

# Neonatal tetanus in Sagamu, Nigeria during the Expanded Programme on Immunization and the National Programme on Immunization eras: A comparative analysis.

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## Abstract

**Background:** It is essential to continually study the pattern of occurrence of neonatal tetanus (NNT) for better control measures. **Objective:** To compare the prevalence rates and outcome of NNT in a Nigerian tertiary hospital over two periods characterized by different national immunization programmes - the Expanded Programme on Immunization (EPI) and the National Programme on Immunization (NPI). **Methods:** The records of babies hospitalized with NNT between 1991 and 1996 (EPI period) and between 1997 and 2005 (NPI period) were studied. **Results:** The prevalence rates for the EPI and NPI periods were 6.4 percent and 2.9 percent respectively. Most of the mothers did not receive ante-natal care (81.4 percent for EPI and 75.6 percent for NPI), did not take anti-tetanus vaccines in pregnancy (87.7 percent for EPI and 88.4 percent for NPI) and delivered their babies outside the health facilities (86.6 percent for EPI and 83.3 percent for NPI). The Case Fatality Rate was 49.5 percent and 61.5 percent for the EPI and NPI periods respectively. **Conclusion:** The prevalence and mortality of NNT remains high in Nigeria despite a change in immunization programme.

## INTRODUCTION

Over the years, studies have shown that neonatal tetanus (NNT) is a major cause of neonatal morbidity and mortality in the developing world.<sup>1-3</sup> As at 1999, Nigeria was listed as one of the three major countries in the whole world where NNT still constituted a major public health issue.<sup>4</sup> Several international interventions have been instituted to reduce this global burden but the persistence of NNT cases in clinical practice is evidence that the various interventions might have failed. NNT is said to have been eliminated from a country when the annual incidence is less than 1 per 1000 live births.<sup>4,5</sup> Although, only 5 percent of NNT cases are actually reported to health services,<sup>6</sup> the incidence of NNT in Nigeria ranges between 14.6 and 20 per thousand live births.<sup>7</sup>

Poor anti-tetanus coverage of women in the child-bearing age has been identified as a bane of successful elimination of NNT in the developing world.<sup>6</sup> One major step taken to address the problem of poor vaccine coverage in Nigeria was the replacement of the Expanded Programme on Immunization (EPI) with the National Programme on Immunization (NPI) in 1997.<sup>8</sup> The former which was largely

funded by donors like the WHO and the UNICEF presumably failed due to poor implementation arising from lack of governmental commitment.<sup>8</sup> Therefore, the funding of the latter was completely taken over by the Nigerian government to reflect governmental commitment to the immunization scheme and attract better implementation especially in terms of vaccine provision and delivery to the end-users. The targets included improved distribution of vaccines and increased community participation.<sup>8</sup> However, the programme, as far as anti-tetanus vaccination was concerned, remained clinic-based.

Therefore, this study aims to compare the prevalence and outcome of NNT in a Nigerian Teaching Hospital over the two periods (spanning over 15 years) characterized by different immunization programmes in Nigeria.

## METHODS

A review of all neonates managed for tetanus at the Olabisi Onabanjo University Teaching Hospital (OOUTH) Sagamu, Nigeria between January 1991 and December 2005 was carried out. The hospital provides specialist neonatal services to at least three states of the federation. Cases of

NNT were defined according to the WHO criteria.<sup>9</sup>

For the purpose of this study, the EPI period spanned January, 1991 to December 1996 while the NPI period spanned January 1997 to December 2005. The hospital records of the patients were studied and the information retrieved included the personal data, the clinical presentations, place of delivery, details of treatment, duration and outcome of hospitalization. Maternal data such as age, parity, place of antenatal care (ANC) and anti-tetanus immunization history were also recorded. Parental occupation and educational qualification were used to categorize socioeconomic status.<sup>10</sup> Socio-economic classes I to III formed the upper class while classes IV and V constituted the lower class.

Data analysis was carried out with SPSS 15.0 software. Data for the two periods were compared using Odds Ratio (OR) at 95% Confidence Interval (CI) and Pearson Correlation. Statistical significance was established when CI embraced unity or the value of p was less than 0.05.

## RESULTS

### AGE, SEX AND WEIGHT OF THE SUBJECTS

During the period studied, 175 babies out of 4151 total neonatal admissions had NNT giving an overall prevalence rate of 4.2%. Figure 1 shows the wide fluctuations in annual prevalence rates ranging from 1.1% to 9.1%.

