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SUPPLEMENT ARTICLE

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Differences in obstetric practices and outcomes of postpartum hemorrhage across Nigerian health facilities

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Abstract

Objective: To explore differences in obstetric practices and clinical outcomes of postpartum hemorrhage (PPH) in Nigerian facilities.

Methods: A descriptive cross-sectional study of public health facilities providing maternal healthcare services in Nigeria. Surveys were conducted across 38 purposively sampled facilities (January 2020–March 2021) to collect information on obstetric practices related to the management of the third stage of labor, treatment of postpartum hemorrhage, and clinical outcomes related to postpartum hemorrhage in the preceding 12 months.

Results: The median number of annual births per facility was 2230 (IQR, 1952–3283). The cesarean section rate was 21.6% (range 2.1%–52.6%). There was large variability in PPH rate (median 3%, range 0.4%–16.8%) and blood transfusions for PPH (median 2.8%, range 0.4%–48.6%) after vaginal birth. There was less variability for laparotomies (median 0.25%, range 0%–2.8%) and maternal deaths (median 0.11%, range 0%–0.64%) due to PPH after vaginal birth. The number of maternal deaths from all causes varied (median 0.27%, range 0%–3.5%). The rates of PPH and adverse maternal outcomes did not vary substantially between state or federal facilities, region, type of facility, and the number of clinical staff.

Conclusion: Across the Nigerian facilities surveyed there was large variation in PPH rates and adverse maternal outcomes due to PPH. This variability remains largely unexplained and requires further insights and detailed data to gain a deeper understanding of the root causes and challenges to implement customized solutions to improve maternal outcomes.

KEYWORDS
bleeding after pregnancy, clinical practice, maternal death, Nigeria, obstetric hemorrhage, postpartum hemorrhage, pregnancy outcomes

1 | INTRODUCTION

The tragedy of maternal mortality remains in low-resource countries, where a mother's death is not only a disaster for her immediate family, but also an economic loss to the whole family, her community, and the society as a whole.[1] The death of a mother also negatively impacts the health her surviving children.[1] A quarter of all maternal deaths are due to postpartum hemorrhage (PPH), which is the leading cause of maternal deaths globally, of which the majority occur in Sub-Saharan Africa.[2]

In 2017, Nigeria reported the highest estimated number of maternal deaths globally, with a total of 67 000 maternal deaths, representing almost one-quarter (23%) of global maternal deaths.[3] Nationally, Nigeria recorded 512 maternal deaths per 100 000 live births in the 2018 National Demographic Health Survey.[4] Within the country there is large variation in maternal mortality indices. The maternal mortality ratio (MMR) is higher in the north of the county than in the south. MMR in the north increased from 620 to 709 per 100 000 live births from 2008 to 2013. The south had a lower MMR of 401 per 100 000 live births in 2008, which decreased to 365 per 100 000 live births in 2013.[5]

Most deaths from PPH occur within the first 24 h after delivery. Most of these deaths are preventable with the use of prophylactic uterotonics during the third stage of labor, together with timely and appropriate PPH management. The World Health Organization (WHO) published *Recommendations for the Prevention and Treatment of Postpartum Hemorrhage* in 2012 to provide evidence-informed recommendations for managing PPH.[6] However, adherence is limited due to several challenges. Inconsistent adherence to these recommendations could result in the variability of adverse outcomes due to PPH between facilities. Other factors include sociodemographic and economic factors, specifically factors related to the type of health facility, number of staff, expertise, and availability and quality of uterotonics and antifibrinolytics, among others. However, the contribution of these practices and factors to the variations in PPH management in Nigerian health facilities is unclear. The aim of the present study was to determine the prevalence of PPH across Nigerian health facilities, describe the various practices in the management of PPH across different health facilities, and explore factors responsible for the differences in the management of PPH.

2 | MATERIALS AND METHODS

A descriptive cross-sectional study was conducted in public health facilities providing maternal healthcare services within Nigeria. The health facilities were surveyed for the specific purpose of a research study (E-MOTIVE trial)[7] and 38 facilities were recruited.

