Impact of hygienic caring of the umbilical cord in the prevention of neonatal tetanus

Peer review status:
No

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Previous Article Reference: http://www.webmedcentral.com/article_view/4889
Article ID: WMC004891
Article Type: Research articles
Article URL: http://www.webmedcentral.com/article_view/4891
Subject Categories: PUBLIC HEALTH
Keywords: Antenatal Care, Neonatal Tetanus, Nigeria, Tetanus Toxoid, Traditional Birth Attendants, Umbilical Cord Care

How to cite the article: Saleh JA, Nemecek J, Jones C. Impact of hygienic caring of the umbilical cord in the prevention of neonatal tetanus. WebmedCentral PUBLIC HEALTH 2015;6(5):WMC004891

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Source(s) of Funding:
No funding for this study.

Competing Interests:
No competing interest or priority.
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Abstract

**Background:** Neonatal tetanus (NNT) remains among the leading causes of deaths among neonates in the developing countries with a recorded 130,000 neonatal deaths in 2004. In addition to immunizing pregnant women with 3 doses of tetanus toxoid vaccine, hygienic delivery of the newborn and caring of the umbilical cord are key prerequisite towards meeting with the NNT elimination deadline. The hygienic caring of the umbilical cord aims to ensure that infection by especially tetanus bacteria and irritation of any sort are avoided.

**Study Design:** Retrospective study

**Methods:** The study is quantitative and cross-sectional involving mothers who gave birth to NNT babies within their first 28 days of life. The study used secondary dataset from the northeastern Nigeria stored in the NNT database of the Nigeria National Primary Healthcare Development Agency and the World Health Organization Nigeria. The data was collected by trained disease surveillance and notification officers in the region from January 2008 to December 2013.

**Results:** The results shows that in the six provinces, mothers who did not treat the umbilical cord of their newborn babies in a hygienic way are 68% (147/216) \( (n = 147) \) and those that did treat the umbilical cord of their newborn in a hygienic way are 32% (69/216) \( (n = 69) \). Overall, there was significant variation between the proportions receiving hygienic cord care depending upon province (range 17% - 58%).

**Conclusion:** To achieve NNT elimination, it is paramount for government of countries that still have high prevalence of NNT to ensure that expectant mothers and TBAs are educated on how to hygienically care for the umbilical cords of newborn children. This is in addition to giving 3 doses of tetanus toxoid vaccine to all women of childbearing age especially those living in high-risk areas, hygienic delivery of the newborn, and improved NNT surveillance.

Introduction

In this 21st century, there is no doubt that the global community has shown increase commitment more that ever before towards improving the lives of children across the globe. Although there are some appreciable results in that direction in the developing countries, arguably the positive impact is much in the developed economies. The developing countries are still having enormous challenges with high infant and neonatal death rates. It has been shown that two-third of the neonatal deaths, which often are preventable, occur as a result of vaccine preventable diseases, pre-maturity and birth asphyxia. Thus statistics has shown that 99% of these deaths occur in the low and mid-income countries of the world\(^1\)\(^,\)\(^2\)\(^,\)\(^3\)\(^,\)\(^4\)\(^,\)\(^5\).

Studies has shown that an estimated out of the 10 million children under the age of five years that die annually across the globe, four million of these deaths occur within the neonatal life of these children. Neonatal tetanus (NNT), considered as one of the most underreported deadly vaccine preventable diseases commonly seen in the developing countries, is considered as the main cause of death in the newborn within the first 28 days of life. In spite the increased commitment from governments of countries that have NNT, it is estimated that only 5% of cases reports to the heath services especially within the under-developed countries\(^1\)\(^,\)\(^2\)\(^,\)\(^3\)\(^,\)\(^4\)\(^,\)\(^5\).

It is as a result of this that in 1989 at the World Health Assembly and also the world summit for children in 1990, that WHO, UNICEF and other partner agencies agreed on a strategic framework for the elimination of NNT in 1995\(^4\). The NNT elimination framework aims at less than 1 case of NNT per 1,000 live births per annum in every district of every country across the globe. The framework requires the strengthening of routine immunization of all pregnant women with the tetanus toxoid (TT), immunization of women with 3 doses of tetanus toxoid vaccine during their childbearing age especially those living in high-risk areas, hygienic delivery of the newborn, and improved NNT surveillance\(^1\)\(^,\)\(^5\).

