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Research article

Maternal mortality review in a major tertiary referral hospital in Liberia, 2018–2021

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ABSTRACT

Objectives: Anecdotal evidence showed increased maternal deaths at the major tertiary hospital over the past two years (2020–2021). We reviewed the maternal death audit data, identified the main causes of maternal death, and associated risk factors. Findings were shared with policy-makers to help reduce maternal mortality.

Study design: We conducted a secondary data review and descriptive analysis of maternal death at the tertiary hospital located in Monrovia.

Method: The maternal death data were extracted from patient medical records, including death certificates and maternal audit records. The record of live births was obtained from the delivery register. Data were analyzed using Epi Info version 7.2 Maternal mortality ratio (MMR) was estimated, the leading direct and indirect causes of maternal death were identified, and the factors associated with maternal death were explored using logistic regression at a 5% level of significance.

Results: There are a total of 233 maternal deaths and 14, 879 live births giving a maternal mortality ratio (MMR) of 1565 per 100,000 live births during the period under review. The median age of the mothers at death was 29 (14–45) years. About 40.3% (94/233) of cases died within <1 day of admission, referrals accounted for 59% (137/233) of the cases. Direct causes of death accounted for 66% (147/223). Hemorrhage [30.6% (45/147)], Eclampsia [(30/147) 20.6%] and Sepsis [(30/147) 20.6%] were the main direct causes of death while cardiovascular-related [18.4% (14/76)] and HIV/AIDS [16% (12/76)] were the leading indirect cause of death. Patients from referred other facilities were 7.9 times more likely to die as compared to non-referral (pOR:7.9, 95%CI: 5.9–10.6, $p < 0.001$).

Conclusion: The maternal mortality ratio remained high. Referrals were done late. The Liberia Ministry of Health should equip more secondary-level health facilities and tertiary hospitals to handle maternal emergencies and sensitize the populace and healthcare workers on prompt identification and referral of obstetric emergencies. The MoH also needs to improve the blood transfusion services to help in the management of postpartum hemorrhage.

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1. Introduction

Maternal mortality is a public health problem of global concern. Over 303,000 maternal deaths occurred worldwide in 2015 giving a global maternal mortality ratio of 216 maternal deaths per 100,000 live births [1]. Postpartum hemorrhage alone caused more than 80,000 maternal deaths worldwide in 2015 [2]. In 2017, there was a decrease in global maternal deaths from 303,000 to 295,000, reducing the MMR from 216 per 100,000 live births to 211 per 100, 000 live births [3]. Sustainable Development Goal number three (SDG 3) is targeted at reducing the global maternal mortality ratio from 211 per 100,000 to less than 70 per 100,000 live births [3].

Sub-Saharan Africa had a high maternal mortality rate of 524 deaths per 100,000 live births in 2017. There has been a tremendous reduction in maternal mortality in the last decade globally. However, a significant number of deaths still occur disproportionately in low-income countries [4]. The government of Liberia declared maternal mortality as an emergency in 2013 due to the increase in maternal mortality ratio from 934 per 100,000 live births in 2006 to 1072 per 100,000 live births in 2013 [5]. To meet the Sustainable Development Goal and other international agreements, the government of Liberia set up ten years (2011–2021) plans to address Maternal, Neonatal, Child, and Adolescent mortality through the delivery of appropriate obstetric care at all levels of the health system, strengthening community engagement and reporting and reviewing all maternal deaths [6]. However, Liberia still has a high burden of maternal death with a maternal mortality ratio of 725 per 100,000 live births as of 2015 [5]. In 2017, Liberia was among the ten countries that achieved less than a 5% reduction in MMR [3]. Part of the government policy was to provide free maternal and neonatal services to the population, strengthen and equip the designated referral hospitals and provide ambulance services to improve the movement of critical patients from the lower-level hospitals to the referral hospitals. The John F. Kennedy Medical center is one such referral center that is participating in the provision of referral services to women that need tertiary-level or emergency obstetric care.

