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Is Stillbirth Rate Higher among HIV Positive than HIV Negative Mothers?: A 10-year Experience in a Nigerian Tertiary Hospital

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ABSTRACT

Background: It's not clear to what extent public health interventions have reduced stillbirth rate among HIV-negative and HIV-positive mothers over the past decade. **Objectives:** Trend in stillbirth was compared between HIV-negative and HIV-positive mothers who delivered in Nnamdi Azikiwe University Teaching Hospital (NAUTH) between 2011 and 2021. **Materials and Methods:** Retrospective review of records of all 579 mothers who had stillbirth during the period was conducted. Proforma was used to abstract data from delivery register and antenatal cards. Data were analyzed using SPSS version 21. Statistical significance was set at P<0.05. **Results:** The ratio of HIV-negative:HIV-positive mothers was 4.4:1. The HIV-negative and HIV-positive mothers had a comparable median age (30[8] versus 30[7] years, p=0.149), and parity (3[2] versus 3[3], p=0.455). The HIV-negative mothers were predominantly unbooked in NAUTH in contrast to HIV-positive ones (94.3% versus 22.4%; p<0.001). Overall, stillbirth rate was 67/1000 total births (579/8641). This was comparable between HIV-negative and HIV-positive mothers (67/1000 versus 65/1000 total births, p=0.768). Stillbirth declined by 47.8%, 48.7% and 56.8% in the general, HIV-negative and HIV-positive populations, respectively. There was no significant difference between stillbirth trend of the two groups(p=0.295). HIV-negative had non-significantly higher stillbirth rate compared to HIV-positive mothers in all years except 2013, 2015 and 2020. About two-thirds of the stillborn were delivered during call-duty hours and had abnormal birth weight. **Conclusion:** Stillbirth rate is comparable between predominantly booked HIV-positive and predominantly unbooked (possibly high-risk) HIV-negative mothers in NAUTH. Although stillbirth almost halved between 2011 and 2021, the rate remains high in both populations.

Keywords: Fetal death, Intrauterine death, Pregnancy outcomes, South-East Nigeria, Stillbirth trend

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INTRODUCTION

Stillbirth is a major though underreported public health issue. The World Health Organization (WHO) uses the International Classification of Diseases Tenth Edition (ICD-10) definition of late fetal death (at gestational age ≥ 28 completed weeks or birthweight ≥ 1000g or body length ≥ 35cm) as definition of stillbirth.[1-3] The use of only gestational age (GA) criteria has been proposed because it is a better predictor of viability.[4] Stillbirth refers to a baby delivered with no sign of life at 28 completed weeks GA or more.[4,5]

Globally, in 2019, an estimated 2 million babies were delivered stillborn giving a stillbirth rate of 13.9 per 1000 total births.[6] The West and Central African regions have the highest stillbirth rate with 22.8 per 1000 total births delivered stillborn in the region compared to 2.9 per 1000 total births in Western Europe. This reflects the quality of healthcare services provided during pregnancy and childbirth. Stillbirth is associated with enormous, long-lasting, and complex physical, psychosocial, and economic consequences to affected families. This include grief, stigma, blame, marginalization, and anxiety which could result in considerable mental health issues.[7-9] In some African communities, stillbirth is perceived to be caused by evil spirits and regarded as a taboo.[9.10]

Despite the huge burden and negative impact of stillbirths, it has not received the deserved attention in global agenda, policies and programmes.[5,6] This is probably due to underreporting and paucity of data needed for planning interventions. The rate of reduction of stillbirth is considerably slower compared to the rate of reduction of neonatal mortality and other indicators of childhood mortality.[7] Between 2000 and 2019, the global rate of stillbirth reduced by 2.3% while neonatal and under-5 mortality rates reduced by 2.9% and 4.3%, respectively.[6] The least progress in stillbirth reduction was made by sub-Saharan Africa especially by the West and Central Africa.[2] At the current rate, it may take 160 years before a pregnant woman in Africa has the same chance of having a livebirth as a woman in high-income country, and the Every Newborn Action Plan goal of reducing still birth to 12 per 1000 births by 2030 may never be achieved.[12,13] Nigeria is among the ten nations that account for more than two-thirds of stillbirths alongside India, Pakistan, China, Ethiopia, Democratic Republic of the Congo, Bangladesh, Indonesia, Tanzania, and Niger.[4.8] Therefore, urgent interventions are needed to reduce the burden of stillbirths in the country. This require a clear understanding of its trend and risk factors.