#### Figure 1

Figure 1: Prevalence rates of Neonatal tetanus between 1991 and 2005.

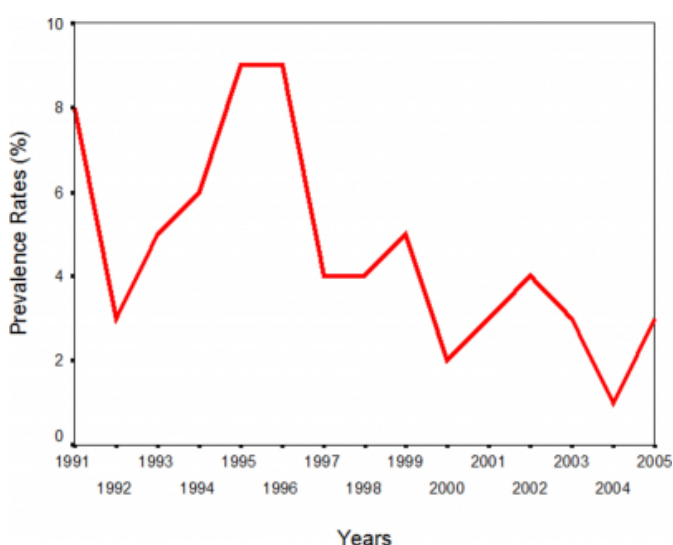


Table I compares the bio-data of the infants studied over the two periods. The male-to-female ratio was 1.36:1 and 1.78:1

in the EPI and NPI periods respectively. Overall, their age range was 2 to 14 days with a mean of  $8.54 \pm 4.3$  days but majority of them (52.6%) were aged 7 days and above. The proportions of babies with NNT who presented within 7 days of life were similar in both periods. The mean (SD) admission weight was  $2.7 \pm 0.5$  kg [range: 1.5 to 3.9 kg]. Similarly, the proportion of babies with tetanus who were preterm or low-birth-weight were similar in the two periods studied.

#### Figure 2

Table I: COMPARISON OF THE BIO-DATA OF 175 BABIES WITH NNT IN THE EPI\* AND NPI\*\* PERIODS

Parameters	EPI* n = 97 (%)	NPI** n = 78 (%)	Statistics
<b>Age</b>			
≤ 7 days	45 (46.4)	38 (48.7)	
> 7 days	52 (53.6)	40 (51.3)	OR = 0.91; CI = 0.48 – 1.73
<b>Sex</b>			
Male	56 (57.7)	50 (64.1)	
Female	41 (42.3)	28 (35.9)	OR = 0.76; CI = 0.40 – 1.48
<b>Weight distribution</b>			
Normal	72 (74.2)	51 (65.4)	
Low birth weight	25 (25.8)	27 (34.6)	OR = 1.52; CI = 0.76 – 3.08
<b>Maturity</b>			
Preterms	14 (14.4)	7 (9.0)	
Term	83 (85.6)	71 (91.0)	OR = 1.71; CI = 0.60 – 4.99

\* EPI – Expanded Programme on Immunization

\*\*NPI – National Programme on Immunization

Overall, there were 97 NNT cases out of 1518 total admissions in the EPI period and 78 NNT cases out of 2633 total admissions in the NPI periods. Therefore, the prevalence rates were 6.4% and 2.9% for the EPI and NPI periods respectively and this was statistically significantly different (OR = 2.24; CI = 1.63 – 3.07). The trend of NNT admissions over this fifteen-year period correlated poorly with the trend of total admissions for the EPI ( $r = -0.140$ ;  $p = 0.792$ ) and NPI ( $r = 0.084$ ;  $p = 0.831$ ) periods. Therefore, changes in the pattern of NNT admissions could not be attributed to changes in the pattern of total neonatal admission.

### MATERNAL PROFILE AND ANTI-TETANUS IMMUNIZATION (TABLE II AND III)

Most of the mothers (157; 89.7%) belonged to the lower

socio-economic classes IV and V. None of them belonged to the upper socio-economic classes I and II. The proportion of mothers who belonged to socio-economic class V in the EPI and NPI periods were similar [51(52.6%) vs 44(56.4%); OR = 0.86, CI = 0.45 – 1.63]. Majority of the mothers in the EPI and NPI periods were primipara (54.6% and 65.4% respectively; OR = 6.4, CI = 0.33 – 1.23). Most of the mothers were older than 18 years; 90.7% and 84.6% in the EPI and NPI periods respectively (OR = 0.56, CI = 0.20 – 1.54).

