Original Research Article

A TEN-YEAR REVIEW OF NEONATAL TETANUS SEEN IN A TERTIARY HEALTH FACILITY IN SOKOTO NORTH-WESTERN NIGERIA: BEFORE AND DURING THE COVID 19 PANDEMIC

ABSTRACT

Background: Neonatal tetanus (NNT) remains among the leading causes of preventable morbidity and mortality among neonates in Nigeria. Nigeria remains among the countries carrying the global NNT burden. At the onset of the COVID 19 pandemic, reports have predicted that the pandemic will significantly impact on the health systems globally, and low-resource countries where vaccination programs fared even worse are likely to see a surge in vaccine-preventable diseases during and in the post COVID 19 pandemic.

Aims: To determine the prevalence, yearly trend, risk factors, and outcome of NNT cases seen in the Special Care Baby Unit (SCBU) of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto, Nigeria over a ten year period: before and during COVID 19 pandemic.

Methods: This was a retrospective study. Data was retrieved from all the case notes of neonates admitted with clinical diagnosis of NNT into the SCBU of the UDUTH, Sokoto from 1st January, 2013 to 31st December, 2022. Data obtained was analyzed using SPSS version 21.

Results: During the 10 years period of the study, NNT accounted for 0.4% of admissions, mMajority 15(57.0%) of the mothers of the neonates with NNT were from the rural areas, 15(56.0%) had no antenatal care (ANC) and only 10(37.0%) of the mothers received vaccination against tetanus. All the mothers were from the lower socio-economic class. Most 17(63.0%) of the neonates were delivered at home by traditional birth attendants. The umbilical cord was the portal of entry in 26(96.0%) of cases, while 1(4.0%) followed traditional uvulectomy. Cord care was with hot water fermentation in more than half of the neonates 17(63.0%), while only 1(4.0%) of the mothers used chlorhexidine gel for cord care. The case- fatality rate was 6(22.0%). Ythe yearly trend showed increased incidence of NNT admissions in the year 2022.

Conclusion: The study showed that NNT is still a public health problem in the study with an increased scourge during the COVID 19 pandemic, which can be tackled through health education of mothers via mass media, improving the quality and access to ANC services, tetanus toxoid vaccination, hospital delivery and avoidance of traditional uvulectomy particularly in rural areas by the Sokoto state government. Antenatal and vaccination services should be given priority in response to future pandemics to sustain gains of the SDG 3.

Keywords: Neonatal tetanus, Sokoto, North-Western, Nigeria, COVID 19, pandemic

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1. INTRODUCTION

Neonatal tetanus (NNT) is a vaccine-preventable disease which occurs mainly as a result of unhygienic delivery practices and harmful traditional cord care practices which include cutting the cord with un-sterile equipment and application of substances such as animal dung to the cord, hot compresses and usage of unsterile razor blades [1]. The disease can also follow traditional practices like traditional uvulectomy, scarification marks and other surgical traditional procedures ~~in~~ carried out on newborns of mothers ~~that~~ who are unimmunized or are ~~poorly~~ insufficiently immunized against tetanus [2]. For most cases of neonatal tetanus, the portal of entry is the umbilical stump, ear piercing and infected circumcision sites [1]. Neonatal tetanus is a toxin-mediated disease which usually presents with inability to suck, in a newborn ~~that~~ who has been sucking before, excessive crying or irritability, with or without fever, generalized body stiffness and painful muscle spasms [1]. Neonatal Tetanus (NNT) has been reported to have been virtually eliminated from developed countries, ~~but~~ however, it continues to be a leading cause of neonatal mortality in developing countries [3]. Even with treatment, the case fatality rate can be as high as 80–90% [4]. In some developing countries the case fatality of NNT can be up to 100% due to lack of intensive care facilities [1]. In 2015, there ~~were~~ was an estimated 56,000 tetanus-related deaths worldwide and about 35% of tetanus-related deaths occurred in newborns [5].