The tertiary hospital is one of the largest referral hospitals in Liberia that caters to maternal cases from in and out of Montserrado county. Anecdotal evidence showed an increase in maternal deaths over the last two years (2020–2021) at the hospital. We described maternal death in the hospital and characterized the causes of death to inform policy updates in reducing further maternal deaths.

2. Methods

2.1. Study setting

The study was a hospital-based review of maternal death conducted at one of Liberia's major referral hospitals located in Monrovia. The John F. Kennedy Medical Center has a fully functional Obstetrics and Gynecology Department which caters to all obstetrics and gynecology cases. The department provides obstetric emergency services and a routine antenatal clinic that runs five days a week (Monday-Friday). The high-risk patients are identified early and cared for by the specialist and consultant obstetricians. It has multiple delivery theatres and carries out an average of 250–400 deliveries per month. Obstetric emergencies are brought to the facility in ambulances that are owned by the government and private facilities. Some patients are brought in commercial vehicles, while others walk in. The other services provided by the department included prevention of mother-to-child transmission (PMTCT) of HIV, laboratory services, birth registry, and birth control program, (and family planning). The hospital also provides parenting services for the parents (mentoring pregnant teenagers on safe parenthood) and ambulances for transferring patients between departments, and for investigations. The hospital has a maternal death review team set up to investigate all maternal deaths. The team comprised the hospital administrator, Head of Department (Doctor), District Surveillance Officer (DSO), District maternal reproductive health supervisor, and facility surveillance focal person.

Maternal mortality is one of the reportable events under the Integrated Disease Surveillance and Response (IDSR) in Liberia [7]. Cases are reported within 24 h to the next level, and investigations or reviews are done within 72 h from occurrence by a review team set up at health facilities and supervised by a district surveillance officer.

2.2. Study design and population

We conducted a secondary data analysis of all maternal deaths recorded from 1st January 2018 to 31st December 2021. All pregnant women who died in the hospital or arrived dead during pregnancy or up to 42 days after delivery or who met the operational case definition for maternal death were included. The study focused on the hospital-reported data for which information was available.

2.3. Data collection

We used a checklist to extract data from patients' care notes within a two-month period. Data were obtained from patient medical records, including charts, death certificates, and maternal death review forms. We also compared the data with reports submitted to the district health team.

2.4. Data management and analysis

Maternal death was defined as "the death of a woman while pregnant or within 42 days of the end 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"[8]. Data were cleaned and delinked to maintain confidentiality. The demographic and outcome variables such as age, address, occupation, referral status, length of stay to death, cause of death, and live births were considered and analyzed using Epi Info version 7.2. Social demographics were summarized using frequency and proportion and results were presented in tables and graphs. We calculated the maternal mortality ratio using the live births per 100,000. We also calculated measures for association considering outcome variable death against referral using logistic regression. Prevalence odds ratio, and 95% confidence interval (CI), were reported at a 5% level of significance.

2.5. Ethical consideration

The ethical approval was given by the Institutional Review Board of John F. Kennedy Medical Center with reference 2022/04/JFK0086. The need for informed consent was waived by the ethics committee. The data used was part of the clinical audit for maternal death in the hospital. The permission to access the data was obtained from the hospital administration. Also, the objectives of the study were explained to all stakeholders, and confidentiality was assured.

3. Results

There are a total of 233 maternal deaths and 14, 879 live births giving a maternal mortality ratio (MMR) of 1565 per 100,000 live births during the period under review. The median age was 29 years ranging from 14 to 45 years. About 15.5% (36/233) of the cases were aged less than 20 years, while the majority of the women 87% (203/233) reside in Montserrado County. Among the deaths recorded, cases that were referred from other health facilities accounted for 59% (137/233), non-referred cases were 31% (72/233) and home delivery accounted for 10% (24/233) (Table 1).