Nigeria consists of six geopolitical zones, 36 states, and one federal capital territory. It is the most populous country in Africa with an estimated population of about 206 140 000[8] and has 34 423 health facilities.[9] Approximately 67% of these health facilities are government-owned and 12% are secondary- and tertiary-level health facilities.[9] While 88% (30 345/34 423) of health facilities are primary healthcare facilities, 12% (3993/34 423) are secondary facilities and 0.25% (85/34 423) are tertiary health facilities.[9] We surveyed state and federal government secondary and tertiary public health facilities with maternity services in 19 states across all six geopolitical zones. The state hospitals are funded by different state governments and the federal government facilities are funded by the federal government of Nigeria. The health facilities were selected through purposive sampling and were eligible if they carried out between 1000 and 5000 births annually and provided comprehensive emergency obstetric care (CEmOC). We opted to focus on secondary and tertiary health facilities, opposed to primary and private health facilities. Secondary and tertiary health facilities are better equipped, serve as referral centers for primary health facilities, and can provide CEmOC services. For this reason, primary and private health facilities were excluded from the study.

Site selection and data collection took place over 15 months (January 2020–March 2021). Data were collected using a predefined facility assessment questionnaire and checklist provided by the E-MOTIVE trial. The facility assessment questionnaire was completed by the doctor in charge of the maternity unit or the head of the obstetrics and gynecology department. Data collected included the total number of annual births, total number of vaginal births and cesarean sections, number of PPH cases, number of laparotomies for PPH, severe maternal outcomes from PPH, maternal deaths from PPH and from all causes, availability of resources used in PPH management, staffing, and stock of uterotonics (Supporting Information S1). The pretrial facility checklist was used to confirm the information from the questionnaire (Supporting Information S2). The checklist was populated during meetings with each site team separately. The meetings involved the head of the maternity unit, head of obstetrics and gynecology, matron in charge of the labor ward, junior midwives, and junior medical officers or residents. Facilities were selected if it was confirmed that they had reliable maternal health data. These data are routinely collected prospectively in all the hospitals and recorded in registers. The registers include daily birth register, blood transfusion register, severe morbidity register (eclampsia and PPH) in the labor ward, and operation register in the theater. This explains how it was feasible to obtain reliable monthly and yearly aggregate data. In the majority of the hospitals, it is also mandatory to submit maternal health data (such as total number of births, cesarean section rates, maternal mortality ratio, and severe maternal morbidities e.g. PPH) yearly to the hospital management. We did not seek detailed information on individual births or insights into the contributing factors to the variability in PPH across the different hospitals. During the hospital visits, we were able to verify the data from the individual registers.

Ethical approval was obtained from National Health Research Ethics Committee NHREC/01/01/2007–07/04/2020, which covers all the facilities within the study. Further ethical approvals were sought and obtained from the respective state ministries of health where the facility is located, and from the individual facilities with established ethical committees. Providers interviewed were assured

TABLE 1 Characteristics of health facilities[a]

Characteristic	No. (n = 38)	(%)
Ownership		
Federal government	14	(36.8)
State government	24	(63.3)
Regional location		
North-West	21	(55.3)
North-Central	8	(21.1)
North-East	3	(7.9)
South-West	1	(2.6)
South–South	5	(13.2)
South-East	0	(0)
Type of facility		
Secondary facility	21	(55.3)
Tertiary facility	17	(44.7)
Number of staff		
<40	15	(39.5)
40–79	9	(23.7)
80–119	7	(18.4)
120–159	2	(5.3)
≥160	5	(13.2)
Cadre of staff		
Clinical officers		
<10	34	(89.5)
10–19	1	(2.6)
≥20	3	(7.9)
Consultants		
<10	29	(76.3)
10–19	9	(23.4)
Nurse/midwives		
<10	3	(7.9)
10–19	16	(42.1)
≥20	19	(50.0)
Number of births		
Total births	2677 ± 1107	
Vaginal	2167 ± 281	
Cesarean	521 ± 1111	
Services available		
Oxytocin	38	(100)
SRA or WHO prequalified	17	(44.7)
Other brands	21	(55.3)
TXA	23	(65.8)
Uterine balloon tamponade	20	(52.7)
Dedicated obstetric theater	24	(63.2)
Blood transfusion service	35	(92.1)
Guidelines for postpartum care	8	(21.1)
Assisted vaginal birth	33	(86.8)
Neonatal resuscitation including intubation and ventilation	34	(89.5)
Maternal cardiopulmonary resuscitation including intubation and ventilation	34	(89.5)
Intensive care unit on site	20	(52.6)
Hysterectomy possible	35	(92.1)

[a]Values are given as number (percentage) or mean ± SD.

of the confidentiality of their responses. We assured confidentiality by not publishing respondents' personal details and only publishing data in aggregate format to ensure cases were unidentifiable.

