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Original Research Article

Causes and trends in maternal mortality in a tertiary health facility in North Central Nigeria

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ABSTRACT

Background: Nigeria remains one of the top three countries with the highest maternal mortality worldwide. Due to poor vital registration in the country, hospital-based maternal mortality statistics still remain an important source for tracking trends and causes of maternal mortality. The aim of the study was to determine the causes and trends of maternal mortality in a tertiary health facility in North Central Nigeria.

Methods: This was a retrospective review of cases of maternal deaths at the Jos University Teaching Hospital from 1st January 2016 to 31st December 2022. Case records of patients that died from pregnancy-related complications were retrieved from the medical records department and other service points of the hospital. The information extracted was maternal socio-demographic characteristics, clinical diagnosis on admission, and duration of hospital stay before demise. The maternal mortality ratio was calculated per 100,000 live births.

Results: There were 80 maternal deaths during the period, and 10,348 live births during the same period, giving a maternal mortality ratio of 773/100,000 live births. The mean age of the women was 27.0±8.1 years, 12.5% were teenage mothers, 6.4% were women ≥40 years. About 27.5% were nulliparous, 16.5% para 5 or more. For women where information on educational level were available 68(85.0%), 48.5% had only primary education or no formal education, 42.5% had no antenatal care. About 72.5% of the maternal deaths were due to direct causes-pre-eclampsia/eclampsia (30.0%), maternal sepsis (17.5%), complications of unsafe abortion (12.5%), obstetric haemorrhage and uterine rupture 6.3%. The main causes of indirect maternal deaths were sickle cell disease, cardiac disease, diabetes mellitus and liver disease in pregnancy. Most (41.3%) of the maternal deaths occurred within the 24 hours of admission. There was no consistent trend noted in maternal mortality between 2016 and 2019; however, a remarkable increase was observed during the Covid-19 period from 2020-2021.

Conclusions: The maternal mortality ratio in Jos, North Central Nigeria remains high, with major causes related to pre-eclampsia/eclampsia, maternal sepsis, unsafe abortion and obstetric haemorrhage. The global Covid-19 pandemic led to an increased maternal mortality in the health facility.

Keywords: Causes and trends, Maternal mortality, North central Nigeria, Tertiary health facility

INTRODUCTION

Nothing could be more tragic than the death of a woman in the process of giving life to her newborn. While childbirth has become safer in most developed countries,

it is still a dangerous journey in low-income countries. About 95% of maternal deaths occur in low- and middle-income countries with two-thirds of the maternal mortality occurring in sub-Saharan Africa.¹ The lifetime risk of a 15-year old girl dying from pregnancy-related complications

is 1: 41 in sub-Saharan Africa, compared to 1:11,000 in Western Europe.^{1,2}

Recent estimates show that Nigeria is one of the top 3 countries with the highest maternal mortality ratio. In terms of contribution to the global number of maternal deaths, it has overtaken India, despite being of a lower population compared to India.^{3,4} It is also among the countries that did not achieve its Millennium Development Goals (MDG) 5 target of reducing maternal mortality ratio by $\frac{3}{4}$ of its 1990 rate at the end of the MDG period in 2015, with no significant progress.⁵ A lot more still needs to be done to make any progress. The United Nations (UN) launched the Sustainable Development Goals (SDG) in 2015, and came into force 1st January 2016, with goal 3: "Ensure healthy lives and promote well-being for all at all ages" and target 3.1 to reduce the global maternal mortality ratio to less than 70/100,000 live births by 2030.⁶ While most high-income countries have achieved this even before the launch date, most low- and middle-income countries like Nigeria still have a long way to go - seven years into the launch of the programme. Although the Nigeria Demographic and Health Survey (NDHS) over the years shows a reducing trend in maternal mortality (NDHS 2008, 2013, 2018), several facility-based studies within the country have shown a rising trend in maternal mortality, with variations between the northern and southern parts of the country.⁷⁻¹⁰ The need to constantly bring the issue of maternal mortality to the front burner to call the attention of policy and decision-makers cannot be overemphasized, as this will help in assessing progress made and planning and investing in measures that could give the greatest benefit.