The incidence of NNT in Nigeria ranges from 14.6 to 20.0 per 1000 live births [6] and ~~–~~NNT accounts for about 20% of neonatal deaths[1]. It is estimated that although fewer than 5% of neonatal tetanus cases are actually reported in many developing countries, the extent of burden cannot be estimated since most of the neonates are delivered at home ~~and~~ where there is no appropriate system of surveillance through which both the birth and death can be reported[7]. It is for this reason that ~~the~~ deaths are possibly greater than the numbers indicate ~~–~~[8]. The year 2005 was set for the worldwide elimination of the disease by UNICEF, WHO and the United Nations Population Fund, which was subsequently changed to 2015[4]. However, this~~e~~ target was not achieved [4]. The World Health Assembly launched the earlier initiative to eliminate neonatal ~~–~~tetanus to include maternal and neonatal tetanus elimination in 1999 with newly set target for the year~~of~~ 2020 for the 59 high risk countries after missing the initial target dates of 2005 and 2015 [9]. As of December, 2020, 12(20%) of the 59 high-risk countries are yet to achieve MNTE . These include~~are~~ Afghanistan, Angola, Central African Republic, Guinea, Mali, Nigeria, Pakistan, Papua New Guinea, Somalia, South Sudan, Sudan, and Yemen[10]. ~~The~~ Maternal & neonatal tetanus remain a considerable challenge in the ~~12 countries~~countries yet to achieve this elimination goal in 2020 ~~and where maternal and neonatal tetanus remains a big challenge were mainly~~ primarily due to wars, conflicts, and politically vulnerable environments [7].

Nigeria remains among the countries carrying the global NNT burden, with global elimination of NNT ~~is~~ defined as the reduction of cases to less than 1/1000 live births in every district each year [4]. In many developing countries like Nigeria, maternal and neonatal tetanus persist as a public-health problem and the burden is a health equity issue affecting those who are the most disadvantaged such as the~~,~~ poor, and those without access to adequate health services [9]. Lack of antenatal care (ANC) (two or more ANC services provided by trained health professionals) and poor maternal tetanus toxoid (TT) immunization (two or more TT vaccines administration

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during pregnancy) coverage have been identified as significant underlying causes of high incidence of NNT in Nigeria [11]. The national average for ANC attendance was 58% with wide regional variations (northwest 31%, southeast 87% and southwest 87.1%) [2]. Likewise, the national maternal TT vaccination coverage was 45% with wide regional variations (northwest 20%, southeast 81.3%) [2]. Other factors responsible for the high incidence of NNT in Nigeria include cultural barriers preventing mothers from attending ANC services, inability to access quality ANCs, religious beliefs preference for home deliveries in the rural areas and lack of trained TBA [11]. The 2018 NDHS indicated that only 39% of births in Nigeria were delivered in a health facility while 59% are delivered at home and only 43% of deliveries are attended by a skilled birth attendant [12].

A case of neonatal tetanus has also been described as a triple failure of the public health system, failure of the routine immunization programme, antenatal care, and ensuring clean and safe delivery practices as well as clean cord care practices [1]. According to the WHO hygienic delivery and cord care practices may be summarized as "six cleans" these include: clean hands, clean perineum, clean delivery surface; clean cord cutting, clean cord tying and clean cord care [1]. Thus, it is therefore paramount to promote clean deliveries and cord care practices in developing countries so as to achieve NNT elimination by the year 2030 as projected [1]. These constitute~~s~~ a huge reason as to why the fourth goal of the Millennium Development Goals was not ~~met~~ achieved [13] and further poses ~~posing~~ a challenge in achieving the Sustainable Development Goals 3 in Nigeria [1].

At the onset of the COVID 19 pandemic, reports have predicted that the pandemic will significantly impact on the health system globally, affecting access, availability and quality of health care services particularly for mothers and newborns [14]. And it is likely that low-resource countries where vaccination programs fared even worse are likely to see a surge in vaccine-preventable diseases in the times to come post Covid 19 pandemic [15]. The first confirmed case of Covid-19 in Nigeria was on 27 February 2020. Nigeria experienced its first wave of COVID-19 infection between February 2020 and October 2020, ~~and the~~preceding the second wave from November 2020 to April 2021. Nigeria has successfully curtailed the spread and impact of COVID-19 infection through active response and surveillance, however, maternal and child health services were severely affected by some of the same ~~-~~measures for controlling the spread of the virus such ~~-~~as lockdown, which was also ~~this is~~ largely related to access to services and fear of contracting COVID 19 in outpatient departments by the patients [16]. This study aimed to determine the prevalence, yearly trend, risk factors, outcome and factors associated with NNT mortality at Special Care Baby Unit (SCBU) of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto over a ten-~~-~~year period before and during the COVID-19 Pandemic.