Data from the facility assessment questionnaire were described and continuous data were summarized using means and standard deviations or median and interquartile ranges if skewed. Binary data were summarized in proportions. Statistical analysis was performed to pool PPH rates and severe maternal outcomes from each facility. Where severe maternal outcome from PPH is defined as a composite outcome of the two severe outcomes – laparotomies and maternal deaths from PPH. The log ratio and its corresponding standard error for each study were computed. Meta-analysis using inverse-variance weighting was performed to calculate the random-effects summary proportions. Heterogeneity of the effects was assessed graphically with forest plots and statistically analyzed using the χ^2 test. Lastly, we performed a stratified analysis, splitting studies according to subgroups based on facility characteristics to explain the observed variability in clinical outcomes. Statistical analyses were performed using Stata version 15.0 (StataCorp, College Station, TX, USA).

3 | RESULTS

A total of 38 facilities were surveyed: 24 (63.3%) state government and 14 (36.8%) federal government facilities (Table 1). Most facilities surveyed were in the north west (n = 21, 55.3%) and north central (n = 8, 21.1%) regions of Nigeria (Figure 1). Twenty-one (55.3%) were secondary- and 17 (44.7%) were tertiary-level facilities. Less than half of the facilities had fewer than 40 clinical members of staff (15 facilities, 39.5%), and fewer than 10 medical officers (34 facilities, 89.5%) and consultant obstetricians (29 facilities, 76.3%) in the department of obstetrics and gynecology/maternity. Only 3 (7.9%) facilities had fewer than 10 midwives or nurses. The median annual number of births per facility was 2230 (IQR, 1952–3283). The cesarean section rate was 21.6% but varied extensively between facilities (range, 2.1%–52.6%).

All facilities surveyed stocked oxytocin. However, only half (n = 19, 50%) of the facilities stocked at least one oxytocin product manufactured in a country with a Stringent Regulatory Authority (SRA).[10] There were 10 different oxytocin products identified across the 38 facilities. Almost half of the products in 17 (44.7%)

facilities were manufactured in countries without SRA or WHO prequalification. Twenty-three (65.8%) facilities routinely stocked tranexamic acid. None of the facilities had access to a purposely designed uterine balloon tamponade device. However, 20 (52.7%) facilities reported the use of an improvised device by using a condom or surgical glove attached to a foley catheter. Most facilities were able to provide blood transfusion and emergency hysterectomy (n = 35, 92.1%), assisted vaginal birth (33 facilities, 86.8%), and both neonatal and maternal resuscitation (n = 34, 89.5%). Only 8 (21.1%) facilities had clear guidelines for managing PPH, 20 (52.6%) facilities had access to an intensive care unit, and 24 (63.2%) had access to a dedicated obstetric theater for emergencies.

Across the facilities, there was large variability in the PPH rate after vaginal birth (median 3%, range, 0.4%–16.8%; Figure 2). There was variability across blood transfusions (median 2.8%, range, 0.4%–48.6%; Figure 3), laparotomies (median 0.25%, range, 0%–2.8%; Figure 4), and maternal deaths (median 0.11%, range, 0%–0.64%; Figure 5) from PPH after vaginal birth. The number of maternal deaths from all causes also varied substantially (median 0.27%, range, 0%–3.5%). The maternal death rate per case of PPH was 4.3% (range, 0%–66.6%) and laparotomy rate per case of PPH was 18% (range, 0%–100%), both with substantial variability.

In a stratified analysis of PPH and severe maternal outcomes from PPH rates (laparotomies and maternal deaths from PPH), we did not find substantial differences by facility characteristics (Figure 6). Specifically, the rates were similar across state and federal government facilities. There were no large differences between regions, secondary or tertiary facilities, or the number of staff working in the obstetric departments (Figure 6).

4 | DISCUSSION

We presented survey results from 38 secondary and tertiary level facilities providing CEmOC in Nigeria that conducted between 1000 and 5000 births annually. The health facilities surveyed are located across Nigeria's six geopolitical zones, in 19 states, and collectively look after over 100 000 women giving birth annually. We assessed each facility's level of preparedness for managing PPH using a facility assessment questionnaire and a pretrial facility checklist. However, facility selection to survey was purposeful as part of eligibility screening for a multicenter study; therefore, the sample may not be representative of the whole country. There was large variability across the facilities in cesarean section rates, PPH rates, blood transfusions, laparotomies, and maternal deaths from PPH after vaginal birth. The number of maternal deaths from all causes also varied substantially. Rates of PPH and severe maternal outcomes did not vary substantially based on the facility