Out of those who reside in Montserrado County, 33.5% (68/203) came from the Commonwealth health district, followed by Somalia Drive 22.7%, (46/203), and Bushrod 22.2% (45/203) (Table 2). The maternal mortality ratio has been on the rise over the period under review except for a slight reduction observed in 2019 (1272/100,000 live births). The highest MMR was observed in 2021 at 1854 maternal deaths per 100,000 live births (Fig. 1).

Direct causes of death accounted for 66% (147/223) (See Table 3). Nine percent (21/233) of pregnant women died on arrival (D.O.A) while being referred and individuals making their way to the hospital. It was observed that 40.3% (94/233) of deaths occurred within a day. Hemorrhage accounts for 30.6% (45/147) of the direct cause of death while Eclampsia and Sepsis accounts for (30/147) 20.6% each. Cardiovascular related accounted for 18.4% (14/76) of the indirect cause of HIV/AIDS accounted for 16% (12/76), (Table 3). A seasonal pattern within the number of cases was observed in November and December over the four years (Fig. 2).

Table 1
Sociodemographic characteristics of maternal death, at a major referral hospital Liberia, 2018–2021.

Variables	Frequency (n = 233, %)
Age (years)	
<20	36 (15.5)
20-24	38 (16.3)
25-29	55 (23.6)
30-34	54 (23.2)
35-39	38 (16.3)
≥40	12 (5.1)
Occupation	
Unknown	141 (60.5)
Student	44 (18.9)
Business	43 (18.5)
Housewife	5 (2.1)
County of Residence	
Montserrado	203 (87.0)
Margibi	11 (4.7)
Grand Bassa	9 (4.0)
Bomi	6 (2.5)
Bong	2 (0.9)
Rivercess	2 (0.9)
Referral	
Yes	137 (58.8)
No	96 (41.2)
Referral Source (n = 137)	
Clinics	71 (51.8)
Hospital	66 (48.2)
Year	
2018	56 (24.0)
2019	52 (22.3)
2020	62 (26.6)
2021	63 (27.1)

Table 2
Distribution of Maternal death in Montserrado county per Health district, 2018–2021.

Health District	Frequency (203, %)
Commonwealth	68 (33.5)
Somalia Drive	46 (22.7)
Bushrod	45 (22.2)
Central Monrovia	35 (17.2)
Todee	6 (2.9)
St. Paul	3 (1.5)

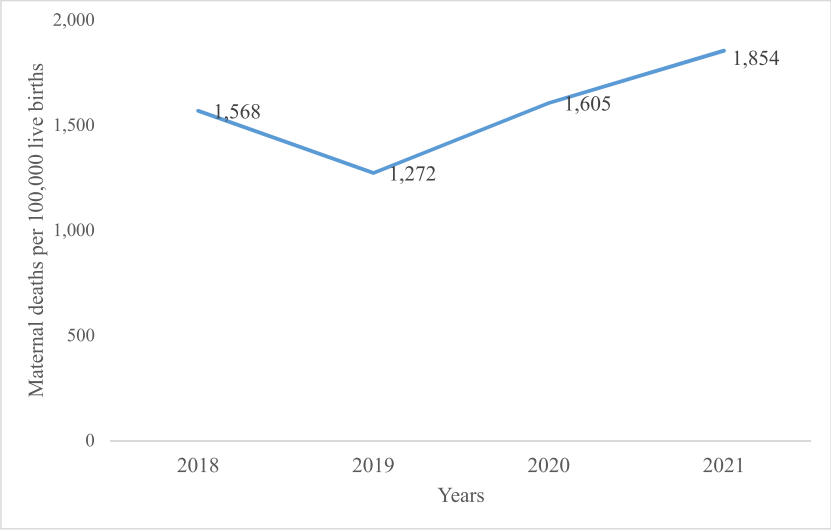

Fig. 1. Maternal Mortality Ratio at a major tertiary referral hospital in Liberia 2018–2021.

Table 3
Length of stay and causes of maternal death at a major referral hospital Liberia, 2018–2021.

