



# 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

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## Authors' contributions

This work was carried out in collaboration among all authors. Author AA designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors OBO and OM managed the analysis of the study. Author IKO, JFB, OYI, WUM, AUM and RAI managed the literature searches. All authors read and approved the final manuscript.

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## ABSTRACT

**Background:** Neonatal tetanus (NNT) remains among the leading cause 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 system globally, and low-resource countries where vaccination programs fared even worse are likely to see a surge in vaccine-preventable diseases during and after COVID-19 pandemic.

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**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 a clinical diagnosis of NNT into the SCBU of the UDUTH, Sokoto from 1<sup>st</sup> January, 2013 to 31<sup>st</sup> December, 2022. The data obtained was analyzed using SPSS version 21.

**Results:** During the 10 years period of the study, NNT accounted for 0.4% of admissions. The majority 15(57.0%) of the mothers of the neonates with NNT were from 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 lower socio-economic classes. 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 done using 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%). the yearly trend showed an increased incidence of NNT admissions in 2022.

**Conclusion:** The study showed that NNT is still a public health problem, 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.*

## 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 compress and usage of unsterile razor blade” [1]. The disease can also follow traditional practices like traditional uvulectomy, scarification marks and other surgical traditional procedures carried out on newborns of mothers who are unimmunized or are insufficiently immunised against tetanus [2]. “For most cases of neonatal tetanus, the portal of entry is the umbilical stump, ear piercing and infected circumcision sites” [1,3,4]. “Neonatal tetanus is a toxin-mediated disease that usually present with an inability to suck in a newborn 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; however, it continues to be a leading cause of neonatal mortality in developing countries” [5]. “Even with treatment, the case fatality rate can be as high as 80–90%” [6]. “In some developing countries the case fatality of NNT can be upto 100% due to a lack of intensive care facilities” [1]. “In 2015, there was an estimated 56,000 tetanus-related deaths

worldwide and about 35% of tetanus-related deaths occurred in newborns” [7].

The incidence of NNT in Nigeria ranges from 14.6 to 20.0 per 1000 live births [8] and NNT accounts for about 20% of neonatal death [1]. “It is estimated that although fewer than 5% of neonatal tetanus cases are actually reported in many developing countries, the extent of the burden cannot be estimated since most of the neonates are delivered at home and there is no appropriate system of surveillance through which both the birth and death can be reported” [9]. “It is for this reason that deaths are possibly greater than the numbers indicate” [10]. “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” [6]. “However, the target was not achieved” [6]. “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 2020 for the 59 high risk countries after missing the initial target dates of 2005 and 2015” [11]. “As of December, 2020, 12(20%) of the 59 high-risk countries are yet to achieve Maternal Neonatal Tetanus Elimination (MNTE) are Afghanistan, Angola, the Central African Republic, Guinea, Mali, Nigeria, Pakistan, Papua New Guinea, Somalia, South Sudan, Sudan, and Yemen” [12]. “Maternal and neonatal tetanus remain a considerable challenge in the

countries yet to achieve this elimination goal in 2020 primarily due to wars, conflicts, and politically vulnerable environment” [9].

“Nigeria remains among the countries carrying the global NNT burden, global elimination of NNT is defined as the reduction of cases to less than 1/1000 live births in every district each year” [1]. “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” [10]. “Lack of antenatal care (ANC) (two or more ANC services provided by trained health professionals) and poor maternal tetanus toxoid (TT) immunisation (two or more TT vaccines administered during pregnancy) coverage have been identified as significant underlying causes of the high incidence of NNT in Nigeria” [13]. “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, the inability to access quality ANCs, religious beliefs, preference for home deliveries in the rural areas and a lack of trained TBA” [13]. “The 2018 Nigeria Demographic and Health Survey (NDHS) indicated that only 39% of births in Nigeria are delivered in a health facility while 59% were delivered at home and only 43% of deliveries were attended by skilled birth attendant” [14].