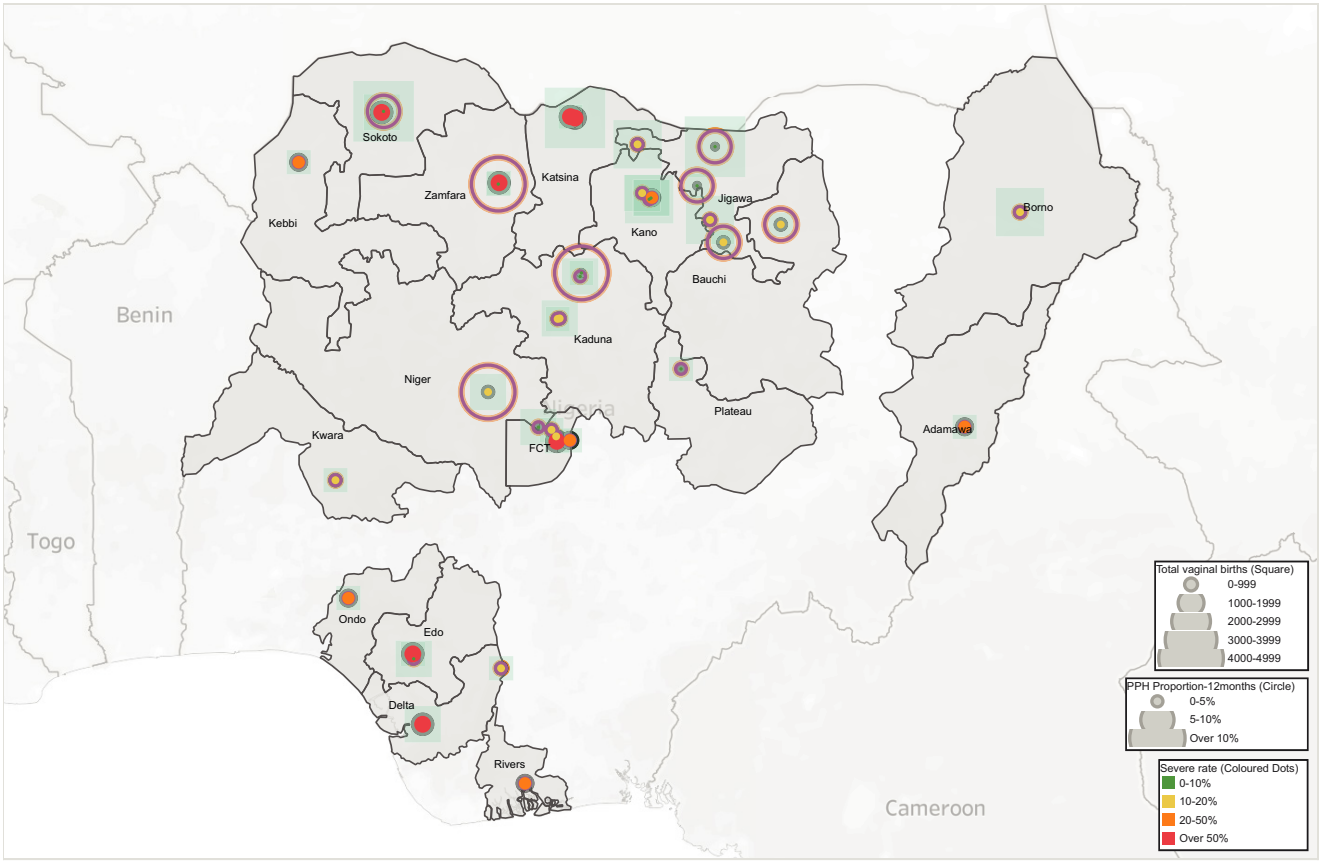

FIGURE 1 Map of the hospitals surveyed in Nigeria with the number of births, postpartum hemorrhage rate, and severe maternal outcomes (laparotomy or maternal death from postpartum hemorrhage) displayed

FIGURE 2 Proportions of postpartum hemorrhage (PPH) per vaginal birth displayed by state in Nigeria