Variables	Frequency (n-233, %)
Length of Stay(Days)	
<1	94 (40.3)
1-3	83 (35.6)
4-6	23 (9.9)
7-9	12 (5.2)
>9	21 (9.0)
Direct Causes of Death (n = 147)	
Hemorrhage	45 (30.6)
Sepsis	30 (20.4)
Eclampsia	30 (20.4)
Unsafe Abortion	25 (17.0)
Obstructed labor	11 (7.5)
Pre-Eclampsia	6 (4.1)
Indirect causes of Death (n = 76)	
Cardio-Vascular Related	14 (18.4)
HIV/AIDS	12 (15.8)
Anemia	8 (10.5)
Acute Abdomen	8 (10.5)
Hepatitis B	7 (9.2)
Cancer	5 (6.6)
Pneumonia	4 (5.3)
Asthma	3 (4.0)
Sickle Cell Anemia	3 (4.0)
Severe Malaria in pregnancy	2 (2.6)
Covid-19	1 (1.3)
Others	9 (11.8)

Women who were referred to the hospital were more likely to die (pOR:7.9, 95%CI: 5.9–10.6, $p < 0.001$) compared to those who were not.

4. Discussion

This paper describes maternal deaths at a major referral hospital in Liberia to identify the leading cause(s) of death over the period 2018 to 2021. We found that the maternal mortality ratio in the hospital was high. The level was found to be much higher than the national average at 725/100,000 live births [5]. This is probably due to the increased number of cases seeking care at the facility being one of the major tertiary hospitals in the country. Being the main tertiary hospital means that it receives almost all the cases with bad obstetric history referred from other health facilities. The high maternal mortality ratio could also be due to the nature of the cases being handled by the hospital such that most of the cases were likely complicated cases with a poorer prognosis compared to the general population. Our finding is contrary to what was observed in Eastern Nepal [4].

It is revealing that the majority of the deaths occurred within the first 24 h of admission to the hospital. This finding is taken in the context of the fact that more than half of all maternal deaths in the hospital were referred from other health facilities. This high proportion of the deaths occurring early in the admission suggests that the cases were probably referred late or a possible lack of or inadequate communication between the referring hospital and the destination hospital. This could also be probably due to late referrals from health facilities and delayed health-seeking behavior among cases. Our finding is similar to what was done in Kenya which states that the majority of cases died within 24 h of admission [9].

Hemorrhage, Eclampsia, and Sepsis were the three direct leading causes of maternal death among our participants which could probably be due to staff at lower or referring hospitals being unable to identify pregnancy-related risks earlier or trying to manage cases in a resource-limited facility. This finding is similar to studies that found postpartum hemorrhage and eclampsia as the leading direct causes of maternal death [4,10,11]. And cardio-vascular related and HIV/AIDs were the indirect causes of death at 34.6%, which could be likely due to missed opportunities for testing and treatment, loss to follow-up, and poor adherence to treatment by patients. This differs from what was done in Ghana which found a lower proportion [12].

We also observed that the years 2020 and 2021 had higher maternal death. The increase in maternal death during this period may likely be due to the COVID-19 pandemic which caused some facilities to close down at some point and also fear of seeking care at health facilities during this period our findings are similar to what was observed in Kenya and Uganda [13].

Most of the deaths occurred between ages 25–34 as compared to women of younger or older ages, this age group is at high risk of pregnancy at the peak of their reproductive age. The study finding is similar to what was observed in Gaza-Strips with most of the deaths occurring before the age of 35 years though the majority of deaths occurring in ages younger than 25 years have been reported [14,15]. We also found that 15.5% of deaths occur among women aged less than 20 years. This proportion of death among young mothers is worrisome. More inquiries need to be made to fully understand the factors driving the high level of mortality among this age group in the population.

More than half of the maternal cases had unknown occupations. This is probably because these cases arrived at the hospital in a critical state unable to talk, and family members are unable to provide such information due to the relative's condition or accompanying relatives don't know. However, 37.4% of maternal cases were students and businesswomen.