Maternal human immunodeficiency virus (HIV) infection has been associated with poorer pregnancy outcomes.[14-19] However, it is not clear to what extent maternal HIV contributes to the heavy burden of stillbirth in Nigeria, a country which accounts for the 2nd largest global burden of in utero exposure to HIV.[20] Currently, lifelong highly active anti-retroviral therapy (HAART) is recommended for all HIV-positive women of childbearing potential in Nigeria.[20] This has achieved tremendous gains in prevention of mother-to-child transmission (PMTCT) of HIV. Despite universal access to HARRT and its gains in PMTCT, reports indicate a higher risk of stillbirth among HIV-positive compared to HIV-negative mothers, especially in developing countries.[21,22]

This study was conducted to compare the incidence and trend of stillbirth among HIV-positive and negative mothers who delivered at NAUTH, Nnewi.

MATERIALS AND METHODS

Study site

The study was conducted in the Labour Ward of Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi. Anambra State, Nigeria. NAUTH is the only federal tertiary institution in

Anambra State. It offers tertiary services to the entire Anambra State and neighboring states in all aspects of healthcare including obstetrics and HIV management. Women who are enrolled into the PMTCT of HIV programme of NAUTH are commenced on lifelong HARRT according to Nigeria National guidelines.[20] HIV services are provided free of charge in the center. Ante-natal clinic for both HIV-infected and uninfected women hold every week day (Mondays to Fridays) while delivery services are provided every day on 24 hours basis. The services are provided by consultants in Obstetrics and Gynaecology (O&G), O&G resident doctors and certified nurse midwives.

Data collection

Details of all women who delivered in NAUTH Nnewi are recorded in a delivery register, which is domiciled in the labour ward of NAUTH, Nnewi. Such details include age, parity, booking status in NAUTH, HIV-status, date and time of delivery, mode of delivery, baby's sex, baby's weight and APGAR score. The data of all women who had a stillbirth between 1st January 2011 and 30th June 2021, were abstracted from the delivery register using a proforma. The ante-natal cards of the women who had stillbirth were also retrieved from the NAUTH Medical Records Department to collect other details such as GA at delivery, educational status, occupation, past obstetrics history, and source of referral for unbooked subjects. All mothers who had a miscarriage rather than stillbirth were excluded. For this study, stillbirth was defined as a baby delivered at GA ≥28 completed weeks with no sign of life at delivery.

Data analysis

Data was analyzed using SPSS version 22. The characteristics of mothers who had stillbirths and their babies were described using frequency tables for categorical variables while median (and interquartile range) was used for continuous variables. The trend in stillbirth was shown using the relative frequency of stillbirth between 2011 and 2021. The percentage change in stillbirth occurrence between 2011 and 2021 was calculated using 2011 as the reference year. Stillbirth rate was defined as the number of stillbirths per 1000 total births. The relationship between categorical variables were examined using Pearson's Chi-square test while Mann-Whitney U test was used to examine the relationship between categorical and continuous variables. The trend of stillbirth between HIV-positive and HIV-negative mothers was compared using the Cochran-Mantel-Haenszel statistic. Significance level was set at 5%.

Ethical Considerations

The study was carried out in accordance with regulations and declaration of Helsinki. Ethical clearance for the study was obtained from NAUTH Ethics Committee with Ethical Clearance Number NAUTH/CS/66/VOL.15/VER.3/055/2022/044. All data were handled confidentially. No name was written on the proforma used for data collection. Rather, a unique identifier was used to represent the participants and a password protected database was used to protect personal information of the study participants. All data is domiciled with the principal investigator, and restricted from other persons.

RESULTS

Overall, 8641 pregnant women delivered in the hospital at GA ≥28 completed weeks during the period under review. Out of this, 8062(93.3%) had livebirths while 579 (6.7%) had stillbirths.

Comparable non-significant rate of stillbirth was observed among HIV-negative and HIV-positive mothers (6.7% [472/7004] versus 6.5% [107/1636], p=0.768). As shown in Table 1, majority of the mothers who had stillbirth delivery were married (90.5%) and were in the age category of 20 to 39 years (92%). About two-thirds completed secondary or tertiary education (64.4%), and were income earners (68.9%). Majority of them did not receive ANC at NAUTH

(81.0%), and were referred from private owned hospital facilities (80.0%). Of the 551 mothers who had documented GA at delivery, 23.4%, 28.3% and 48.3% delivered very premature (28 to < 32 completed weeks), late premature (32 to < 37 completed weeks) and term babies (37 completed weeks), respectively. As displayed in Table 2, the median age and parity of the mothers were 30(8) years and 3(2), respectively. About a quarter (23.5%) of the mothers had delivered a stillborn in the past while 7.1% had previous history of miscarriage. About two-thirds of the stillborn were delivered during call duty hours (63.4%) between 16.00 hours and 8.00 hours the next day, and had abnormal birth weight (64.1%). The median birth weight was 2.2(1.9)kg while rate of delivery by caesarean section was 39.0%.