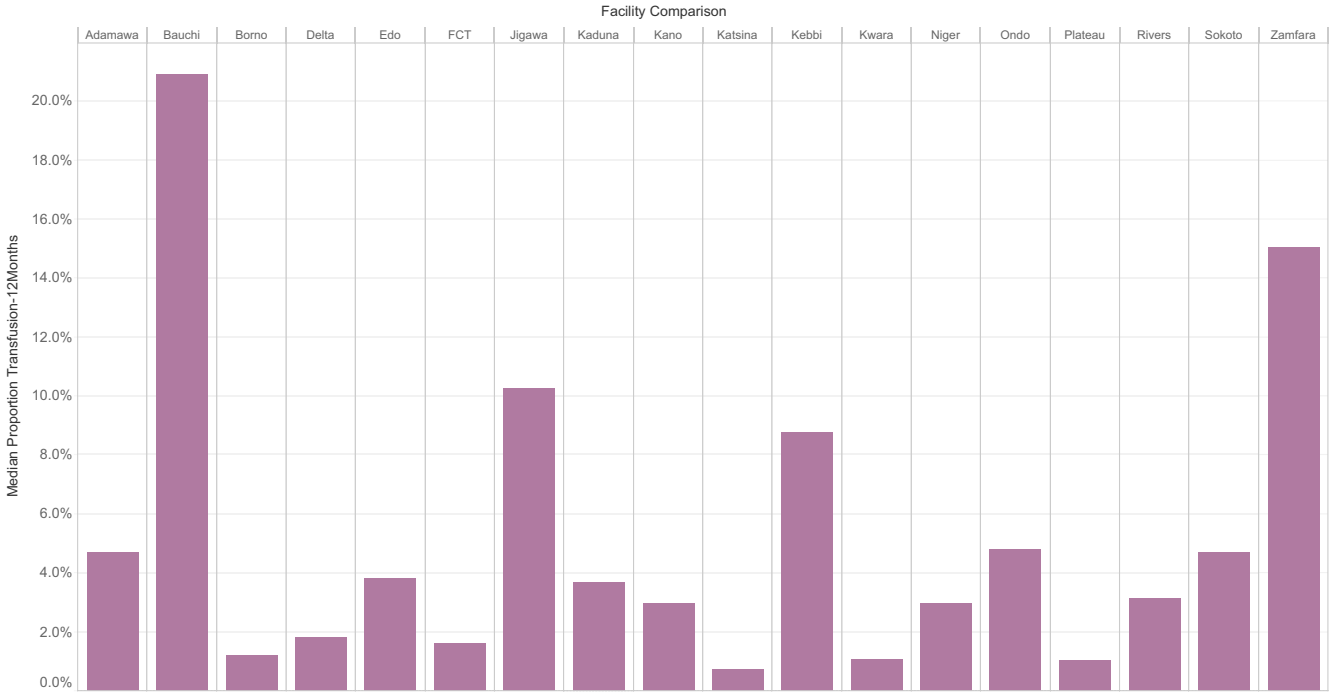

FIGURE 3 Proportions of blood transfusion per birth displayed by state in Nigeria

characteristics such as ownership, region, level of facility, or number of staff.

The data demonstrated large variability in PPH, adverse maternal outcome rates related to PPH, and facility preparedness for managing PPH. Data from these regions in Nigeria are scarce. Capturing these data is essential to highlight the magnitude of the burden from PPH. Even though many facilities were surveyed, there were limitations due to the amount of clinical data routinely collected and the quality of the registers maintained locally. These limitations resulted in the inability to understand and describe in detail the large variability in PPH rates and adverse outcomes from PPH across the facilities. Facility characteristics, such as the type of facilities or number of staff, do not take into account the severity of the case mix that each facility is dealing with, therefore comparisons about performance are not reliable.