Almost all maternal deaths are preventable with good adequate maternal care, safe deliveries, and good nutrition and hygiene.¹¹ These deaths can also be prevented if births are attended by skilled health personnel. As complications during pregnancy can sometimes be unpredictable, when it occurs, there is a need to have quick access to quality emergency obstetric services by skilled health personnel, who are regularly supervised and have the proper equipment and supplies.² There is also a need to continue to rely on good measurement and apply the best scientific understanding of what is causing the death of mothers. Due to poor vital registration in Nigeria, like most low-income countries, hospital-based maternal mortality statistics remain a useful source of supplemental information for tracking progress in maternal mortality, particularly changes in trends and causes of maternal deaths. This study aims to review the causes and trends in maternal mortality in the last seven years since the commencement of the UN SDG programme.

METHODS

This was a retrospective review of cases of maternal deaths in Jos University Teaching Hospital (JUTH) from 1st January 2016 to 31st December 2022. JUTH is a tertiary institution located in the capital of Plateau state in North

central Nigeria with about 600-bed capacity that serves as a referral institution for primary and secondary health facilities both within and outside Jos metropolis. It also receives referrals from the neighbouring states of Bauchi, Nasarawa, Federal Capital Territory, Kaduna, Benue, Gombe and Taraba.

Case records of patients that died from pregnancy-related complications were retrieved from the medical records department; other information about each maternal death was retrieved from the labour ward, antenatal and post-natal wards, theatre and the intensive care unit of the hospital. The information extracted was maternal socio-demographic characteristics like age, parity, educational level and booking status. Information on clinical diagnosis on admission, and duration of hospital stay before demise were also obtained. Maternal death was defined as the death of a woman while pregnant or within 42 days of the termination of the pregnancy, irrespective of the site or duration of the pregnancy, from complications related to or aggravated by the pregnancy or its management, excluding deaths from incidental or accidental causes (ICD-10). Records of live births within the study period were also obtained from the delivery unit. The data obtained were entered in an excel spreadsheet and exported to IBM SPSS version 25 and analyzed, the results presented as percentages.

RESULTS

There were 80 maternal deaths during the period of review, with 10,348 live births occurring during the same period - giving a maternal mortality ratio of 773/100,000 live births. The mean age of the patients was 27 ± 8.1 years. About 12.5% (10) were teenage mothers ≤ 19 years of age and 6.4% (5) were forty years and above. The median parity was 2 (range 0-13) with 27.5% of the patients being nulliparous, while 16.3% were women of high (para ≥ 5) parity. Information on the educational level was available for 68 (85%) of the patients, among these women, 12 (17.6%) had no formal education or only a primary level of education 21 (30.9%). Fewer women, 10 (14.7%) had a tertiary level of education. Overall, 34 (42.5%) women did not book for antenatal care; only 17.7% (14) booked for antenatal care in JUTH, Table 1. Of particular note was that 2 of the women who had antenatal care in our hospital presented with uterine rupture: one was in labour at home while the other laboured in a primary health care centre.

Nearly three-quarters 58 (72.5%) of maternal deaths were due to direct causes, Figure 1. The major causes of maternal deaths were pre-eclampsia/eclampsia 24 (30.0%), maternal sepsis 14 (17.5%), and complications of unsafe abortion 10 (12.5%). Obstetric haemorrhage and uterine rupture accounted for 6.3% each of the maternal deaths. The two major causes of indirect maternal deaths were sickle cell disease in pregnancy (6.3%) and cardiac disease (5%). Other indirect causes of maternal deaths in this review were diabetes mellitus, liver disease, bacterial meningitis, HIV/TB, viral haemorrhagic (lassa) fever,

Covid-19, acute kidney failure and anaesthetic complications, Table 2.

Table 1: Socio-demographic characteristics of maternal deaths.

Parameter	N (%)	
Age range in years		Mean±SD
≤19	10 (12.5)	28.7±8.1
20-24	13 (16.3)	
25-29	27 (33.8)	
30-34	14 (17.7)	
35-39	11 (13.8)	
40-44	1 (1.3)	
45-49	3 (3.8)	
≥ 50	1 (1.3)	
Total	80 (100)	
Educational level	N*= 68	
No formal education	12 (17.6)	
Primary	21 (30.9)	
Secondary	25 (36.8)	
Tertiary	10 (14.7)	
Total	68 (100.0)	
Parity		Median (range)
0	22 (27.5)	2 (0-13)
1	16 (20.0)	
2	11 (13.8)	
3	15 (18.8)	
4	3 (3.8)	
≥5	13 (16.3)	
Total	80 (100.0)	
Booking status		
Booked in JUTH	14 (17.7)	
Booked elsewhere	29 (36.3)	
Not booked	34 (42.5)	
No information on booking status	3 (3.8)	
Total	80 (100.0)	