2. MATERIAL AND METHODS

This was a retrospective cross-sectional hospital-based study, carried out between 1st January 2013 to 31st December 2022 at UDUTH, Sokoto. Usmanu Danfodiyo University Teaching Hospital, Sokoto is a tertiary public health facility providing health care to citizens of Sokoto State and also serves as a referral center to public and private hospitals within the state and adjoining states like Kebbi state, Zamfara and

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neigbouring countriesy like Niger. The folders of all the neonatal tetanus cases admitted into the SCBU of UDUTH, Sokoto during the study period under review, were retrieved. Extracted iInformation of the patients extracted included: gGender, age at presentation to the hospital, date of admission, total duration of hospital stay, place of residence, place of delivery, probable portal of entry, presenting complaints, period of onset, maternal tetanus toxoid vaccination status, antenatal clinic visit, examination findings, diagnosis, associated complications , duration of admission, outcome, home treatment offered, mothers' occupation and the mothers' highest level of education were obtained from the admission register and case files. Socio-Economic Class (SEC) of the mothers was assessed using Oyedeji Socio-economic classification Scheme [17]. Appropriate cord care was defined as the use of chlorhexidine gel. The period of onset was defined as the interval in days between inability to suck breast and occurrence of spasms. Diagnosis of tetanus was made clinically according to the WHO diagnostic criteria [18]. All the cases of NNT were admitted into the quiet section of the SCBU to reduce external stimuli that can provoke spasms and also received intravenous anti-tetanus serum within the first 24 to 48 hours of admission and along with intravenous metronidazole as the antibiotic of choice. Spasms are controlled with a combination of phenobarbitone, diazepam and chlorpromazine which were given via intravenous route initially but were later changed to oral medications via a nasogastric tube. The neonates were fed with expressed breast milk via a nasogastric tube. Sepsis worked up was done for all the babies and those with neonatal sepsis had were administered relevant antibiotics. Data was analysed using the IBM SPSS version 21. Pearson's Chi-square was used to test for association and where necessary, Fisher's exact testss was were used.

3.RESULTS

3.1 Demographic and Clinical Characteristics of Patients with Neonatal Tetanus

There were 27 cases of NNT out of the total 6750 neonates admitted into the SCBU over the ten years period of the study, accounting for a prevalence of 0.4%. Of the affected, tThere were 17 males and 10 females, giving a male: female ratio of 1:0.6. Majority 17(63.0%) of the neonates were delivered at home by a traditional birth attendants (Table 1).

Table 1: Demographic and clinical characteristics of patients with Neonatal Tetanus

Variable	Frequency	Percentage (%)
Gender		
Male	17	63.0
Female	10	37.0
Age at presentation (days)		
<3	3	11.0
4-7	17	63.0
>7	7	26.0
Mean age		
Place of delivery		

Hospital	10	37.0
Home	17	63.0

3.2 Yearly trend of cases with Neonatal Tetanus

There was a sharp rise in the number of NNT cases seen in the year 2022 (Figure 1**).**