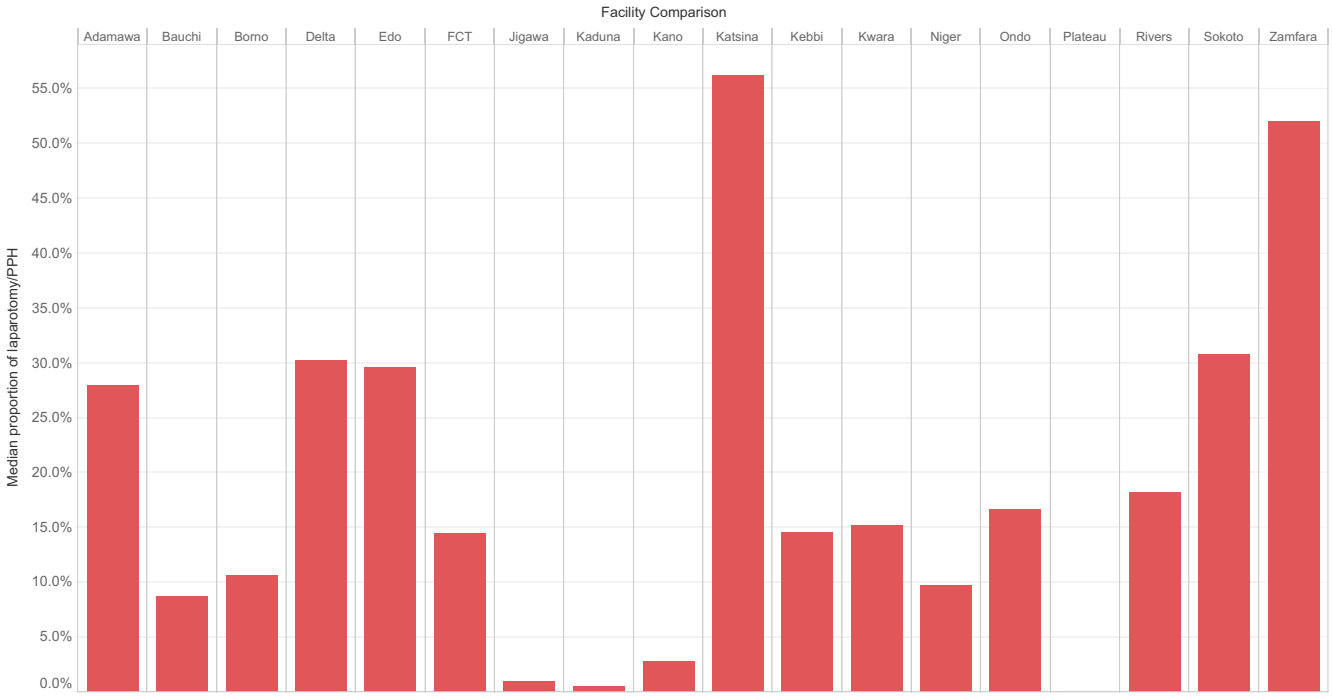

FIGURE 4 Proportions of laparotomy per case of PPH displayed by state in Nigeria

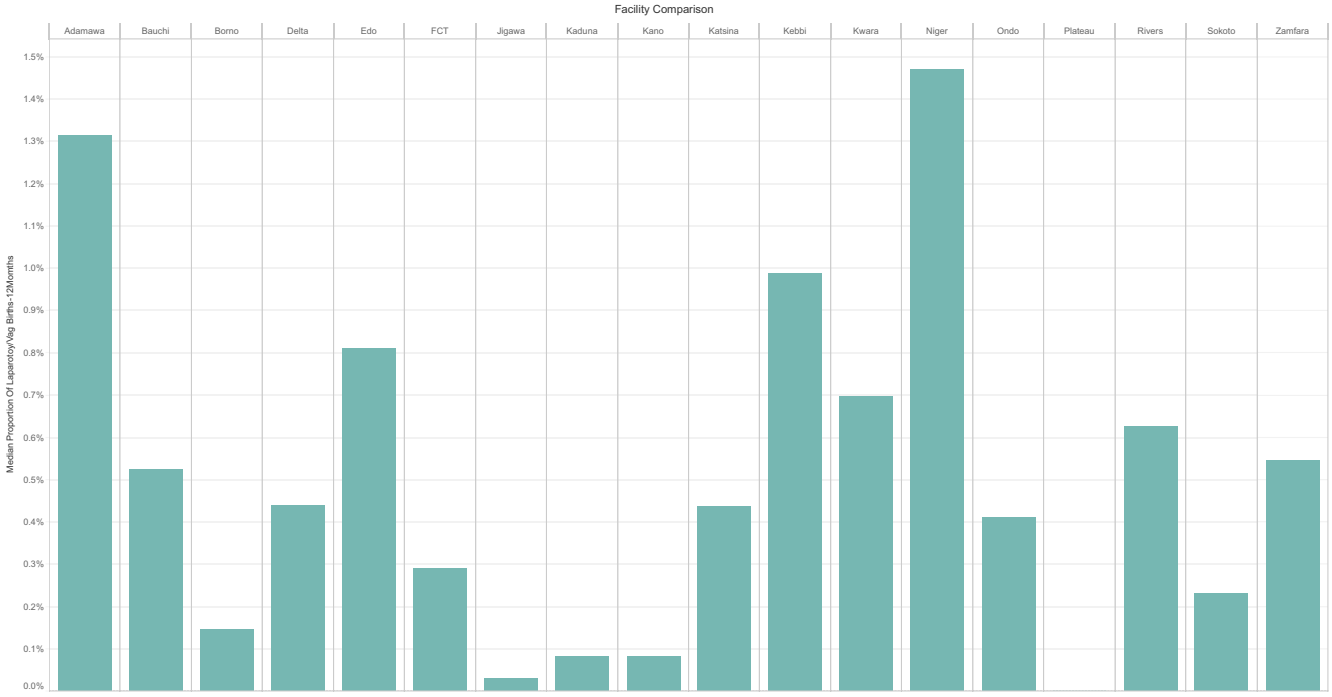

FIGURE 5 Proportions of maternal death per case of postpartum hemorrhage (PPH) displayed by state in Nigeria

Our findings are similar to previous studies in Nigeria that highlighted large variability in PPH rates and adverse outcomes. A study in northern Nigeria identified primary PPH as the most common cause of postpartum maternal morbidity (35.4%).[11] A 5-year study to determine the rate and causes of PPH in a tertiary-level facility in southern Nigeria found that PPH complicated 1.68% of total vaginal births in that period.