*No information on educational status of 12 patients

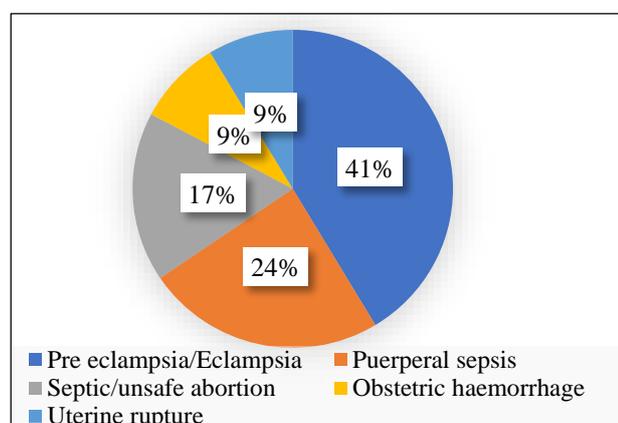


Figure 1: Direct causes of maternal deaths in JUTH.

Table 2: Direct and indirect causes of maternal deaths.

Cause of maternal mortality	N	Percentage
Direct causes		
PET/Eclampsia	24	30.0
Puerperal sepsis	14	17.5
Unsafe abortion	10	12.5
Obstetric haemorrhage	5	6.3
Uterine rupture	5	6.3
(Subtotal)	58	72.5
Indirect causes		
Sickle cell disease in pregnancy	5	6.3
Cardiac disease	4	5.0
Diabetes mellitus	2	2.5
Decompensated chronic liver disease	2	2.5
Viral haemorrhagic (Lassa) fever	2	2.5
Bacterial meningitis	2	2.5
HIV/TB	2	2.5
Others*	3	3.8
Subtotal	22	27.5
Total	80	100.0

*Viral pneumonia-Covid 19, Acute gastroenteritis with acute renal failure, Anaesthetic complication

Table 3: Maternal mortality ratio by age range.

Age (years)	Total live births	No of Maternal deaths	MM/100,000 Live births in age range
≤19	270	10	3,704
20-24	1,473	13	883
25-29	3,222	27	838
30-34	3,181	14	440
35-39	1,739	11	633
≥40	463	5	1,080
Total	10,348	80	

There was a disproportionately high maternal mortality at the extremes of maternal age. Women aged ≤19 years had the highest age-related maternal mortality ratio, followed by women ≥40 years of age, Table 3. Most, 33 (41.3%) of the maternal deaths occurred within the first day (24 hours) of admission and 27 (33.8%) occurred within 2-7 days of admission, Table 5. Majority (n =33) of those that died within 24 hours of admission were women who either did not have antenatal care 15 (45.5%) or booked for antenatal care elsewhere 13 (39.4%) and were referred to JUTH.

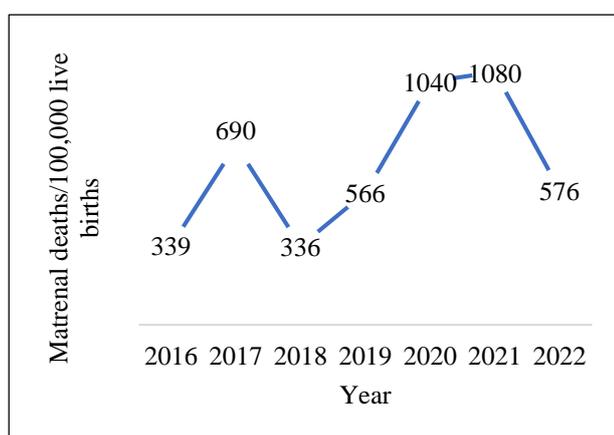
There was no consistent trend in the maternal mortality ratio over the first 4 years of the review period (2016 – 2019), however, a marked increase in the mortality ratio was observed in the years 2020 and 2021, which seems to coincide with the period of Covid-19 pandemic; however, a decline in the ratio to a level close to the pre Covid-19 (2019) was observed in 2022 (Figure 2, Table 4).

Table 4: Trend in maternal mortality.

