

Tetanus in developing countries: an update on the Maternal and Neonatal Tetanus Elimination Initiative

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Abstract

Tetanus is a vaccine-preventable disease that yearly causes a total of 309,000 deaths. Of particular concern is maternal and neonatal tetanus (MNT), which can be prevented through immunization of the mother in pregnancy. In 2000, neonatal tetanus alone was responsible for an estimated 200,000 deaths. While the focus is on 57 priority countries, 90% of the neonatal tetanus deaths occur in 27 countries.

UNICEF is spearheading the effort to eliminate MNT by the year 2005, with the support of numerous partners. MNT elimination is defined as less than one case of neonatal tetanus per 1000 live births at district level. The main strategies consist of promotion of clean delivery practices, immunization of women with a tetanus toxoid (TT) containing vaccine, and surveillance.

Maternal tetanus immunization is, in most developing countries, implemented as part of the routine immunization program. However, large areas remain underserved, due to logistical, cultural, economical or other reasons. In order to achieve the target of MNT elimination by 2005, and to offer protection to women and children otherwise deprived from regular immunization services, countries are encouraged to adopt the “high risk approach”. This approach implies that, in addition to routine immunization of pregnant women, all women of child bearing age living in high risk areas are targeted for immunization with three doses of a tetanus toxoid containing vaccine (TT or Td), implemented as “supplemental immunization activities” (SIAs).

Through SIAs, about 17 million women have been reached with at least two doses of TT vaccine in the past 3 years, and it is estimated that another 200 million need to be targeted in the years to come. SIAs should substantially reduce the burden of disease. Countries will also have to improve their existing immunization and clean delivery programs to ensure that the elimination of maternal and neonatal tetanus is maintained.

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1. Background

At the end of the 1980s, neonatal tetanus was considered a major public health problem. WHO estimated that in 1988, 787,000 newborn children died of neonatal tetanus, hence a rate of 6.5 cases per 1000 live births [1].

In 1989, the 42nd World Health Assembly (WHA) called for elimination of neonatal tetanus by 1995 [2]. In 1990, the World Summit for Children listed neonatal tetanus elimination as one of its goals [3], which were endorsed by the 44th WHA in 1991 [4]. “Neonatal Tetanus Elimination” is defined as less than one case of neonatal tetanus per 1000 live births at the district level [5].

Due to slow implementation of the recommended strategies, the target date for elimination was postponed to 2000

[6,7] and later, while adding maternal tetanus elimination as a goal, to 2005 [8,9].

Progress, however, in reducing incidence has been substantial over the past decade. WHO estimates that in 2000, 309,000 people died of tetanus [10], including 200,000 cases of neonatal tetanus [11], a reduction of about 75% when compared to 1988. As about 4.2 million neonates die yearly in the first 4 weeks after birth [12], neonatal tetanus now contributes to about 5% of global neonatal mortality, compared to 14% in 1993 [13]. Data on maternal tetanus are much more difficult to obtain, but estimates are that up to 30,000 cases occur yearly [14].

The disease has also been reduced geographically: whereas in 1994, 82 countries were considered as not having eliminated NT [1], the focus is now on 57 countries that have not eliminated NT in all districts. Twenty-seven of these account for 90% of all neonatal tetanus cases [8]. Four other countries have indicated that neonatal tetanus

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elimination may have been achieved: Zimbabwe [15], Namibia [16], and Malawi and the Republic of South Africa (unpublished data).

Progress has been partly made possible by a major team-building and fund raising effort spearheaded by UNICEF, which has led to improved program funding and to the involvement of numerous partners [17,18].

2. Strategies of the Maternal and Neonatal Tetanus Elimination Program

Promotion of clean deliveries, improvement of surveillance, and immunization are the main strategies to achieve elimination [8].

2.1. Promotion of clean deliveries

Promotion of clean deliveries is an effective way to reduce maternal and neonatal infections, including tetanus. As part of improving maternal health, it is given high priority by initiatives such as the Safe Motherhood Initiative [19,20]. But with only 30% of births attended by skilled health personnel in the least developed countries [21], there are still numerous challenges ahead. Distribution of clean delivery kits, community education, and training of traditional birth attendants are three examples of how delivery practices are being improved.