HIV-negative and HIV-positive mothers did not differ significantly in age category (p=0.093), median age (p=0.149), parity (p= 0.429), median parity (p=0.455), previous history of intra-uterine fetal death (p=0.664) or miscarriage (p=0.510), mode of delivery (p=0.409), and birth weight category (p=0.665) or median birth weight (p=0.374) as shown in Table 2. In contrast, the two groups differed significantly in booking status in NAUTH (p<0.001) and time of delivery (p=0.028). A higher proportion of HIV-positive compared to HIV-negative mothers significantly received ANC in NAUTH Nnewi (77.6% versus 5.7%, respectively; p<0.001), and delivered during regular working hours of 08.00 to 16.00 (46.7% versus 33.1%, respectively; p=0.028).

As displayed in Figure 1, the overall stillbirth rate declined by 47.8% between 2011 and 2021. However, the decline was interjected by spikes at various points. Over the ten year period, the average decline rate was 4.8% per year.

As shown in Figure 2, the stillbirth rate dropped in 2012 in both HIV positive and negative populations. However, this was not sustained as the rates subsequently increased, peaking in 2014 and 2015 for HIV negative and positive mothers, respectively. This was followed by an unsteady decline to the lowest rate in 2019 for HIV-positive and 2020 for HIV-negative populations. Year 2021 witnessed a rise in stillbirth compared to rates in 2020. Overall, the rates of stillbirth was approximately halved between 2011 and 2021 in the general, HIV-negative and HIV-positive populations. Apart from 2013, 2015 and 2020, stillbirth rates were consistently higher among HIV-negative compared to HIV positive population in all the years but this was not statistically significant in any year. There was no statistically significant difference in the trend of stillbirth among HIV-negative and HIV-positive mothers over the years (p=0.295). Among the HIV-negative and HIV-positive populations, the percentage decline in stillbirth was 48.7% and 56.8%, respectively, between 2011 and 2021.

The factors significantly associated with having a stillbirth were period of delivery (p< 0.001), parity (p=0.032) and not receiving ANC in NAUTH (p<0.001) as shown in Table 3.

Table 1: Characteristics of 579 mothers who had stillbirth delivery in NAUTH between 2011 2021

Characteristics	Frequency	Percent
<20	15	2.6
20-29	237	40.9
30-39	296	51.1
>39	31	5.4
Mother's highest educational level		
No formal or Primary education		
Secondary education	182	31.4
Tertiary education		
Missing data	294	50.8
Mother's occupation	79	13.6
Student/apprentice/unemployed	161	27.8
Artisan	84	14.5
Trader	230	39.7
Public servant	64	11.1
Professional	21	3.6
Missing data	19	3.3
Mother's marital Status		
Married	524	90.5
Single	37	6.4
Missing data	18	3.1
Was ANC received in NAUTH?		
Yes	110	19.0
No	469	81.0
Source of referral (n=469)		
Maternity home	118	25.2
PHC	39	8.3
Private hospital	257	54.8
Public secondary level facility	38	8.1
Missing data	17	3.6
GA at delivery		
28 to < 32 completed weeks	129	22.3
32 to < 37 completed weeks	156	27.0
≥ 37 completed weeks	266	45.9
Missing data	28	4.8

ANC=Antenatal care, GA=gestational age

Table 2: Comparison of characteristics of HIV-Positive and HIV-Negative mothers who had stillbirth delivery in NAUTH between 2010-2021