Year	Total live births	Maternal deaths	Maternal death/100,000 live births
2016	1,179	4	339
2017	1,158	8	690
2018	1,189	4	336
2019	1,942	11	566
2020	1,731	18	1,040
2021	1,759	19	1,080
2022	1,390	8	576

Table 5: Duration of hospital stay from admission to death.

Duration of hospital stay (days)	N (%)
≤1	33 (41.3)
2-7	27 (33.8)
8-14	16 (20.0)
≥15	4 (5.0)
Total	80 (100.0)

**Figure 2: Trend in maternal deaths from 2016 – 2022 in JUTH.**

DISCUSSION

Our review shows a high maternal mortality ratio of 773/1,00,000 live births consistent with other reports of institutional reviews within the country over different periods,^{8-10,12} even within the same institution, reviews over different periods have shown a high maternal mortality ratio.^{7,13,14} This shows that efforts towards reducing maternal mortality over time have not achieved the expected goal of reducing preventable maternal deaths significantly.

Though our review shows a mean age of the mothers at 27.0±8.1 years, with women aged 25-29 years contributing to 33.8% of the maternal deaths, the age-specific maternal mortality ratio shows a clearer picture of the age group with the highest burden of maternal mortality. Our study did not show the typical J-shaped pattern of the age-specific maternal mortality ratio, however, it shows the

high risk of mortality attributed to extremes of maternal age, with women ≥40 years having an age-specific mortality ratio of about one and a half times more and women aged ≤19 years having an age-specific maternal mortality ratio almost five times more than the average (773/100,000) maternal mortality ratio for the study period.¹⁵ This could be due to the high mortality associated with pre-eclampsia/eclampsia known to be common in extremes of maternal ages, and unsafe abortion - a more common occurrence among younger gravidae. An earlier study in our institution on maternal mortality among adolescents also showed a high maternal mortality ratio, the major causes being unsafe abortion, eclampsia and sepsis.¹⁶ These were also quite common in this study. Most studies in developing countries show that teenage pregnancy is associated with a high risk of poor maternal and perinatal outcomes because most are usually of low socio-economic status with no or low level of education.¹⁷ A systematic review conducted to identify the adolescent maternal health impacts of pregnancy in Ghana, Nigeria and Liberia shows a high prevalence of anaemia, postpartum haemorrhage, cephalopelvic disproportion, hypertensive disorders and unsafe abortion in addition to psychological effects which adversely affect pregnancy outcome in this age group.¹⁸ The burden of maternal mortality among adolescents is much higher in developing countries of sub-Saharan Africa and Asia.¹⁵ The weak health systems in most developing countries further increase their risk of dying from pregnancy complications when it occurs. Comparatively, developed countries do not show the marked increase in mortality risk observed in teenage pregnancy in developing countries, however, advanced maternal age has been shown to be an independent risk factor for obstetric and neonatal complications.^{15,19} High risk of co-morbidities like hypertension, diabetes mellitus, kidney disease and IVF pregnancies contribute to the increased risk observed in these mothers.¹⁹ Two of our patients (not shown) had their pregnancies through IVF and were both above 40 years.

Our review shows a remarkable increase in maternal mortality in the years 2020 and 2021, almost doubling the values in the preceding two years. These coincide with the period of the Covid-19 global pandemic. Although only one case of maternal death was adjudged to be due to complications of Covid-19, the pandemic adversely affected the healthcare delivery system around the world, with maternal health services facing more challenges. The impact was felt even more in countries with weak health systems like ours. Disruptions occurred in both the demand and supply sides of maternal health services due to resource shortages, low patient turnout due to transport restrictions from lockdowns, and fear of contracting the disease. Skilled attendance at delivery, antenatal and post-natal care was noted to be reduced in some countries.^{20,21} In Nigeria, a study conducted in three states: Lagos, Niger and Bauchi - which closely border Plateau state, showed reduced antenatal clinic attendance and reduced skilled attendance at birth.²² It is quite possible that these factors contributed to the increased maternal mortality ratio

observed within that period, more so that the ratio was noted to have reduced to the pre-pandemic levels in the year 2022.