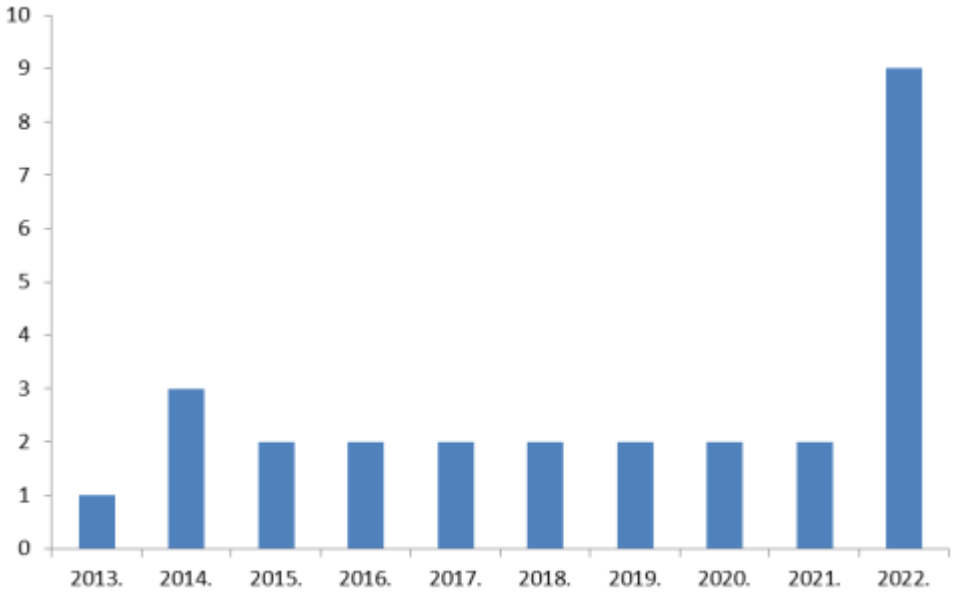

Figure 1: A bar chart showing the yearly trend of NNT admissions

3.3 Maternal socio-demographic characteristics

Majority 15(56.0%) of the mothers of ~~the~~ neonates with NNT were from the rural areas of Sokoto, and only 12(44.0%) had antenatal care. Most 17(63.0%) of the mothers had taken no vaccination against tetanus (Table 2).

Table 2: Maternal socio-demographic characteristics

Variable	**Frequency**	**Percentage (%)**
Maternal age (years)		
20-<25	**4**	**14.8**
25-<30	**6**	**22.0**
30 and above	**17**	**63.0**

Mean age of the mothers	**29**±2.7	
Maternal ANC attendance		
Yes	12	44.0
No	15	56.0
Place of residence		
Urban	12	44.0
Rural	15	56.0
Maternal TT Vaccination status		
Completed	0	0.0
Uncompleted	10	37.0
None	17	63.0
Mother's SEC		
Upper	0	0.0
Middle	0	0.0
Lower	27	100.0

3.4 **Items used for cord care**

Umbilical cord care was by hot fomentation in 17(63.0%) of the neonates, while only 1(4.0%) used chlorhexidine gel (Table 3).

Table 3: Items used for cord care

Item used for cord care	Frequency	Percentage (%)
Hot Fermentation	17	63.0
Herbal medication	5	19.0
Tooth paste	2	7.0
Methylated spirit	2	7.0
Chlorhexidine gel	1	4.0

3.5 Portal of entry, period of onset and Incubation period for Neonatal Tetanus
The major probable portal of entry in most 26(96.0%) of the cases of NNT was the umbilical stump, while 1(4.0%) followed traditional uvulectomy. The period of onset was within 4-7 days of life in majority 25(92.6%) of the patients (Table 4).

Table 4: Portal of entry, period of onset and Incubation period for NNT

Variable	Frequency	Percentage (%)
Portal of entry		
Umbilical Stump	26	96.0
Traditional Uvulectomy	1	4.0
Period of onset (days)		
<3	2	7.4
4-7	25	92.6
Incubation period (days)		
1-3	3	4.0
4-6	19	70.0

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7-14	7	26.0

3.6 Clinical presentation and complications

All the affected ~~babies~~ neonates presented with inability to suck and generalised spasms, while more than half of the patients had fever and difficulty in breathing at presentation. About 52.0% of the neonates had hypoglycaemia, while 22.0% had anaemia as a complication. Sepsis was identified as a co-morbidity in 23(85.0%) of the neonates.

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Table 5: Clinical presentation and complications

Variable	Frequency	Percentage (%)
Clinical Presentation		
Inability to suck	27	100.0
Spasms	27	100.0
Apnoea	5	19.0
Fever	23	85.2
Difficulty in breathing	17	63.0
Complications		
Hypoglycemia	14	52.0
Anaemia	6	22.0
Pneumonia	6	22.0

3.7 Duration of hospital stay and outcome of Neonatal Tetanus

The duration of hospital stay ranged between 1-14 days. Majority 20(74.0%) of the neonates were discharged, while 1(4.0%) Signed Against Medical Advice, ~~while~~ and 6(22.0%) died (Table 6).