The NNT case definition, used in this study, is any newborn who in the first 2-3 days of life was able to breastfeed, and then suddenly became irritable, could not breastfeed and die within the first 28 days of life\(^19\).
Also considered, as NNT is any death of a newborn child within the first 28 days of life for unexplained reasons\textsuperscript{16}.

The umbilical cord transports nutrients from the mother to baby in-utero. The umbilical cord ceases to function after birth thus leaving the stump, which usually dries up and falls off within 1-2 weeks after the newborn is born\textsuperscript{16}. Hygienic caring of the umbilical cord aims to ensure that infection by especially the tetanus bacteria or irritation of any sort is avoided. Hygienic caring of the umbilical cord could be done by keeping the cord clean by adhering to either or all of the following: rubbing the base of the cord with a methylated spirit, or using Goldenseal root and Echinacea; keeping the area dry through adequate ventilation; using sponge bath until after the cord falls off, and allowing the cord to heal naturally\textsuperscript{18}. The practice of caring of the umbilical cord in the developing countries is often not in accord with the standard norms thus resulting in high prevalence of NNT\textsuperscript{10-17}.

The strategic plan put in place by has yielded remarkable improvement in NNT globally as evidenced by a 93% reduction in NNT cases. Nonetheless, the fight is far from over as statistics shows that there are still 25 countries as at December 2013 that have not reached the MNT elimination status. Sadly, Nigeria, with all its vast human and capital resources is among the 25 remaining countries with unacceptably high prevalence of NNT\textsuperscript{4}. Because of failure of countries such as Nigeria in meeting with the deadline, the target date was revised to 2015\textsuperscript{14}.

The 2008 Nigeria Demographic and Health Survey\textsuperscript{6}, as shown in Table 1, indicates that the northeastern region has an interesting health statistics: total fertility rate of 7.2 (national 5.7), women age 15-19 who are mothers 39% (national 23%), women who gave birth in the last 5 years and received antenatal care from a skilled provider 43% (national 58%), Births assisted by a skilled provider 16% (national 39%), Births delivered in a health facility 13% (national 35%), Children 12–23 months fully immunized 8% (national 23%), Children 12–23 months with no immunizations 33 (national 29%), Literate women age 15–49/men age 15–49, stands at 23/54 (national 54/77%), and those with no education women age 15–49/men age 15–49, stands at 68/45 (national 36/19%).

**Methods**

The research is a retrospective cross-sectional quantitative study using NNT dataset collected from 2008 – 2013 involving 312 participants who are mothers of NNT babies. The study used secondary dataset from the northeastern Nigeria. The data was collected by trained disease surveillance and notification officers in the six provinces. The NNT data was archived in the NNT database of the Nigeria National Primary Healthcare Development Agency and the World Health Organization Nigeria. The selection criterion for the participants is that all mothers who gave birth to newborn babies within the first 28 days of life and fit in to the standard NNT case definition. The authors arrived as to whether hygienic care of the umbilical cord was practiced and the type of care given using the outlined questions on the standard NNT case investigation tool.

The northeast region comprises of six provinces namely Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe. The two dominant religions in the region are Islam and Christianity, and the region is less densely populated as compared with the southern region of the country. The rural dwellers are predominantly farmers and often with large-scale production of crops and livestock. The northeastern region, in comparison with other regions in Nigeria, has poorer economic indices and worse health outcomes\textsuperscript{6,7}.

For the purpose of this research work, ethical approval for the use of the NNT dataset was obtained from the zonal office of the NPHCDA. The NNT data was collected from eligible participants in the northeast region using a standard tool.

Informed of consent of the participants was obtained from the local authorities and the husbands of these women prior administering the questionnaire. The participants were well informed in the local language that they understood on the purpose of administering the questionnaire. The information obtained was securely kept in the official database, and restricting data access except to authorize persons.

The instrument used for collecting data from the respondents has on its various columns the following: the first column for capturing demographic information of the NNT child, as well as that of the parents. Other columns are tailored to obtain information on the mother’s vaccination history, birth of an infant, infant clinical history, cord treatment, action taken in the form of response, and final classification of the case. To ensure that the outcome is valid and generalizable, quality of the items was sought with content validity. The content of the instrument clearly measures what it was expected to measure; thus validity and reliability of the measurement instrument was well tested\textsuperscript{9,10}. 


Results

The scores of this study were coded and tabulated using Statistical Package for the Social Sciences (SPSS) version 22. The summary of values, where applicable, includes the mean, central tendency, variance, and standard deviation. Both inferential and descriptive statistics were used to draw conclusions from the sample.