Maternal Characteristics	HIV-Negative frequency (%)	HIV-Positive frequency (%)	Total frequency (%)	P-value
Age (years)				
<20	13(2.8)	2(1.9)	15 (2.6)	0.093
20-29	201(42.6)	36(33.6)	237(40.9)	
30-39	230(48.7)	66(61.7)	296(51.1)	
>39	28(5.9)	3(2.8)	31(5.4)	
Median age (IQR)	30.0(8)	30.0(7)	30.0(8)	0.149
Parity				
P1	108(22.9)	28(26.2)	136(23.5)	0.429
P2-P4	275(58.3)	55(51.4)	330(57.0)	
≥P5	89(18.9)	113(22.4)	113(19.5)	
Median parity (IQR)	3(2)	3(3)	3(2)	0.455
Number of previous IUFD				
0	364(77.1)	79(73.8)	443(76.5)	
1	79(16.7)	17(15.9)	96(16.6)	0.664
2	20(4.2)	8(7.5)	28(4.8)	
3	6(1.3)	2(1.9)	8(1.4)	
4	3(0.6)	1(0.9)	4(0.7)	
Number of previous miscarriages				
0	438(92.8)	100(93.5)	538(92.9)	0.510
1	23(4.9)	3(2.8)	26(4.5)	
2	8(1.7)	2(1.9)	10(1.7)	
≥3	3(0.6)	2(1.9)	5(0.9)	
Was ANC received in NAUTH?				
Yes	27(5.7)	83(77.6)	110(19.0)	<0.001*
No	455(94.3)	27(22.4)	469(81.0)	
Time of delivery				
0.0 to 7.59.hours	120(25.4)	21(19.6)	141(24.4)	0.028*
8.00 to 15.59 hour	156(33.1)	60(46.7)	206(35.6)	
16.00 to 23.99	196(41.5)	36(33.6)	232(40.1)	
Mode of delivery				
Vaginal delivery	284(60.2)	69(64.5)	353(61.0)	0.409
Caesarean section	188(39.8)	38(35.5)	226(39.0)	
Baby's birth weight category (gramme)				
<1000	73(15.5)	15(14.0)	88(15.2)	
1000-1499	72(15.3)	15(14.0)	87(15.0)	0.665
1500-2499	134(28.4)	25(23.4)	159(27.5)	
2500-<3999	163(34.5)	45(42.1)	208(35.9)	
≥4000	30(6.4)	7(6.5)	37(6.4)	
Median weight(IQR)	2.1(1.9)	2.4(2.0)	2.2(1.9)	0.374
Total (%)	**472 (81.5)**	**107(18.5)**	**579(100.0**	

*Statistically significant, ANC=antenatal care, IUFD=intrauterine fetal death, ANC=Antenatal care

Table 3: Trend in relative frequency of stillbirth among HIV-positive and HIV-negative mothers who delivered in NAUTH between 2011 and 2021

Year of delivery	Still birth		Total	p-value
	No (n=8062)	Yes (n-579)		
2011 (n=721)				
HIV -Negative	457(90.0)	51(10.0)	508 (70.5)	
HIV -Positive	194(91.1)	19(8.9)	213 (29.5)	0.643
2012 (n=1073)				
HIV -Negative	765(92.8)	59(7.2)	824 (76.8)	
HIV -Positive	234(94.0)	15(6.0)	249 (23.2)	0.535
2013 (n=1148)				
HIV -Negative	816(92.5)	66(7.5)	882 (76.8)	
HIV -Positive	245(92.1)	21(7.9)	266 (23.2)	0.824
2014 (n=778)				
HIV -Negative	537(91.3)	51(8. 7)	588 (75.6)	
HIV -Positive	177(93.2)	13(6.8)	190 (24.4)	0.424
2015 (n=780)				
HIV -Negative	598(92.7)	47(7.3)	645 (82.7)	
HIV Positive	121(89.6)	14(10.4)	135 (11.3)	0.225
2016 (n=772)				
HIV -Negative	590(93.1)	44(6.9)	634 (82.1)	
HIV -Positive	130(94.2)	8(5.8)	138 (11.9)	0.627
2017 (n=882)				
HIV -Negative	679(92.1)	58(7.9)	737 (83.6)	
HIV Positive	137(94.5)	8(5.5)	145 (16.4)	0.325
2018 (n=700)				
HIV -Negative	574(95.7)	26(4.3)	600 (85.7)	
HIV Positive	96(96.0)	4(4.0)	100 (14.3)	0.879
2019 (805)				
HIV -Negative	660(93. 8)	44(6.2)	704 (87.5)	
HIV Positive	99(98.0)	2(2.0)	101 (12,5)	0.084
2020 (n=665)				
HIV -Negative	580(98.1)	11(1.9)	591 (88.9)	
HIV -Positive	72(97.3)	2(2.7)	74 (11.1)	0.622
2021 (n=317)				
HIV -Negative	276(94.8)	15(5.2)	291 (91.8)	
HIV -Positive	25(96.2)	1(3.8)	26 (8.2)	0.770
Total HIV -Negative	6532(93.3)	472(6.7)	7004 (81.1)	
Total HIV -Positive	1530(93.5)	107(6.5)	1637 (18.9)	0.768
Total	**8062 (93.3**	**579 (6.7)**	**8641 (100.0)**	**8641(100.0)**