[12] In a similar 3-year study in a facility in northern Nigeria, the incidence of PPH was 4.5%.[13] A 6-year study in southeast Nigeria found a 3.4% prevalence of primary PPH from all births.[14] Likewise, in a critical review of 6 years of experience in quality assurance in obstetrics in Nigeria, data from 19 facilities across four states revealed great variability in both MMR and the incidence of PPH. MMR ranged from 180 maternal deaths per 100 000 live births in Ondo State

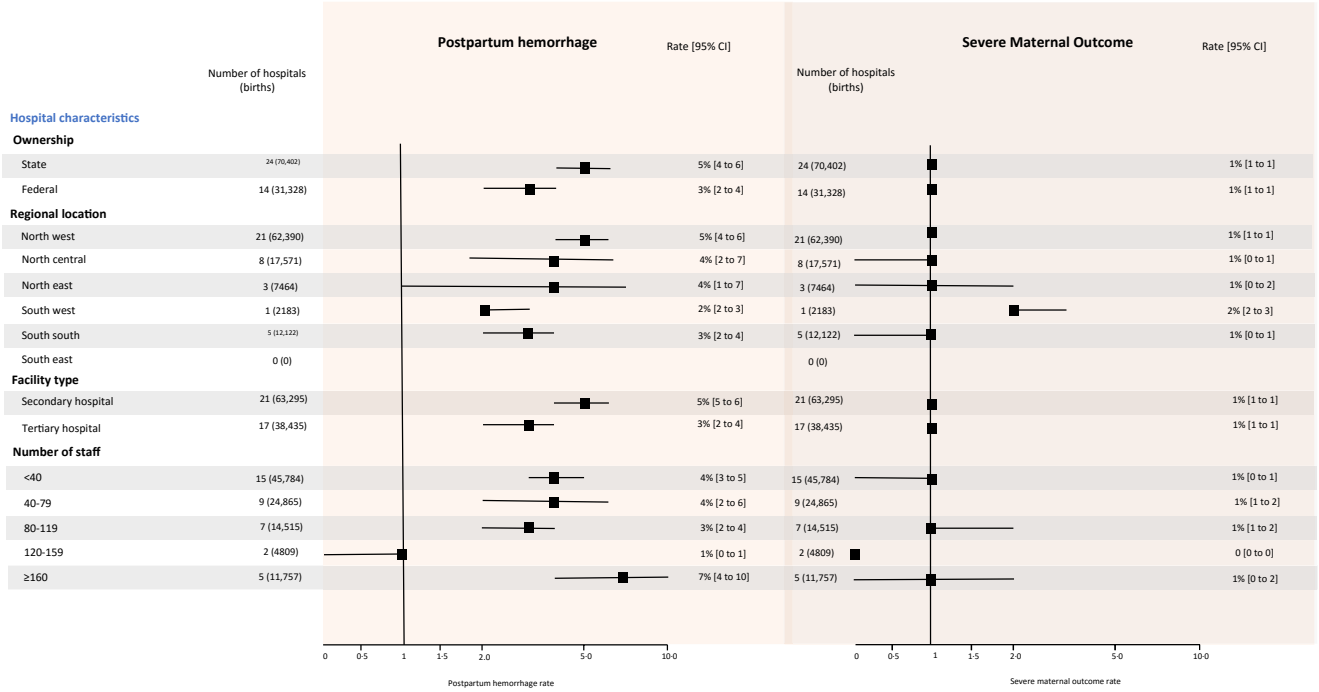

FIGURE 6 Pooled rates and confidence intervals of postpartum hemorrhage (PPH) and severe maternal outcomes across the hospitals surveyed in Nigeria stratified by hospital characteristics

