driver to take me to the hospital.”

Families of two of the eight women who died in the community recounted difficulty in finding transportation. These two women died while their family members searched for a way to transport them to the hospital.

**Third delay**

The third delay is at the facility itself. Once a woman arrives at the facility, she may not receive the care she needs. Staff may not be present or adequately trained and supplies may not be available (Thaddeus and Maine, 1994).

Providing and receiving timely care was not seen as a problem among participants experiencing a near-miss event with only four cases (3%) identifying delay at the facility as a barrier. One 30-year old woman said the following. ‘Yes, I arrived at the hospital about six a.m., but was taken to the operating room around three p.m. Then later I received a unit of blood. Blood was also not available on time.’

A delay at the facility was identified in the death of one woman. A staff member at the hospital stated:

Yes, it took a long time, almost two weeks after she arrived. Her abdomen became grossly distended before she was taken for a laparotomy. Probably if it was done when the stomach continued to distend despite the NG [nasogastric] tube, probably this would have avoided her death.

**Limitations**

A limitation to this study is that data were collected in only one of 15 counties in Liberia. The county chosen for data collection was one of the most devastated with services severely disrupted during the war. The near-miss audit form had very limited questioning around the third delay making it difficult to analyse this delay with any detail. Women and family members may not have known if the care they received at the hospital was delayed.

**Discussion**

On the basis of results of these audits, it is evident that women and family members prolonged the decision to seek professional care from the hospital or community based clinic and that many women arrived at the hospital in very poor condition. Interviewing women who survive a near-miss event is a unique source of information (Okong et al., 2006). It provides an avenue to make accessible the voices and experiences of those whose stories would otherwise go unheard (Madison, 2005).

Sixty-one per cent of births in Liberia occur in the home with the remainder delivered in health facilities with a skilled attendant. In rural areas the number of hospital deliveries decreases to 26% (LISGIS, 2008). Delays in reaching a referral hospital can have a tremendous impact on maternal survival rates.

Many women waited days or even weeks before considering seeking care. Education did not appear to play a role in whether a woman made a prompt decision. Several women with no education sought care sooner whereas women with a higher level of education waited days and used self-treatment before seeking professional care. Furthermore, some women hid their labour from their husbands and family members compounding a further delay.

Gathering information on maternal morbidities or near-miss events could be viewed as a keystone to quality assurance strategies within facilities. The quality of obstetric care was not adequately evaluated with this tool. The educational level of key decision makers to seek care was also not included in the data collection but would be important in future research. As women are often not the decision maker due to gender inequality, does the level of education make a difference in the person who actually makes the decision? Much of the decision making among families is complex and includes family dynamics, gender inequities, economics, culture, and politics.

Additional modifications to the interview guide would help ensure accurate information reflecting that the standard of care was being met. Revising the tools to include more demographic information about family members would also help to understand maternal illness and death through the lens of their families and communities.

**Conclusion**

The advantages of maternal mortality and near-miss audits either in the community or in a facility is that they allow exploration of medical and non-medical factors leading up to a severe complication or maternal death. They also provide the family and community’s views on access to health services. Audits can provide a good learning experience for staff if the mortalities and morbidities are reviewed using a team approach. Audits can stimulate a change in clinical practice and help identify areas for county health departments to focus their scant resources. Case definitions for maternal mortality are universally accepted according to the International Classification of Disease, 10th edition (ICD-10) but a concrete list of what constitutes severe pregnancy related morbidities or near-miss events does not exist and may vary from one study to the next. Although near-miss audits are now accepted as complimentary to maternal mortality reviews (Penney and Brace, 2007) diverse approaches are being used internationally.

Family and community members as well as traditional birth attendants can be instrumental in encouraging a family to seek care when complications arise. This gateway into women’s health-care provides an important opportunity to increase referral. Community based interventions such as educating traditional midwives, families and women in early problem recognition and prompt referral can help save lives.

Policy makers and providers must re-examine current approaches to improve reproductive health, addressing the contextual factors and community based issues. Audits can be used as a quality improvement tool in facilities. Results can be used to identify communities with high rates of delay to target educational programs. Uncovering the barriers to seeking care embedded in the context of Liberian life could be a beginning step to address reducing maternal morbidity and mortality.

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References