“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 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 constitutes a huge reason as to why the fourth goal of the Millennium Development Goals was not achieved [15] and further poses a

challenge to 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” [16]. “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” [17]. “The first confirmed case of Covid-19 in Nigeria was on February 27, 2020. Nigeria experienced its first wave of COVID-19 infection between February 2020 and October 2020, 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. This is largely related to access to services and the patients’ fear of contracting COVID-19 in outpatient departments” [18]. This study aimed to determine the prevalence, yearly trend, risk factors, outcome and factors associated with NNT mortality at the 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. MATERIALS AND METHODS

This was a retrospective cross-sectional hospital-based study, carried out between 1<sup>st</sup> January 2013 to 31<sup>st</sup> 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 serving as a referral center to public and private hospitals within the state and adjoining states like Kebbi state, Zamfara and neighbouring countries 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 information about the patients included: gender, 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, the mothers occupation

and the mothers highest level of education which were obtained from the admission register and case files. The socio-economic class (SEC) of the mothers was assessed using the Oyediji socio-economic classification scheme [19]. Appropriate cord care was defined as the use of chlorhexidine gel. The period of onset was defined as the interval of days between the inability to suck breasts and the occurrence of spasms. The diagnosis of tetanus was made clinically according to the WHO diagnostic criteria [20]. 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 intramuscular anti-tetanus serum within the first 24 to 48 hours of admission along with intravenous metronidazole as the antibiotic of choice. Spasms are controlled with a combination of phenobarbitone, diazepam and chlorpromazine which were initially given via intravenous route but were later changed to oral medications via a nasogastric tube. The neonates were fed expressed breast milk via a nasogastric tube. Sepsis worked up was done for all the babies and those with neonatal sepsis were administered relevant antibiotics. The 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 tests 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, there were 17 males and 10 females, giving a male to female ratio of 1:0.6. The majority 17(63.0%) of the neonates were delivered at home by a traditional birth attendants (Table 1).

#### 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 (Fig. 1).

#### 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).

#### 3.4 Items Used for Cord Care

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

#### 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 1. Demographic and clinical characteristics of patients with Neonatal Tetanus**

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

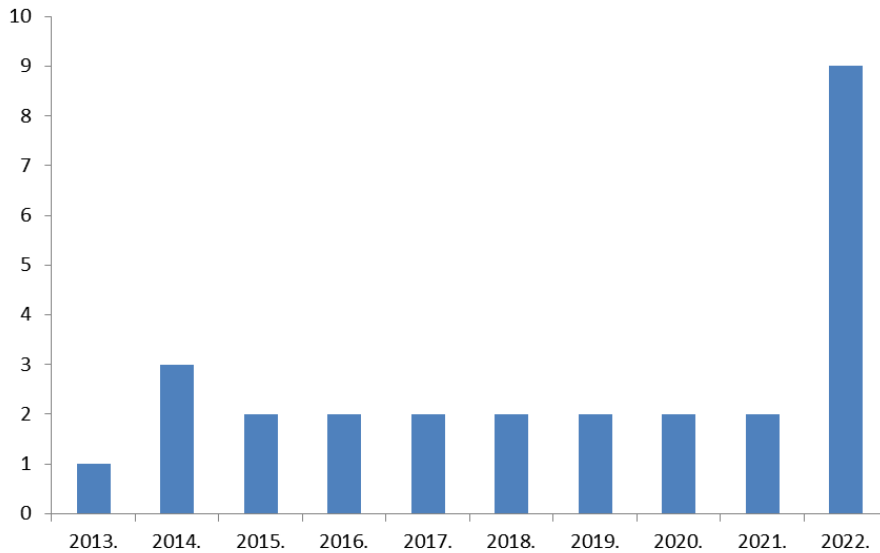


Fig. 1. A bar chart showing the yearly trend of NNT admissions

Table 2. Maternal socio-demographic characteristics

Variable	Frequency	Percentage (%)
<b>Maternal age (years)</b>		
20-<25	4	14.8
25-<30	6	22.0
30 and above	17	63.0
<b>Mean age of the mothers</b>	<b>29±2.7</b>	
<b>Maternal ANC attendance</b>		
Yes	12	44.0
No	15	56.0
<b>Place of residence</b>		
Urban	12	44.0
Rural	15	56.0
<b>Maternal TT Vaccination status</b>		
Completed	0	0.0
Uncompleted	10	37.0
None	17	63.0
<b>Mother's SEC</b>		
Upper	0	0.0
Middle	0	0.0
Lower	27	100.0