to 2150 per 100 000 live births in Kano State. Likewise, the prevalence of PPH across the 19 facilities ranged from 0.18%–11.4%.[15] All of these studies corroborate our findings.

The present study also found deficiencies in facility preparedness in addressing obstetric emergencies, which is consistent with previous studies.[16] In 2016, a study was conducted to determine the availability of emergency obstetric care (EmOC) in Kano metropolis in 37 public health facilities. Of the 37 health facilities, 13 (35.1%) had access to intravenous oxytocic drugs, while 3 (8.1%) had at least four midwives and provided blood transfusion services.[17] This highlights the deficit of EmOC in these facilities in line with our findings. In addition, even though the use of uterine balloon tamponade for treatment of PPH is associated with a high success rate,[18] only approximately half of the facilities surveyed in the present study used it. The high blood transfusion rate in some facilities is not surprising, with WHO estimating that 41.8% of pregnant Nigerian women are anemic.[19] Furthermore, previous studies from northern and southern Nigeria have reported the prevalence of anemia in pregnancy at 13.5%–51.8%[20,21] and 12.3%–32.0%.[22] The implication of this is that once a woman goes into labor with a deficit, then blood transfusion may become necessary even with mild to moderate PPH. This may explain the high rate of blood transfusion in some of the facilities surveyed. Similar to the findings of the present survey, variation in the cesarean section rate had also been reported previously.[23] Our survey also revealed that less than half of the facilities stocked oxytocin manufactured in countries with stringent SRA. An SRA is a national drug regulation authority that is considered by the WHO to apply stringent standards for quality, safety, and efficacy in its process of regulatory review of drugs and vaccines for marketing authorization.[10] This is also not surprising as there are concerns about the quality of oxytocin in low-and-middle-income countries.[24] A systematic review reported up to 45.6% of oxytocin samples failed quality tests, mainly as a result of inadequate concentration of the active ingredient of oxytocin.[24]

Regarding the implications of our study, the high fertility rate in Nigeria and the large variability in PPH rates and severe maternal outcomes draw attention to the lack of preparedness for CEmOC, lack of guidelines for managing PPH, lack of access to an intensive care unit, and lack of access to a dedicated theater in some facilities. Our findings highlight the urgent need to address equitable access to CEmOC and improve standardized provisions across Nigerian health facilities.

The research priority from our study is to understand why there is large variability in PPH rates and adverse outcomes. Addressing the limitations of routinely collected data, by increasing and standardizing the data collected and improving maternity registers as well as individual delivery data, would provide a more in-depth understanding of facility profiles and obstetric practices that influence clinical outcomes. Improved data collection can help identify positive outliers with lower rates of maternal adverse outcomes, that can in turn help to develop contextually appropriate solutions for other facilities requiring improvement.

In conclusion, across the Nigerian facilities surveyed there was large variation in PPH rates and adverse maternal outcomes due to PPH. This variability remains largely unexplained and requires further insights and in-depth data to gain a deeper understanding of the root causes and challenges to implement customized solutions to improve maternal outcomes.

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CONFLICT OF INTEREST

K-MM, AA, RT, LB, AD, AC, and ID report BMGF funding for the E-MOTIVE trial paid to the University of Birmingham. Other authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

AAW: study planning, questionnaire administration, data collation, manuscript writing. AA: data analysis. RT: study conduct, data collection, data analysis, participated in facility interviews. LB: study conduct, data collection, participated in facility interviews. K-MM: study conduct, pretrial facility checklist, data collection. AD: study design, planning and conduct, data collection, participated in facility interviews. BMM and TA: pretrial facility checklist, manuscript writing. FD: facility assessment questionnaire, data collation. AC: study design, planning and conduct, manuscript critical review. IDG: study design, planning, and conduct, pretrial facility checklist, data collection and analysis, manuscript writing. HSG: study planning, facility selection, participated in the interviews, finalized the manuscript. All authors reviewed and approved the final manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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