2.2. Surveillance

Surveillance for neonatal tetanus is known to be difficult, as most neonatal tetanus deaths occur at home, with birth and death both not being reported. This is particularly the case in areas at highest risk for neonatal tetanus [7,8]. Nevertheless, surveillance for neonatal tetanus remains important, as it helps to target interventions, especially to sustain elimination status or when the disease becomes more rare. WHO has made recommendations on ways to improve neonatal tetanus surveillance [22,23], including integration of existing surveillance systems and building on the experience of polio surveillance [24], but much work remains to be done: WHO received reports of only 15,334 cases of neonatal tetanus in 2000 [25], compared to an estimated 200,000 neonatal tetanus deaths that same year.

2.3. Immunization

Since the 1980s, many children and pregnant women have been immunized with tetanus toxoid containing vaccines. Childhood immunization with three doses of diphtheria and tetanus toxoid and pertussis vaccine (DTP) is estimated to be above 70% throughout the 1990s [11], albeit with large variations between countries and regions. While three doses of DTP are important to protect the children against

vaccine-preventable diseases, including tetanus, it is insufficient to provide protection throughout childbearing life against maternal and neonatal tetanus (MNT) [26]. In the absence of further booster doses, it is immunization of pregnant or adult women that is aimed at reducing maternal and neonatal tetanus. IgG antitoxins, formed after immunization with tetanus toxoid, can pass through the placenta to the foetus, and so protect the newborn from neonatal tetanus [27].

3. Maternal immunization and its role in achieving MNT elimination

Routinely, many countries immunize mothers during their pregnancy with tetanus toxoid. WHO recommends two doses be given during the first pregnancy, followed by one dose in each subsequent pregnancy, up to a total of five doses. Five doses are considered to give protection during the rest of the childbearing years [26]. For women who received childhood doses of tetanus toxoid, fewer doses will be required in adulthood to provide full protection [27].

Reported vaccination of pregnant women with at least two doses of tetanus toxoid (TT2+) has been around or above 50% for most of the 1990s, with reported coverage likely underestimating the true level of protection [25]. But it is in the areas that are underserved in terms of education, health services, and economic development that coverage tends to be lower [11], and that harmful delivery practices are found. Neonatal tetanus cases tend to occur more in these “high risk areas” [28].

As it is difficult in the short-term to improve provision of services in high risk areas, WHO, UNICEF and UNFPA have adopted the “high risk approach”. This implies that in high risk areas tetanus immunization is provided through supplemental immunization activities (SIAs), targeting all women of childbearing age (including pregnant women), with three properly spaced doses of tetanus toxoid containing vaccine [8].

Prior to implementation of SIAs, detailed country plans of action need to be developed, outlining the role and scope of the SIAs. The objective is to immunize at least 80% of all women in the high risk areas with three doses of TT [8]. High risk areas are identified after a review of a series of indicators, based on district level data [29]. As tetanus is non-contagious, SIAs can be implemented in phases over several years, with periodic assessments to ensure on-going high quality of implementation.

SIAs are a powerful tool in the fight to eliminate maternal and neonatal tetanus, as successful examples from Thailand [30], Egypt [28], Venezuela [31], Indonesia (unpublished data) and Morocco [8] have shown. Their effective implementation however poses several challenges. Apart from the difficulties associated with reaching a target population that often is overlooked by routine services, one particular problem is false rumours about possible contraceptive effects of the vaccine. Such rumours have on several occasions

hampered effective implementation of SIAs, and have resulted in low levels of acceptance [32].

UNICEF estimates that it costs about US\$ 1.20 to safely immunize one woman during SIAs with three doses of TT vaccine. This amount includes funds to teach and promote clean birthing practices, as well as the supplies and operational costs. The total program is estimated to cost about US\$ 300 million, of which US\$ 148 million remains to be raised. This amount is needed to immunize the 240 million women in the priority countries through SIAs, to promote clean delivery practices and to improve surveillance. About 17 million women have already been immunized through SIAs in the period 1999–2002 [33].