Table 6: Duration of hospital stay and outcome of NNT

Variable	Frequency	Percentage (%)
Duration of admission (days)		
1-7	2	7.0
8-14	8	30.0
>14	17	63.0
Outcome		
Discharge	20	74.0
SAMA	1	4.0
Died	6	22.0

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3.8 Factors associated with Neonatal Tetanus mortality

There was no significantly association observed between the age of the mother, period of onset and age at presentation respectively (p=> 0.05).

Table 7: Factors associated with NNT mortality

Variable	Outcome		Test statistics	*P* value
	Survived	Died		

Age at presentation (days)				
<7 days	15(75.0%)	5(25.0%)	Fisher's exact	0.29
≥7 days	4(57.0%)	3(43.0%)		
Gender of the neonates				
Male	13(76.5%)	4(23.5%)	Fisher's exact	1.0
Female	8(80.0%)	2(20.0%)		
Period of Onset (days)				
<3	5(25.0%)	15(75.0%)	Fisher's exact	1.0
>3	1(14.0%)	6(86.0%)		
Maternal age (years)				
20-29	8(80.0%)	2(20.0%)	Fisher's exact	0.6
30-39	13(76.0%)	4(23.0%)		

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4.DISCUSSION

The prevalence of neonatal tetanus of 0.4% observed in this study is lower than 4.7% reported by Alhaji et al [19] in University of Maiduguri over a 2 year period 2009 to 2010, and also lower than 0.7% reported in 2011 by Onalo et al [20] in Zaria, but however, a lower prevalence of 1% and 0.34% when compared to the finding of this study were reported in 2015 by Mbarie *et al* [21] in Benin City and Ogundare *et al* [1] in Ekiti in the year 2011 to 2020 respectively. The high prevalence of NNT observed in our study is not surprising as there was low maternal tetanus toxoid vaccination, majority (63%) of the mothers had no TT vaccination and this may be as a result of low ANC attendance also observed among the mothers. Protection of neonates against tetanus depends on passive transfer of maternal antibody from vaccinated mothers [22]. The reason for this wide variation in the prevalence may probably be due to the differences in the timing and duration at which the various studies were conducted and the time interval between the previous studies and ~~this~~ the present study~~current one~~. Several other studies reported continuous scourge of NNT in hospital-based surveys [2, 6].

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All the parents of the patients with neonatal tetanus are of low socio-economic status, similar findings were also reported by other researchers [1, 6, 19] which has been shown to be a factor associated with increased risk of neonatal tetanus. Mothers educated beyond the primary school level were more likely to understand the importance of antenatal care and to receive tetanus toxoid vaccination; mothers that had antenatal care are more likely to deliver in a medical establishment [23].

The male preponderance in the cases of NNT seen in our study is in tandem with the findings of previous studies[1,19]. Although there is no definitive explanation for the gender difference in the prevalence of NNT, it may however be due to male-child preference by some cultures and traditional expectations of men as bread winners for families, are some of the reasons for the extra-care given to a male child

and make parents to seek –medical attention promptly for the male child [24],[24] while another study speculated that due to the extremely scarce resources in developing countries, male neonates are preferentially taken to government hospitals, while the females neonate with NNT are treated at home by traditional healers and thus, such cases are unreported [25].

The lack of TT vaccination observed among 63.0% mothers of the neonates with NNT in this study is consistent with the findings of previous studies [2,6,19]. Antenatal clinic attendance (ANC) ~~also~~ in this study was also very low.~~,~~ More than half (56%) of the mothers had no ANC;~~,~~ this falls below the national average of 57% ~~this also~~ corroborating~~es~~ the findings of previous studies [1, 2, 6, 19]. The lack of ANC attendance may also result in lack of tetanus toxoid vaccination during pregnancy as seen in this study. Antenatal clinic attendance is also an opportunity for mothers to get appropriate information on the importance of supervised delivery and appropriate method of cord care [25]. Majority (63.0%) of the babies in the present study were delivered at home, ~~this~~ which commemorates the findings of earlier studies done in Nigeria [1, 2, 19] and a report from the 2018 Nigeria Demographic Health Survey[12], which ~~put~~ placed ~~the~~ neonates at risk of unapproved and unhygienic traditional practices during and after delivery.