Commonwealth health district had the highest proportion of maternal cases from Montserrado. This is probably because the Commonwealth health district is one of the biggest health districts in Montserrado with one referral hospital for maternal emergencies. There was a seasonal pattern of increased death observed in December which could probably be due to the festive season, where most women are engaged with activities such as travel, and business, which most times lead to missing out on regular ANC visits. It could also be due to possible unofficial permission taken by health workers, especially around the end of the year festivities which depletes the real number of health workforce available to attend to possible emergencies when they do occur during this time of the year.

Our study has some limitations, the unavailability of a complete data set on maternal death stored at the facility was a limitation, and the researchers used a checklist to extract information from multiple sources. There were some missing variables such as occupation, gravida, parity, and number of antenatal visits. Also, we do not have a comprehensive list of all the women who might have died in the community. Despite these limitations, the data provided information to help improve maternal health delivery services in Liberia.

5. Conclusion

The burden of maternal mortality at the tertiary hospital is higher than national. Most of the cases died within a day of admission to the hospital. Hemorrhage, Eclampsia, and Sepsis were the leading direct causes of maternal death, and cardiovascular-related, and HIV/AIDS were the two leading indirect causes of maternal death. Cases referred from other health facilities were at high risk of dying as compared to those who were not referred.

We recommend that the Liberia Ministry of Health (MoH) equip more secondary-level health facilities and tertiary hospitals to handle maternal emergencies and sensitize the populace and the healthcare workers on prompt identification and referral of obstetric emergencies to the next level of care. The MoH also needs to improve the blood transfusion services to help in the management of postpartum hemorrhage.

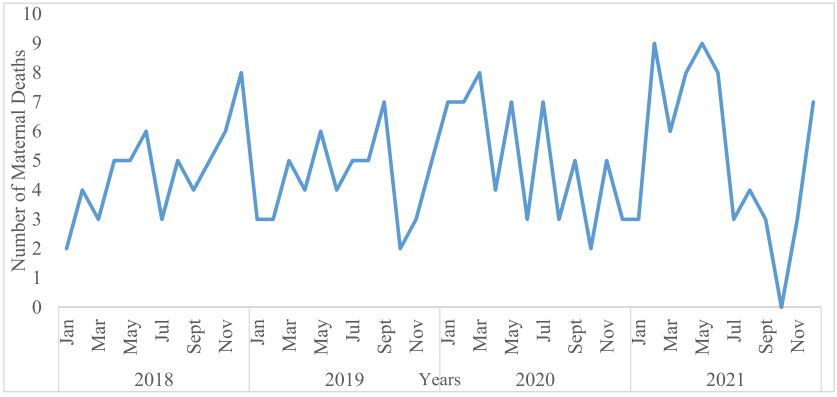

Fig. 2. The trend of maternal deaths recorded at a major referral hospital in Liberia, 2018–2021.

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Ethical consideration

The ethical approval was given by the Institutional Review Board of John F. Kennedy Medical Center with reference 2022/04/JFK0086. The need for informed consent was waived by the ethics committee. The data used was part of the clinical audit for maternal death in the hospital. The permission to access the data was obtained from the hospital administration. Also, the objectives of the study were explained to all stakeholders, and confidentiality was assured.

Data availability

The Data is available alongside the manuscript file.

CRediT authorship contribution statement

Tete K. Thomas: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Chukwuma David Umeokonkwo:** Writing – review & editing, Methodology, Formal analysis, Data curation, Conceptualization. **Himiede W. Sesay:** Writing – review & editing, Supervision, Formal analysis. **Peter Adewuyi:** Methodology, Formal analysis, Conceptualization. **Obafemi J. Babalola:** Methodology, Formal analysis, Conceptualization. **Ian Wachekwa:** Formal analysis, Conceptualization. **Maame P. Amo-Addae:** Writing – review & editing, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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