The data were screened for missing data. Missing data were investigated using frequency counts, and several cases were found within the distributions. Specifically, 96 of the participants did not state whether they had their umbilical cord treated \( (n_{\text{missing}} = 96) \). Thus out of the responses from 312 data participants, 216 evaluated by the chi-squared model \( (n = 216) \). Displayed in Table 2 is a cross tabulation of the frequencies of mothers that had the umbilical cord of the new born treated across the six provinces in the region.

In this study, mothers who gave birth to NNT babies reported significantly fewer incidences of proper umbilical cord treatments. The figure shown below is a graphical display of the differences between mothers that reported hygienic treatment of the umbilical cord compared to mothers that did not.

**Exploratory Analysis**

Using SPSS 22, an exploratory analysis for the differences in frequency between cord treatment and province was conducted. The chi-square test of independence conducted for this was to determine if significant differences in frequency of umbilical cord treatments existed between births within the six provinces in the region. The result indicated that there was a significant difference in the frequencies of mothers that had their umbilical cord treated \( (p = .005) \) — see Table 3 for summary details of the chi-squared tests of independence for the Hypothesis.

Furthermore, there were twice as many births in Nigeria where the umbilical cord was not treated in a hygienic way \( (n = 147) \) as compared to births in which the umbilical cord was treated in a hygienic way \( (n = 69) \). Looking at each of the six provinces, Borno province had the highest 83% \( (49/59) \) of those mothers who did not treat the umbilical cord of their newborns in a hygienic way while Adamawa province had the lowest 42% \( (8/19) \). The proportion in the other provinces is that Bauchi province had 73% \( (36/49) \) who did not observe hygienic treatment of the cord of their newborn babies \( (n = 36) \); Gombe province had 68% \( (28/41) \) \( (n = 28) \); Taraba province had 54% \( (23/42) \) \( (n = 23) \); and Yobe province had 50% \( (3/6) \). Thus, the results shows that in the six provinces, mothers who did not treat the umbilical cord of their newborn babies in a hygienic way are 68% \( (147/216) \) \( (n = 147) \) while those that treated the umbilical cord of their newborn in a hygienic way are 32% \( (69/216) \) \( (n = 69) \).

Using frequency statistics and chi-squared tests, the study is able to determine if there exist significant differences in the frequency of umbilical cord treatments between births within six Nigerian provinces.

Discussion

The results from the single sample proportions and chi square tests of independence all shows that significant differences existed between mothers that indicated receiving treatment and those that did not and that there were twice as many births in Nigeria where the umbilical cord was not treated \( (n = 147) \) as compared to births with cord treatment \( (n = 69) \). The findings from this research is supported various studies on NNT. It is interesting to mention that the typical local cord practices in the northeastern part of Nigeria include the use of charcoal or cow dung to dress the umbilical cord of newborn babies\(^{11,12}\). Various literature shows that unhygienic birth practices is common in the developing countries of especially West Africa notable among them is Nigeria. The common practice in the African continent of especially the western region is cutting of the umbilical cord with unsterilized or contaminated sharp objects and application of charcoal or cow dung to the umbilical cord of the newborn\(^{10,11}\). In comparison to other developing countries of the Asian continent, treatment of the umbilical cord is either with ghee/surma or charcoal as the case may be\(^{12,13}\). Additionally, similar studies show that other harmful cultural practices that often practiced throughout the developing countries that results in the high prevalence of NNT include the use of hot fomentation, application of charcoal as a means of caring for the umbilical cord\(^{15,16,17}\).

The findings from this research is supported various studies on NNT in various developing countries, which showed that the unhygienic birth practices, cutting of the umbilical cord with unsterilized or contaminated sharp instruments, and treatment of the cord with a cow dung, ghee/surma or charcoal are contributing factors to neonates developing NNT\(^{10,14}\).

In a study conducted in rural areas of northern Ghana, it was observed that most mother of newborn children...
lack adequate knowledge on the practice of safe cord care. The study noted that out of the 404 newborns, only 1 (0.2%) had safe cord care\(^{20}\). Additionally, in a similar study in Sylhet District of Bangladesh, the authors observe high prevalence of unhygienic cord care practices among care givers in the area\(^{21}\). These studies and other similar studies show that lack of knowledge on unhygienic caring of the umbilical cord among caregivers is an important factor that predisposes the unimmunized newborn children to develop NNT. In other similar studies, additional factors that result in the high prevalence of NNT include harmful cultural practices of caring for the umbilical cord such as hot fomentation, application of charcoal\(^{15,16,17}\). Still, the high proportion of mothers who gave birth to newborn babies and did not treat the umbilical cord of the babies could explain reason for the high prevalence of NNT in the northeastern part of Nigeria\(^{11}\).