The sharp rise in NNT cases seen in the year 2022 could be due to the COVID 19 pandemic, disruption of essential health care services including maternal, newborn and immunization services ~~were~~ being reported in many countries including Nigeria [10]. At least two doses of tetanus toxoid containing vaccine (TTCV) supplementary immunization were postponed in 2020 to the second ~~-~~half of 2021 [10]. The COVID-19 pandemic has also resulted in more home deliveries and diversion of resources to halt the pandemic, thereby causing a setback to the MNTE strategies [15]. Reports from Pakistan~~-~~ by Iqbal et al [26] ~~-~~and Missaghi et al [27] showed increased cases of NNT during the COVID 19 pandemic which was probably due ~~this was due~~to women not attending ANC to get the TT vaccine and were delivering their babies at home, consequently leading to increasing cases of NNT. Apart from the COVID 19 pandemic that has disrupted the health care services leading to the increased cases of NNT, upsurge of NNT has been reported ~~by~~ in many studies [6, 28] before the COVID 19 pandemic largely due to home deliveries~~y~~, lack of maternal TT vaccination and unhygienic cord care practices.

The main portal of entry for the organism was the umbilical cord as a result of unhygienic umbilical cord care practices. This finding is similar to previous findings [1, 2, 19]. Only few (4.0%) of the mothers of the ~~-~~patients in this study reported to have used only Chlorhexidine gel for the care of their baby's umbilical cord while majority had used harmful and unhygienic substances for cord care. This finding is in keeping with ~~the~~ findings of previous studies [1, 6, 19]. All the neonates in this study had short incubation period and short period of onset as majority of the neonates presented within the first week of life [1, 6, 19]. The prognosis of neonatal tetanus is strongly influenced by both the incubation and period of onset. Short incubation and period of onset correlates with increased disease severity and higher mortality [19]. More than half of the babies had features of sepsis at presentation, ~~this~~ supporting~~s~~ the findings of a previous studies [1, 19]~~-~~. This may ~~-~~probably be related to ~~the~~ unhygienic cord care practices and unhygienic home deliveries. Survival rate in this study was 78%, while the case fatality rate was 22%.~~,~~ T~~t~~he case fatality reported in this study is lower

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than 66.7% reported by Alhaji *et al* [19] ~~i~~In Maiduguri, ~~also~~ and lower than 71% reported by Ladan *et al*[2] in Kano. Oluwafemi *et* al [29] in Ondo state of Nigeria reported a lower ~~-~~case fatality rate of 17.4% ~~when compared~~in comparison to th~~e~~is present study. Successful management of NNT cases requires intensive care and most of the neonatal units in Nigeria lack facilities such as neonatal ventilators [6]~~[6]~~ for critical care for babies with uncontrolled spasms~~.~~. U~~u~~se of ~~-~~ mechanical ventilators ~~is~~ are crucial for survival to control respiratory spasms and prevent respiratory failure in patients with NNT [6] without which ~~the~~ mortality can ~~be up~~rise up to 100% [1].

4. CONCLUSION

Th~~e~~is study ~~showed~~ exhibited that NNT is still a public health problem in the study with a notable increase~~n increased scourge~~ during the COVID 19 pandemic period. This issue~~, which~~ can be tackled through targeted health education of mothers via mass media, improving the quality and access to ANC services, ensuring complete course of tetanus toxoid vaccination, prioritizing hospital delivery and avoidance of traditional uvulectomy particularly in rural areas by the Sokoto state government. Antenatal and vaccination services should be given priority in response to future pandemics to sustain gains of the SDG 3.

ETHICAL APPROVAL

Ethical Clearance was obtained from the Ethics Committee of UDUTH, Sokoto.

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