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

### 3.6 Clinical Presentation and Complications

All the affected neonates presented with inability to suck and generalised spasms while more than half of the patients had fever and difficulty breathing at presentation. About 14(52.0%) of the neonates had hypoglycaemia, while 6(22.0%) had anaemia as complication. Sepsis was

identified as a co-morbidity in 23(85.0%) of the neonates.

### 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, and 6(22.0%) died (Table 6).

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

Variable	Frequency	Percentage (%)
<b>Portal of entry</b>		
Umbilical Stump	26	96.0
Traditional Uvulectomy	1	4.0
<b>Period of onset (days)</b>		
<3	2	7.4
4-7	25	92.6
<b>Incubation period (days)</b>		
1-3	3	4.0
4-6	19	70.0
7-14	7	26.0

**Table 5. Clinical presentation and complications**

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

**Table 6. Duration of hospital stay and outcome of NNT**

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

**Table 7. Factors associated with NNT mortality**

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

**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).

**4. DISCUSSION**

The prevalence of neonatal tetanus of 0.4% observed in this study is lower than 4.7% reported by Alhaji et al. [21] in the University of Maiduguri over a 2-year period from 2009 to 2010, and also lower than 0.7% and 1% reported in 2011 by Onalo et al [22] in Zaria and Mbarie et al. [23] in Benin City in 2015 respectively, but however, a lower prevalence of 0.34% when compared to the finding of this study was reported by O Gundare et al. [1] in Ekiti in the year 2011 to 2020. 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 the passive transfer of maternal antibodies from vaccinated mothers [24]. 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 the present study. Several other studies reported the continuous scourge of NNT in hospital-based surveys [2,8].

All the parents of the patients with neonatal tetanus are of low socio-economic status; similar

findings were also reported by other researchers [1,8,21], 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 [25].

The male preponderance in the cases of NNT seen in our study is in tandem with the findings of previous studies [1,21] Although there is no definitive explanation for the gender difference in the prevalence of NNT, it may however be due to male-child preference in 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 [26], 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 neonates with NNT are treated at home by traditional healers and thus, such cases are unreported [27].

The lack of TT vaccination observed among the 63.0% mothers of the neonates with NNT in this study is consistent with the findings of previous studies [2,8,21]. Antenatal clinic attendance (ANC) in this study was also very low. More than half (56%) of the mothers had no ANC, which falls below the national average of 57%, corroborating the findings of previous studies [1,2,8,21]. The lack of ANC attendance may also result in a 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 [27]. The majority (63.0%) of the babies in the present study were delivered at home. This commemorates the findings of earlier studies done in Nigeria [1,2,21] and a report from the 2018 Nigeria Demographic Health Survey [14], which place 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 reported in many countries including Nigeria [12]. At least two doses of tetanus toxoid-containing vaccine (TTCV) supplementary immunization were postponed from 2020 to the second half of 2021 [12]. The COVID-19 pandemic has also resulted in more home deliveries and the diversion of resources to halt the pandemic, thereby causing a setback to the MNTE strategies [17]. Reports from Pakistan by Iqbal et al. [28] and Missaghi et al. [29] showed increased cases of NNT during the COVID-19 pandemic which was probably 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 in many studies [8,30] before the COVID-19 pandemic largely due to home deliveries, a 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 [1,2,21]. Only one of the mothers of the patients in this study reported to have used only Chlorhexidine gel for the care of the baby's umbilical cord, while the majority had used harmful and unhygienic substances for cord care. This finding is in keeping with the findings of previous studies [1,8,21]. 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 [1,8,21]. 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 [21]. More than half of the babies had features of sepsis at presentation, supporting the findings of previous studies [1,21]. This may probably be related to unhygienic cord care practices and unhygienic home deliveries. The survival rate in this study was 78%, while the case fatality rate was 22%. The case fatality rate reported in this study is lower than 66.7% reported by Alhaji et al. [21] in Maiduguri, and it is also lower than the 71% reported by Ladan et al. [2] in Kano. Oluwafemi et al. [31] in Ondo state of Nigeria reported a lower case fatality rate of 17.4% in comparison to the present study. Successful management of NNT cases requires intensive care and most of the neonatal units in Nigeria lack facilities such as neonatal ventilators [8]. For critical care for babies with uncontrolled spasms, use of mechanical ventilators are crucial for survival to control respiratory spasm and prevent respiratory failure in patients with NNT [8] without which mortality can rise up to 100% [1].