The leading causes of direct maternal mortality have remained essentially the same in our facility over the years: namely haemorrhage, hypertensive disease, unsafe abortion and maternal infections, with more recent reviews showing PET/Eclampsia taking the lead like in our review, while haemorrhage was the case in an earlier review.^{13,14,7} Although the reason for this is unclear, it is noteworthy that the commencement of operations by the zonal national blood transfusion services within Jos, the state capital and the implementation of evidence-based interventions like the use of tranexamic acid, improved availability of misoprostol, etc., in the management of postpartum haemorrhage, occurred after the earlier review in 2005.⁷ However, not much progress has been made in terms of evidence-based interventions to reduce mortality related to pre-eclampsia/eclampsia other than the use of Magnesium sulphate to prevent or reduce the frequency of convulsions. It is also possible that the incidence of pre-eclampsia/eclampsia has increased over time, this is a subject for another study.

Our result also shows that the major direct causes of maternal deaths are similar to findings from other tertiary health institutions within and outside the country.^{8,9,23} This brings to bear the fact that the common causes of maternal mortality are the same worldwide, the main challenge being accessing necessary evidenced-based interventions that vary from one country to the other, which leads to the wide global disparity in maternal mortality. Our review indicates that over half of the indirect causes of maternal deaths are from complications of non-communicable diseases-sickle cell disease, diabetes mellitus, cardiac and liver diseases. It is noteworthy in our review that complications related to sickle cell disease which was the fourth most common cause of indirect maternal mortality about twenty years earlier, was now the most common in this study followed by cardiac disease, diabetes mellitus and liver disease. Increased maternal mortality observed in sickle cell mothers could be due to improved survival of girls with sickle cell disease over the years resulting in a relatively high number of women now presenting in pregnancy with complications. There is therefore the need to introduce preconception care to these girls as soon as they attain reproductive age. HIV-related maternal deaths have reduced compared to previous reviews, mainly due to worldwide improvement in the survival of HIV-infected individuals due to increased availability of anti-retroviral treatments.^{7,13}

Our data shows that a high percentage of women died within 24 hours of admission to the hospital, implying that their condition has already become very severe due to one form of delay or the other from the home due to socio-economic or geographical factors, or delay at the referring hospital. Delayed access to appropriate lifesaving emergency obstetric interventions may also have occurred

in our institution. All are the effects of a weak health system, common to most developing countries.

The retrospective nature of our review resulted in a number of missing information about some of the cases, however, the fact still remains that maternal mortality in our institution like others within the country still remains unacceptably high, seven years into the implementation of the UN sustainable development goals. The direct causes of maternal deaths have not changed: hypertensive disorders of pregnancy, haemorrhage, maternal sepsis and complications of unsafe abortion. The Covid-19 pandemic years also recorded a further increase in maternal mortality due to worsened challenges of access to maternal health services. We agree with the opinion of the group on the road map for accelerated reduction of maternal and newborn mortality in Nigeria that ‘the status quo has to change’ through more political commitment to the implementation of strategies and policies already developed, if Nigeria is to make significant progress towards achieving the United Nations SDG target of reducing maternal mortality in 2030.²⁴

CONCLUSION

The major direct causes of maternal mortality in our institution are pre-eclampsia/eclampsia, obstetric haemorrhage, maternal infections and complications of unsafe abortion. There was an increased in maternal mortality observed in our institution during the Covid -19 pandemic.

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REFERENCES

1. UNICEF. Trends in maternal mortality 2000 to 2020, 2023. Available at: <https://data.unicef.org/resources/trends-in-maternalmortality-2000-to2020/> Accessed 21 March 2023.
2. UNICEF. Maternal mortality rates and statistics: maternal mortality, 2023. Available at: <https://data.unicef.org/topic/maternal-health/maternal-mortality/>. Accessed 21 March 2023.
3. UNICEF. Trends in estimates of maternal mortality ratio (MMR), maternal deaths and lifetime risk of maternal death. 2000-2020. Available at: <https://data.unicef.org/topic/maternal-health/maternal-mortality/>. Accessed 23 March 2023.
4. UNICEF. Trends in maternal mortality: 1990-2008. Estimates by WHO, UNICEF, UNFPA, and World Bank, 2023. Available at:

- <https://apps.who.int/iris/bitstream/handle/10665/44423/9789241500265-eng.pdf>. Accessed 29 September 2022.
5. WHO. Trends in maternal mortality 1990-2015. Estimates by WHO, UNICEF, UNFPA, World Bank group and the United Nations Population Division. 2015. Available at: https://apps.who.int/iris/bitstream/handle/10665/193994/WHO_RHR_15.23_eng.pdf. Accessed 21 March 2023.
 6. United Nations. Department of Economic and Social affairs: Sustainable Development. Goal 3, Ensure healthy lives and promote well-being for all at all ages. Available at: <https://sdgs.un.org/goals/goal3>. Accessed 21 March 2023.
 7. Ujah IAO, Aisien OA, Mutihir JT, Vanderjagt DJ, Glew RH, Uguru VE. Factors Contributing to Maternal Mortality in North-Central Nigeria: A Seventeen-year Review. *Afr J Reprod Heal.* 2005;9(3):27-40.
 8. Olamijulo JA, Olorunfemi G, Okunola H. Trends and causes of maternal death at the Lagos University teaching hospital, Lagos, Nigeria (2007-2019). *BMC Preg Childb.* 2022;22(1):360.
 9. Bakari M, Takai IU, Bukar M. Rising trend in maternal mortality at the University of Maiduguri Teaching hospital. *Trop J Obstet Gynaecol.* 2015;32(1):124-31.
 10. Audu BM, Takai UI, Bukar M. Trends in maternal mortality at University of Maiduguri teaching hospital, Maiduguri, Nigeria - A five-year review. *Niger Med J.* 2010(22);51:147-51.
 11. Roser M, Ritchie H. Maternal mortality. *Our World in Data.* 2013. Available at: <https://ourworldindata.org/maternal-mortality>. Accessed 29 March 2023.
 12. Bello FA, Adesina OA, Morhason-Bello IO, Adekunle AO. Maternal mortality audit in a tertiary health institution in Nigeria: lessons from direct causes and its drivers. *Niger J Med.* 2015;24(4):300-6.
 13. Ngwan SD, Swende TZ. Maternal mortality in Jos, Nigeria: A facility based prospective review. *Int J Biol Med Res.* 2011;2(2):565-8.
 14. Samuels E, Ocheke AN. Near miss and maternal mortality at the Jos University Teaching Hospital. *Niger Med J.* 2020;61:6-10.
 15. Nove A, Matthews Z, Neal S, Camacho AV. Maternal mortality in adolescents compared with women of other ages: evidence from 144 countries. *Lancet Glob Heal.* 2014;2:e155-164.
 16. Ujah IAO, Aisien OA, Mutihir JT, Vanderjagt DJ, Glew RH, Uguru VE. Maternal mortality among adolescent women in Jos, North-Central, Nigeria. *J Obstet Gynaecol.* 2005;25(1):3-6.
 17. Nwobodo EI, Panti A. Adolescent Maternal Mortality in North-west Nigeria. *West African J Med.* 2012;31(4):224-6.
 18. Lambonmung A, Acheampong CA, Langkulsen U. The Effects of Pregnancy: A Systematic Review of Adolescent Pregnancy in Ghana, Liberia, and Nigeria. *Int J Environ Res Pub Heal.* 2022;20(1):605.
 19. Bouzaglou A, Aubenas I, Abbou H, Rouanet S, Carbonnel M, Pirtea P, et al. Pregnancy at 40 years old and above: obstetrical, fetal, and neonatal outcomes. Is age an independent risk factor for those complications?. *Front Med.* 2020;7:208.
 20. Jacobs ED, Okeke MI. A critical evaluation of Nigeria's response to the first wave of COVID-19. *Bull Nat Res Cen.* 2022;46(1):44.
 21. Ameyaw EK, Ahinkorah BO, Seidu AA, Njue C. Impact of COVID-19 on maternal healthcare in Africa and the way forward. *Arch Pu Heal.* 2021;79(1):1-5.
 22. Tilton A, Bwala A, Katagum K, Badiora A, Ibrahim AY, Doherty P. The impact of COVID-19 on maternal and neonatal health in three states in Nigeria, 2021. Available at: https://options.co.uk/sites/default/files/the_impact_of_covid19_on_maternal_and_neonatal_health_in_three_states_in_nigeria.pdf. Accessed 29 March 2023.
 23. Idoko P, Anyanwu MO, Bass S. A retrospective analysis of trends in maternal mortality in a Gambian tertiary health centre. *BMC Research Notes.* 2017;10:1-7.
 24. WHO. Accelerated reduction of maternal and newborn mortality in Nigeria: A roadmap for action 2019-2021, 2019. Available at: <https://health.gov.ng/doc/accelerated-reduction.pdf>. Accessed 12 April 2023.

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