4. Sustaining elimination

While SIAs are helpful to achieve elimination, other strategies have to be adopted to sustain it. Strengthening of routine antenatal TT immunization and improving access to clean delivery services are essential to sustain neonatal tetanus elimination, but may require an overhaul of the health care delivery system, with a special focus on the immunization program, particularly in remote and underserved areas.

Additional maintenance strategies include providing booster childhood doses with tetanus toxoid containing vaccines. This can be implemented as school-based immunization, especially during the first school years, where enrolment and attendance are high [8,34,35], during measles immunization campaigns, or during other opportunities. These strategies, implemented at regular intervals, typically target boys and girls alike, and hence also have an impact on tetanus occurring in males.

Alternatively, in the absence of structural improvements of routine immunization or clean delivery services, repeat SIAs targeting the new cohorts of women of child bearing age can be used to provide populations with the levels of immunity required to sustain elimination [36].

Further health gains can be obtained by providing a combined diphtheria–tetanus toxoid vaccine. Replacing tetanus toxoid with tetanus–diphtheria toxoid (Td) in all immunization strategies has been recommended by WHO [37], but has found little response in developing countries [38].

References

- [1] Expanded Programme on Immunization. Progress towards the global elimination of neonatal tetanus, 1989–1993. *Wkly Epidemiol Rec* 1995;70:81–5.
- [2] World Health Organization. Handbook of resolutions and decisions of the World Health Assembly and the Executive Board (1985–1992), vol. III. 3rd ed. Geneva: World Health Organization; 1993. p. 102 [Resolution WHA 42.32].
- [3] World declaration on the survival, protection and development of children and plan of action for implementing the world declaration on the survival, protection and development of children in the 1990s. New York: United Nations; 30 September 1990. Available at <http://www.unicef.org/wsc/goals.htm/Major>.
- [4] World Health Organization. Handbook of resolutions and decisions of the World Health Assembly and the Executive Board (1985–1992), vol. III. 3rd ed. Geneva: World Health Organization; 1993. p. 60 [Resolution WHA 44.33].
- [5] Expanded Programme on Immunization. Global Advisory Group. Part II. Achieving the major disease control goals. *Wkly Epidemiol Rec* 1994;69:29–31.
- [6] Expanded Programme on Immunization. Eliminating neonatal tetanus—how near, how far? Geneva: World Health Organization; 1996.
- [7] World Health Organization. Progress towards the global elimination of neonatal tetanus, 1990–1998. *Wkly Epidemiol Rec* 1999;74:73–80.
- [8] World Health Organization, UNICEF, UNFPA. Maternal and neonatal tetanus elimination by 2005. Strategies for achieving and maintaining elimination. Geneva: World Health Organization, UNICEF, UNFPA; November 2000 [WHO/V&B/02.09].
- [9] United Nations General Assembly. Report of the Ad Hoc Committee of the Whole of the 27th Special Session of the General Assembly, Supplement No. 3. New York: United Nations; 2002 [A/S-27/19/Rev.1]. Available at <http://www.unicef.org/specialsession/>.
- [10] World Health Organization. The World Health Report 2001. Mental health: new understanding, new hope. Geneva: World Health Organization; 2001.
- [11] World Health Organization, UNICEF, World Bank. State of the world's vaccines and immunization. Geneva: World Health Organization; 2002.
- [12] Department of Reproductive Health and Research. Annual Technical Report 1999. Geneva: World Health Organization; 2000. p. 63 [WHO/RHR/00.9].
- [13] Department of Family and Reproductive Health. Newborn care. Report of a Technical Working Group. Geneva: World Health Organization; 1996 [WHO/FRH/MSM/96.13].
- [14] Faveau V, Mamdani M, Steinglass R, Koblinsky M. Maternal tetanus: magnitude, epidemiology and potential control measures. *Int J Gynecol Obstet* 1993;40:3–12.
- [15] World Health Organization. Assessment of elimination of neonatal tetanus, Zimbabwe. *Wkly Epidemiol Rec* 2001;76:101–6.
- [16] World Health Organization. Assessment of neonatal tetanus elimination, Namibia. *Wkly Epidemiol Rec* 2002;77:121–3.
- [17] Crossette B. Gates Foundation gives UNICEF \$26 million to combat tetanus. *The New York Times*; 22 November 1999.
- [18] United States Fund for UNICEF. Maternal and neonatal tetanus elimination—links to our partners. Available at <http://www.unicefusa.org/mnt/links.html>.
- [19] Division of Reproductive Health. World Health Day—Safe Motherhood—7 April 1998—Information Kit. Geneva: World Health Organization; 1998. Available at <http://www.who.int/archives/whday/en/whday1998.html>.
- [20] The Safe Motherhood Initiative. Implementing the safe motherhood action agenda: a resource guide; 2001. Available at <http://safemotherhood.org/>.
- [21] UNFPA. The State of the world population 2001: footprints and milestones: population and environmental change. New York: United Nations; 2001.
- [22] Department of Vaccines and Other Biologicals. Field manual for neonatal tetanus elimination. Geneva: World Health Organization; 1999. p. 44–9 [WHO/V&B/99.14].
- [23] Department of Vaccines and Biologicals. Report of a WHO Meeting on Monitoring and Assessment of Vaccine-Preventable Diseases, Cairo, Egypt, 21–23 January 2001. Geneva: World Health Organization; 2002. p. 28–30 [WHO/V&B/02.03].
- [24] Department of Vaccines and Biologicals. Report of a Global Meeting on Communicable Disease Surveillance, Including Epidemic-Prone and/or Vaccine-Preventable Diseases, Cairo, Egypt, 24–25 January