## 5. CONCLUSION

The study exhibited that NNT is still a public health problem in the study with a notable increase during the COVID 19 pandemic period. This issue 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.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

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



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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Ogundare EO, Ajite AB, Adeniyi AT, Babatola AO, Taiwo AB, Fatunla OA, et al. A ten-year review of neonatal tetanus cases managed at a tertiary health facility in a resource poor setting: The trend, management challenges and outcome. *PLoS Negl Trop Dis.* 2021;15(12): e0010010. Available: <https://doi.org/10.1371/journal.pntd.0010010>
2. Ladan ZF, Mohammed A, Ibrahim M, Obiagwu PN, Abba SU. Neonatal tetanus in Kano: A ten-year review. *Niger J Basic Clin Sci.* 2015;12:30-3
3. Yaguo Ide, Lucy Eberechuku, Tochi Ada Uchenwa-Onyenegecha. Post Neonatal Tetanus: 20 Years Experience As Seen at the University of Port Harcourt Teaching Hospital". *Journal of Advances in Medicine and Medical Research.* 2015;12(2):1-5. Available: <https://doi.org/10.9734/BJMMR/2016/19047>.
4. Khan AA, Zahidie A, Rabbani F. Interventions to reduce neonatal mortality from neonatal tetanus in low and middle income countries-a systematic review. *BMC Public Health.* 2013 Dec;13:1-7.
5. Dikici B, Uzun H, Yilmaz-Keskin E, Tas T, Gunes A, Kocamaz H, Konca C, Tas MA. Neonatal tetanus in Turkey; what has changed in the last decade? *BMC Infect Dis.* 2008 Aug 19; 8:112
6. Oladiran I, Meier DE, Ojelade AA, OlaOlorun DA, Adeniran A, Tarpley JL. Tetanus: continuing problem in the developing world. *World J Surg.* 2002; 26:1282-5.
7. Jun L, Zicheng L, Chao Y, Kaiwen T, Sijie G, Shuang Z, Yi S. Global epidemiology and burden of tetanus from 1990 to 2019: A systematic analysis for the Global Burden of Disease Study 2019. *Internl J Infect Diseases.* 2023;132:118-126
8. Majiyagbe OO, Akintan PE, Ezenwa BN, Fajolul B, Ezeaka VC. Neonatal Tetanus in Nigeria: A call to speed up elimination strategies. *Jos J Med.* 2018;12(1):71-5
9. Syed AR, Bilal IA. Eliminating maternal and neonatal tetanus and promoting clean delivery practices through disposable clean birth kits. *Font Public Health.* 2019;7:339.
10. WHO: Maternal and Neonatal Tetanus; 2024
11. Nneka O, Joseph OA, John A, Shehu U, Fatima G, Abdul-One Amina Muhammed, et al. Maternal and neonatal tetanus elimination in Nigeria: A Review of Delivery and Cord Care Practices among Women of Child Bearing Age. *Austin J Womens Health.* 2022;9(1):1063.
12. Nasir Y, Azhar AR, Diana C, Bilal A, Tedbabe H, Richard RL, Patricia T, Balcha M, Mehoundo F, Mohamed DO, Saadia F, Khin DA, Heather MS, Rania AT. Progress and barriers towards maternal and neonatal tetanus elimination in the remaining 12 countries: a systematic review. *Lancet Glob Health.* 2021;9(11): e1610-e1617.
13. Akani AN, Nte AR, Oruamabo RS. Neonatal tetanus in Nigeria: One social scourge too many! *Niger J Paediatr.* 2004;31:1-9.
14. Nigeria demographics and health survey [NDHS]; 2018.
15. Hassan B, Popoola A, Olokoba A, Salawu FK. A survey of neonatal tetanus at a district general hospital in north-east Nigeria. *Trop Doct.* 2011;41(1):18-20.
16. Riley T, Sully E, Ahmed Z, Biddlecom A. Estimates of the Potential Impact of the COVID-19 Pandemic on Sexual and Reproductive Health in Low- and Middle-Income Countries. *Int Perspect Sex Reprod Health.* 2020;16;46:73-76
17. Dhir SK, Dewan P, Gupta P. Maternal and neonatal tetanus elimination: Where are we now? *Res Rep Trop Med.* 2021; 12:247-61.
18. Burt JF, Ouma J, Lubyayi L, et al. Indirect effects of COVID-19 on maternal, neonatal, child, sexual and reproductive health services in Kampala, Uganda. *BMJ Glob Health* 2021;6(8):e006102
19. Oyedeji GA. Socio-economic and cultural background of hospitalized children in Ilesha. *Nig J Paed.* 1985;12(4):111-7