Table 4: Factors associated with stillbirth among mothers who delivered in NAUTH between 2011-2021

Characteristics	Total	Stillbirth Frequency	Percent	P-value
Maternal HIV Status				
Positive	1637	107	6.5	
Negative	7004	472	6.7	0.772
Sex of stillborn				
Female	4242	283	6.7	0.917
Male	4399	296	6.7	
Period of delivery				
2011-2012	1794	144	8.0	
2013-2014	1926	151	7.8	<0.001*
2015-2016	1552	113	7.3	
2017-2018	1582	96	6.1	
2019 2021	1787	75	4.2	
Maternal age				
<20	238	15	6.3	
20-35	6675	457	6.8	0.604
>35	1728	107	6.2	
Maternal Parity				
P1	1935	136	7.0	
P2-4	5315	330	6.2	0.032*
≥P5	1391	113	8.1	
Mother's booking status				
Booked in NAUTH	5936	110	1.9	<0.001*
Unbooked in NAUTH	2705	469	17.3	
Mode of delivery				
Vaginal delivery	4952	331	6.7	
Caesarean section	3337	226	6.8	0.930
Breech extraction	352	22	6.3	
Total	**8641**	**579**	**6.7**	

DISCUSSION

The findings of this study demonstrated that stillbirth rate is high among both HIV-positive and HIV-negative mothers who delivered in a tertiary referral center located in southeastern Nigeria. This is consistent with previous reports, and reflects the hidden disaster of stillbirth in our environment.[4, 24-28] The overall stillbirth incidence of 57 and 51 per 1000 total births in 2019 and 2020, respectively, were more than twice the 22/1000 total births estimated for Nigeria in 2019 and 22.8/1000 total births estimated for West Africa.[6,29] However, the finding of this study is consistent with 62/1000 total births reported by a similar Lagos University Teaching Hospital (LUTH) study and reports from other teaching hospitals in Nigeria.[25-28] This is not surprising since women with high-risk pregnancies constitute a significant proportion of mothers who deliver in Nigerian tertiary hospitals.[30]

A substantial proportion (four-fifth) of the mothers, especially the HIV-negative ones, did not attend any ante-natal clinic visit in NAUTH. This implies that most of the mothers were referred to the facility solely for delivery, with the possibility of arriving after the fetuses have been compromised as previously reported.[24-28,31] The occurrence of stillbirth in Nigeria has been linked to three-stage delay model similar to the pattern proposed for maternal mortality.[24,31] This includes delay in recognition of danger signs,

delay in accessing care due to socioeconomic or transportation barriers, and delay in receiving high quality emergency obstetrics care. Currently, Nigeria accounts for a substantial proportion of stillbirths globally. It has the highest burden of stillbirth in Africa and 2nd highest in the world.[4] Therefore, it is pertinent to adopt innovative approaches that will curb this hidden tragedy. Such strategies may include building the capacity of health workers to recognize at risk pregnant mothers, and advocacy for prompt referral to sites which offer specialized obstetrics care. The finding that most of the mothers were referred from privately owned hospital or maternity homes suggests the need for inclusion of private hospitals and traditional birth attendants when designing such interventions.

Contrary to our expectations, this study did not find a significant difference in the rates of stillbirth between HIV-positive and HIV-negative mothers. A substantial proportion (77.6%) of the HIV-positive mothers were booked in NAUTH and were most likely on highly active anti-retroviral therapy (HAART) which should reduce the risk of poor fetal outcomes. In addition, the mothers benefitted from specialized obstetrics care as a fallout of enrolment into NAUTH prevention of mother-to-child transmission (PMTCT) of HIV programme. Despite these interventions, they still had a comparable stillbirth rate with HIV-negative mothers who were predominantly unbooked (94.3%) in NAUTH, probably high-risk obstetrics cases and at high risk of stillbirth delivery due to delays in presentation. This implies HIV-infected mothers are at high risk of having stillbirth deliveries. The inability of maternal HAART to completely eliminate the risk of HIV related adverse pregnancy outcomes despite tremendous gains in PMTCT has been reported by previous researchers.[16,32] Therefore, both groups of mothers in this study may have similar risk of stillbirth delivery. To understand the effect of maternal HIV infection on stillbirth, further studies comparing virally suppressed HIV-positive mothers on HAART and apparently healthy HIV-negative mothers are needed.