Additionally, the significant differences that existed between the provinces in the frequency of cord treatment could be explained by the differences in socioeconomic and cultural practices between various communities in the six provinces in the region as well as differences in the availability of health facilities\(^{6}\).

**Conclusion(s)**

Considering the fact that Nigeria remains among the 25 countries still unable to eradicate NNT, there is need for the government and other stakeholders to show increase commitment to achieve the 2015 elimination deadline. In addition to ensuring that all women of childbearing age get immunized with the tetanus toxoid to lifelong immunity, all expectant mothers and TBAs must be educated on caring of the umbilical cords of newborn children in a hygienic manner.

**References**

immunization clinic at the University of Benin Teaching Hospital, Benin City. Niger J Paediatr;38:104–8.


Abbreviation(s)

- NNT - Neonatal Tetanus
- ANC - Antenatal Care
- TBA - Traditional Birth Attendants
- NPHCDA - National Primary Health Care Development Agency
- SPSS - Statistical Package for the Social Sciences
- TT - Tetanus Toxoid

References


Illustrations

Illustration 1

Figure showing mothers that gave birth to NNT babies by umbilical cord treatment status

![Figure showing mothers that gave birth to NNT babies by umbilical cord treatment status](image-url)
Illustration 2

Table 1: 2008 Nigeria Demographic and Health Survey (NDHS) for the North East in comparison to national figure6.

<table>
<thead>
<tr>
<th>2008 Nigeria Demographic and Health Survey (NDHS): North East</th>
<th>Nigeria</th>
<th>North-East Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fertility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total fertility rate</td>
<td>5.7</td>
<td>7.2</td>
</tr>
<tr>
<td>Women age 15–19 who are mothers or now pregnant (%)</td>
<td>23</td>
<td>39</td>
</tr>
<tr>
<td>Births that occurred less than 2 years after the preceding birth (%)</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Current use of any modern method (currently married women 15–49) (%)</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td><strong>Maternal and Child Health</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A. Maternity care</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women who gave birth in the last 5 years who received antenatal care from a skilled provider1 (%)</td>
<td>58</td>
<td>43</td>
</tr>
<tr>
<td>Births assisted by a skilled provider1 (%)</td>
<td>39</td>
<td>16</td>
</tr>
<tr>
<td>Births delivered in a health facility (%)2</td>
<td>35</td>
<td>13</td>
</tr>
<tr>
<td><strong>B. Child immunization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children 12–23 months fully immunized2 (%)</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Children 12–23 months with no immunizations (%)</td>
<td>29</td>
<td>33</td>
</tr>
<tr>
<td><strong>Literacy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literate (women 15–49/men 15–49) (%)</td>
<td>54/77</td>
<td>23/54</td>
</tr>
<tr>
<td>No education (women 15–49/men 15–49) (%)</td>
<td>36/19</td>
<td>68/45</td>
</tr>
</tbody>
</table>

1 Skilled provider includes doctor, nurse/midwife, or auxiliary nurse/midwife. 2 Fully immunized include BCG, measles, and three doses each of DPT and polio.
Illustration 3

Table 2: Cross Tabulation of Whether Participants had the Umbilical Cord of their Newborn Treated by Province

<table>
<thead>
<tr>
<th>Province</th>
<th>Adamawa</th>
<th>Bauchi</th>
<th>Borno</th>
<th>Gombe</th>
<th>Taraba</th>
<th>Yobe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cord Treated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11</td>
<td>13</td>
<td>10</td>
<td>13</td>
<td>19</td>
<td>3</td>
<td>69</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>36</td>
<td>49</td>
<td>28</td>
<td>23</td>
<td>3</td>
<td>147</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>49</td>
<td>59</td>
<td>41</td>
<td>42</td>
<td>6</td>
<td>216</td>
</tr>
</tbody>
</table>
Illustration 4

Table 3: Summary of Chi-squared Tests of Independence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson Chi-Square (χ²)</th>
<th>df</th>
<th>Sig. (p)</th>
<th>Cramer's V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cord</td>
<td>16.963</td>
<td>5</td>
<td>0.005</td>
<td>0.280</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>