20. Case definition. In: Neonatal tetanus elimination field guide [second edition]. Scientific and technical publication No. 602. Pan American Health Organization. Pan American sanitary Bureau, Regional office of the World Health Organization. 525 Twenty-Third Street, N.W. Washington D.C. 2005;13:20037. Available:www.paho.org.
21. Alhaji MA, Bello MA, Elechi HA, Akuhwa RT, Bukar FL, Ibrahim HA. A review of neonatal tetanus in University of Maiduguri Teaching Hospital, North-eastern Nigeria. Niger Med J 2013;54(6):398-401.
22. Onalo R, Ishiaku HM, Ogala WN. Prevalence and outcome of neonatal tetanus in Zaria, Northwestern Nigeria. J Infect Dev Countries. 2011;5:255–259.
23. Mbarie I, Blessing Imuetinyan Abhulimhenlyoha. A 6-year review of neonatal tetanus at the Stella Obasanjo Hospital, Benin City, South-South Nigeria. Afr J Med and Health Scien. 2015;14:52–5
24. Wassilak SGF, Orenstein WA, Sutter RW. Tetanus toxoid. In: Plotkin SA, Orenstein WA. Vaccines. 3rd ed. Philadelphia, PA: W.B. Saunders. 1999;441–74.
25. Nte AR, Ekanem EE, Gbaraba PV, Oruamabo RS. Social-environmental influences on the occurrence of neonatal tetanus in some riverine communities in Nigeria. Trop Doct. 1997;27(4):234-5
26. Yaya S, Odusina, EK, Adjei NK. Health care seeking behaviour for children with acute childhood illnesses and its relating factors in sub-Saharan Africa: evidence from 24 countries. Trop Med Health. 2021;49:95
27. Silvers MJ, Haddy RA. Method for adjusting gender bias in neonatal tetanus reports in Egypt 1991. Epidemiol Infect. 2002;128(2):169-74.
28. Iqbal S, Ali I. Routine vaccination during COVID-19: A case of maternal neonatal tetanus from Pakistan. Front Reprod Health. 2023;3:790647.
29. Missaghi B, Malik MW, Shaukat W, et al. Associations of the COVID-19 pandemic with the reported incidence of important endemic infectious disease agents and syndromes in Pakistan. BMC Infect Dis. 2022;22:887.
30. Omoigberale AI, Abiodun PO. Upsurge in neonatal tetanus in Benin City, Nigeria. East Afr Med J. 2005;82(2):98-102SSS
31. Oluwafemi RO. A nine-year facility-based review of the pattern and outcome of neonatal tetanus in Ondo State, Nigeria. Annals of Clin and Biomed Res. 2023;4:323.

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