The decline rate of 47.8% over the ten year period and the annual reduction rate of 4.8% are higher than 24.1% and 1.1%, respectively, reported for West Africa.[4] The findings suggest that public health interventions targeted at improving pregnancy outcomes are yielding positive impact.[33,34] Since NAUTH is a major tertiary hospital where high risk obstetrics cases in Anambra and parts of neighboring states are referred to, the trend in the facility is believed to reflect the trend in the community. However, more aggressive efforts are still needed to achieve global stillbirth targets.

The lower rate of stillbirth among HIV-positive compared to HIV-negative mothers, as from 2016, could be explained by the adoption of "test and treat" approach in 2016, which ensured that all HIV-positive individuals (including women of childbearing potential) are initiated on lifelong anti-retroviral therapy within two weeks of diagnosis, regardless of their WHO clinical stage and CD4+ cell count.[35] This may improve their well-being and lower the risk of adverse pregnancy outcomes. Our finding implies that this approach is very beneficial, and should be fully implemented and sustained.

Although a dip in stillbirth was experienced in 2020 in both HIV-positive and negative populations, this may not translate to a real dip as that particular year witnessed the peak of Covid-19 lockdown, with limited access to health facilities. This may explain the subsequent rise in the following year after the lockdown eased off. This finding is corroborated by a previous report which showed a drop in cesarean section and delivery rate in NAUTH and other tertiary hospitals in South-East Nigeria during the first wave of Covid-19 pandemic.[36] Aggressive efforts are still needed in reducing stillbirth if the Every Newborn Action Plan goal of 12 per 1000 births by 2030 will be attained.

The timing of stillbirth delivery implies service delivery gaps during certain periods of the day. Approximately two-third of the stillbirths were

delivered during the call-duty hours when full complement of staff is not guaranteed. This suggests the need to adopt approaches that will bridge the gap in the delivery of sustained high quality emergency obstetric care during this period.

The characteristics of the stillbirths and the factors associated with stillbirth delivery highlights the red-flags that should be actively screened for in every pregnant mother who presents in labour. This includes abnormal fetal weights (either low birth weight or fetal macrosomia), primiparity or grandmultiparity and previous intrauterine fetal death. The relationship between low birth weight and stillbirth is well established.[4,6,22,23] Other common causes of stillbirth in sub-Saharan Africa include modifiable factors such as maternal infections, non-communicable diseases such as obesity, hypertension and diabetes mellitus, and post-term pregnancy.[4,6] Mothers identified to have such risks should be promptly referred for specialized obstetrics care and closely monitored. This may forestall late presentation at referral centers after onset of labour when fetal wellbeing might have been compromised. In addition, active monitoring of labour should be promoted at lower levels of care to enable prompt identification of danger signs that will warrant referral for specialized emergency obstetrics care.

CONCLUSION

Stillbirth delivery rate is still high and comparable between predominantly unbooked HIV-negative and predominantly booked HIV-positive who deliver in NAUTH Nnewi. However, stillbirth rate has been approximately halved between 2011 and 2021 in both populations, with overall average annual reduction rate of 4.8%. A considerable proportion of the stillborns either had low birth weight or macrosomic, and were delivered during call duty hours. Factors significantly associated with stillbirth were period of delivery, grandmultiparity and being unbooked in NAUTH. Efforts should be intensified at prompt identification and referral of "at risk" mothers preferably during pregnancy or soon after onset of labour. In referral centers, proactive emergency obstetrics interventions should be adopted to forestall stillbirth delivery especially during call duty hours.

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Author Contributions

CUO and EFU conceptualized and designed the study. CUO, CCO, UOO, CFO and ITO collected data. CUO analyzed the data. CUO and EFU interpreted the data analysis. CUO drafted initial prepared initial draft of the manuscript. CUO, EFU, CCO, UOO, CFO and ITO were involved in critical revision of the manuscript. All the authors read and approved the final manuscript, and agree to be accountable for all aspects of the work.

Data availability

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

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Conflict of Interest

The authors declare no conflicting interest that may be perceived to influence the findings reported in this article.

Ethical Approval

Approval for this study (NAUTH/CS/66/VOL. 15/VER.3/055/2022/044) was obtained from the Research and Ethics Committee (REC) of Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi. The study were carried out in accordance with relevant guidelines and

regulations/declaration of Helsinki. All data obtained during the study handled confidentially.

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