Overall, only 37 (21.1%) of the mothers received antenatal care in health facilities. The proportion of mothers who did not receive ante-natal care in the EPI period was 81.4% compared with 75.6% for the NPI period (OR = 0.71, CI = 0.32 – 1.56). Overall, 127 (72.6%) mothers were not immunized against tetanus in the index pregnancies. The proportion of mothers who did not take tetanus toxoid (TT) vaccine in pregnancy was similarly high in the EPI (87.7%) and NPI (88.4%) periods. Most of the babies (85.1%) were delivered outside the health facilities and the proportion was similar for the EPI (86.6%) and the NPI (83.3%) periods (OR = 0.77; CI = 0.31 – 1.92).

**Figure 3**

Table II: COMPARISON OF THE BIO-SOCIAL CHARACTERISTICS OF THE MOTHERS IN THE EPI\* AND NPI\*\* PERIODS

Parameters	EPI* n = 97 (%)	NPI** n = 78 (%)	Statistics
<b>Age</b>			
≤ 18 years	9 (9.3)	12 (15.4)	
> 18 years	88 (90.7)	66 (84.6)	OR = 0.56; CI = 0.20 – 1.54
<b>Parity</b>			
1	53 (54.6)	51 (65.4)	
2 or more	44 (45.4)	27 (34.6)	OR = 0.64; CI = 0.33 – 1.23
<b>Socioeconomic status</b>			
III and above	8 (8.2)	10 (12.8)	
IV and V	89 (91.7)	68 (87.2)	OR = 0.61; CI = 0.21 – 1.79

Keys:

\* EPI – Expanded Programme on Immunization

\*\*NPI – National Programme on Immunization

**Figure 4**

Table III: COMPARISON OF THE PLACES OF ANTENATAL CARE, DELIVERY AND ANTI-TETANUS IMMUNIZATION OF THE MOTHERS IN THE EPI\* AND NPI\*\* PERIODS

Parameters	EPI* n = 97 (%)	NPI** n = 78 (%)	Statistics
<b>Antenatal Care</b>			
Health facilities	18 (18.6)	19 (24.4)	
Others***	79 (81.4)	59 (75.6)	OR = 0.71; CI = 0.32 – 1.56
<b>TT immunization</b>			
≤ 1 dose	85 (87.7)	69 (88.5)	
≥ 2 doses	12 (12.3)	9 (11.6)	OR = 0.92; CI = 0.33 – 2.52
<b>Place of birth</b>			
Health facilities	13 (13.4)	13 (16.7)	
Others***	84 (86.6)	65 (83.3)	OR = 0.77; CI = 0.31 – 1.92

Keys:

\* EPI – Expanded Programme on Immunization

\*\*NPI – National Programme on Immunization

\*\*\* Others – Churches, Traditional Birth Homes, Residential homes

## OUTCOME OF HOSPITALIZATION

There were 96 deaths among the 175 NNT cases giving an overall Case Fatality Rate (CFR) of 54.9% and this was also equivalent to 8.8% of the total neonatal deaths recorded during the period studied. Fifty five babies (31.4%) recovered from NNT and were discharged alive and well while 24 (13.7%) were discharged against medical advice. The CFR for the EPI and NPI periods were 49.5% (48/97) and 61.5% (48/78) respectively but the difference was not statistically significant (OR = 1.63; CI = 0.85 – 3.13). Out of the 48 deaths recorded in the EPI period, 7(14.6%) occurred within 24 hours of hospitalization compared with 15(31.1%) of the 48 deaths which characterized the NPI period. This difference was not significant (OR = 0.38; CI = 0.12 – 1.13). The proportions of babies who were discharged well were similar in both the EPI and NPI periods [31(31.9%) vs 24(30.8%); OR = 1.06, CI = 0.53 – 2.11]. Similarly, the proportion of cases who were prematurely discharged from the hospital were significantly lower in the NPI period than in the EPI period (7.7% Vs 18.6%; OR = 0.38; 0.12 – 0.98).