2001. Geneva: World Health Organization; 2002. p. 8–9 [WHO/V&B/02.04].
- [25] World Health Organization. WHO vaccine-preventable diseases: monitoring system—2001 global summary. Geneva: World Health Organization; 2001 [WHO/V&B/01.34].
- [26] Expanded Program on Immunization. Immunization policy. Geneva: World Health Organization; 1996 [WHO/EPI/GEN/95.03 Rev.1].
- [27] Galazka A. The immunological basis for immunization series. Module 3. Tetanus. Geneva: World Health Organization; 1993 [WHO/EPI/GEN/93.13].
- [28] World Health Organization. The high risk approach: the WHO recommended strategy to accelerate elimination of neonatal tetanus. *Wkly Epidemiol Rec* 1996;71:33–7.
- [29] Department of Vaccines and Biologicals. Template of a national plan of action for maternal and neonatal tetanus elimination. Geneva: World Health Organization; 2001 [WHO/V&B/01.18].
- [30] Expanded Program on Immunization. Elimination of neonatal tetanus—Thailand. *Wkly Epidemiol Rec* 1993;68:337–41.
- [31] Expanded Programme on Immunization. Neonatal tetanus 1970–1992—Venezuela. *Wkly Epidemiol Rec* 1993;68:109–12.
- [32] Milstien JB, Griffin PD, Lee JW. Damage to immunization programmes from misinformation on contraceptive vaccines. *Reprod Health Matters* 1995;6:24–8.
- [33] United States Fund for UNICEF. Eliminating maternal and neonatal tetanus; November 2002. Available at <http://www.unicefusa.org/mnt>.
- [34] Kessel E. Strategies for the control of neonatal tetanus. *J Trop Pediatr* 1984;30:145–9.
- [35] Steinglass R. Using early childhood booster doses to maintain the elimination of neonatal tetanus. Arlington: Basics; 1998.
- [36] Steinglass R. A better future for children: Progress toward world summit goals for health and nutrition—eliminating neonatal tetanus. Basics II; June 2001.
- [37] The Children's Vaccine Initiative (CVI) and WHO's Global Programme for Vaccines and Immunization (GPV). Recommendations from the Scientific Advisory Group of Experts (SAGE). Part 1. *Wkly Epidemiol Rec* 1998;73:281–8.
- [38] Vaccines and Biologicals. Recommendations from the Strategic Advisory Group of Experts. *Wkly Epidemiol Rec* 2002;77:305–11.