## DISCUSSION

The findings in this study agree with previous works about the epidemiology of NNT as a disease of the infants of

women who did not have prenatal care, were poorly immunized against tetanus in pregnancy and delivered their babies in unhygienic places.<sup>11-15</sup> However, the focus of this study is the probable effect, if any, of the change in the national routine immunization programme on the burden of NNT. Although, the switch from EPI to NPI was not primarily done with respect to anti-tetanus vaccination, it is expected that the TT vaccine coverage should have improved significantly since 1997 and the incidence of NNT should have fallen. No consistent trend in the prevalence rates of NNT was observed in the present study but the annual prevalence rates for the NPI periods appears to be lower than the annual prevalence rates for the EPI period. The reason for this remains unclear. Overall, this study shows that NNT persists in clinical practice and the predisposing factors do not seem to have changed.

While the proportion of newborn babies who are protected against tetanus at birth in Nigeria stands at 51 percent, India, Burkina Faso and Gabon where the EPI vaccines are similarly procured without assistance recorded 80 percent, 75 percent and 60 percent newborn protection respectively.<sup>16</sup> Ironically, Ghana and Zambia where the procurement of vaccines is still partly funded also have better protection of their newborn babies against tetanus (84 percent and 98 percent respectively) than Nigeria.<sup>16</sup> This observation suggests that vaccine coverage depends not only on a change in governmental commitment policies, hence the persistence of NNT in Nigeria.

The highest incidence rates of NNT were recorded in this study in 1991, 1995 and 1996 respectively. Thereafter, the incidence fell drastically since 1997 and had since remained low. The exact reason for this is unknown as the pattern was not commensurate with the pattern of the total admissions. The available data on TT vaccine coverage do not suggest excellent performances in this wise.<sup>8</sup>

The concentration of the mothers in the lower socioeconomic classes was in keeping with previous reports<sup>11, 17</sup> and it also reflects the poor health-seeking behaviour of people in those classes.<sup>10</sup> In a previous Nigerian report, an upsurge in the incidence of NNT was attributed to factors like low utilization of prenatal care facilities arising from ignorance about such care, non-availability of vaccines and fears of possible consequence of vaccination.<sup>13</sup> Poor utilization of health services would also explain the poor rate of utilization of antenatal care services, maternal anti-tetanus immunization and the high rate of delivery outside health

facilities which characterized our findings over these two periods.<sup>18</sup> Therefore, the rejuvenation of the primary health care system would re-position it for better utilization of the services. The training of the traditional birth attendants may also be helpful<sup>19</sup> as 85.1 percent delivered outside hospital facilities.

Similar to findings from other places, most of the mothers in this study were primiparous.<sup>15, 17</sup> These were often poorly immunized in pregnancy and perhaps, were also not adequately immunized in childhood. Given the background of poor childhood immunization in this part of the world, it may be appropriate to advocate for the commencement of anti-tetanus immunization early in life since antibodies have also been reported to increase with successive doses of the anti-tetanus vaccine.<sup>20</sup> This justifies the administration of booster doses of TT at school (elementary and college) entry such that a girl-child would have formed adequate quantities of anti-tetanus antibodies by the time she is ready for confinement. Although, intensive immunization campaigns had been shown to remarkably improve vaccine coverage,<sup>21</sup> the house-to-house approach may be a more efficient option for anti-tetanus immunization campaigns.

The CFR recorded in the two periods under review were comparable to 54.5 percent, 56.2 percent and 58 percent previously reported from other parts of the country<sup>13, 22, 23</sup> and to 66.3 percent and 69 percent reported from India<sup>14</sup> and Ethiopia.<sup>24</sup> These similar figures obtained over time suggest that the scope of management in NNT has not changed remarkably in most parts of the developing world. However, improved quality of intensive care for babies with NNT had been shown to reduce the CFR from 88.5 percent to 53.6 percent in Turkey.<sup>25</sup> A similar study conducted at Ilesa, another southwestern Nigerian community at the end of the last century recorded CFR ranging between 61.1 percent and 29 percent.<sup>26</sup>

Due to the retrospective nature of this study, it was difficult to determine the extent to which the pattern of NNT admissions over the two periods studied was related to temporal changes which might have occurred. Therefore, these patterns of prevalence and mortality in NNT over the two periods may not be strictly ascribed to the changes in the national immunization programmes.

## **CONCLUSION**

NNT remains a plague in Nigeria over a period of fifteen years despite a change in the country's immunization

programme. It might be useful to subsidize and improve accessibility to the existing health facilities. School-based and house-to-house immunization programmes may be more efficient than the routine clinic-based system in ensuring the elimination of NNT. Improvement of neonatal intensive care facilities for better case management is also highly desirable.

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