ELIMINATING NEONATAL TETANUS: AN ANNOTATED BIBLIOGRAPHY

WORKING PAPER: 1

January 1990
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Constance Keedle, Technical Assistant
MotherCare Project

MotherCare Project
1616 N. Fort Myer Dr., 11th Floor
Arlington, VA. 22209

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<tr>
<td>AFRO</td>
<td>WHO Regional Office for Africa</td>
</tr>
<tr>
<td>DPT</td>
<td>Diphtheria/pertussis/tetanus</td>
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<tr>
<td>EPI</td>
<td>Expanded Program on Immunization</td>
</tr>
<tr>
<td>GAG</td>
<td>Global Advisory Group</td>
</tr>
<tr>
<td>KAP</td>
<td>Knowledge, attitudes and practices</td>
</tr>
<tr>
<td>MCH</td>
<td>Maternal and child health</td>
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<tr>
<td>MOH</td>
<td>Ministry of Health</td>
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<tr>
<td>NNT</td>
<td>Neonatal tetanus</td>
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<tr>
<td>PHC</td>
<td>Primary health care</td>
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<tr>
<td>SEAR</td>
<td>WHO Regional Office for South-East Asia</td>
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<tr>
<td>SES</td>
<td>Socioeconomic status</td>
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<tr>
<td>TBA</td>
<td>Traditional birth attendant</td>
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<td>TT</td>
<td>Tetanus toxoid</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<td>WHO</td>
<td>World Health Organization</td>
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INTRODUCTION

Neonatal tetanus causes more than three quarters of a million deaths per year. Second only to measles, neonatal tetanus kills more children than any of the other diseases targeted by WHO's Expanded Programme on Immunization. While several countries have increased coverage of measles vaccine, coverage with tetanus toxoid remains inadequate. To eliminate neonatal tetanus, mothers must be immunized. WHO guidelines recommend five doses to insure protection throughout a woman's reproductive years.

In addition, the elimination of neonatal tetanus relies heavily on adequate reporting of immunization coverage and of neonatal tetanus mortality and on the practice of clean delivery. Many countries have not yet begun to measure the toll neonatal tetanus is taking. In many of these countries, births are carried out by attendants who may not always practice clean, safe delivery. Until these birth attendants are trained in sterile techniques and until they practice these techniques, neonatal tetanus will continue to strike down infants.

The MotherCare Project has made the elimination of neonatal tetanus a focus in its efforts to improve pregnancy outcomes. This bibliography is assembled as a step toward promoting greater understanding of the issues involved in neonatal tetanus elimination. It is divided into nine chapters. The first chapter is a complete alphabetical listing of all references, of which there are more than 230 entries. The following chapters categorize these same references by headings representing major areas in neonatal tetanus, including:

- The definition, history and background of tetanus, including reviews of tetanus;
- Immunological aspects;
- Surveillance of tetanus, including techniques as well as the results of surveys conducted;
- Immunization coverage;
- Missed opportunities in the campaign for tetanus immunization;
- Beyond immunization: training of traditional birth attendants, determining perceptions, and building on cultural patterns;
- Cost analyses; and
- Workshops/Meetings, including reports on several workshops or meetings that have been conducted throughout the world.
After each section are abstracts of key articles. Key articles are noted in the reference list by a star beside the name of the first author. Articles abstracted were selected by experts as key to understanding the present status of policies, program interventions, levels of neonatal tetanus, and immunization coverage. As we have tried to be selective in the materials presented, we acknowledge that the information is not comprehensive. However, we feel the abstracted articles provide a good overview of the present status of neonatal tetanus and the efforts in place to eliminate it.

Marjorie Koblinsky, Ph.D.
Director
MotherCare Project

Constance Keedle, M.P.H.
Technical Assistant
MotherCare Project
CHAPTER 1

NEONATAL TETANUS REFERENCES
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8002 Action plans for the accelerated control of neonatal tetanus presented at the workshop held in Cotonou, Benin, September 19-26, 1988, for the following countries: Burkina Faso - 10 pages; Zaire - 12 pages; Niger - 15 pages; Republique de Guinee - 13 pages; Chad - 25 pages; Republique Federale Islamique des Comores - 17 pages; Cote d'Ivoire - 16 pages; Republique Populaire du Benin - 27 pages; Togo - 12 pages; Madagascar - 20 pages. All in French. Unpublished. 1988.

8003 Action plans for the elimination of neonatal tetanus presented at the workshop held in Dakar, Senegal, December 12-19, 1988, for the following countries: Republique du Cameroun - 21 pages; Republique Populaire du Congo - 16 pages; Republique Centrafricaine - 17 pages; Republique Populaire Democratique Algerienne - 17 pages; Republique Gabonaise - 18 pages; Republique du Rwanda - 18 pages; Republique du Senegal - 17 pages; Republique du Mali - 19 pages; Republique Islamique de Mauritanie - 14 pages. All in French. Unpublished. 1988.

8004 Action plans for the elimination of neonatal tetanus presented at the WHO workshop held in Nairobi, Kenya, April 10-18, 1989, for the following countries: Botswana - 11 pages; Kenya - 8 pages; Lesotho - 7 pages; Malawi - 8 pages; Seychelles - 7 pages; Swaziland - 12 pages; Uganda - 13 pages. Unpublished. 1989.


6005 Babaniyi, O.A. How to improve surveillance of neonatal tetanus through: routine and sentinel reporting. Unpublished paper. 6 pages. No date.


Diarrhoeal diseases control programme (CDD) and expanded programme on immunization (EPI); joint programme surveys. Weekly Epidemiological Record 63, 10: 65-72. March 1988.


Neonatal tetanus/tetanus in paediatric ward, Revolution Hospital, Taiz. Division of Epidemiology, Department of Preventive Medicine, Ministry of Health, Yemen Arab Republic, January 1982. Unpublished paper. 9 pages. 1982.


*Odumosu, M.O. Knowledge about tetanus among selected women in the urban centre of Ile-Ife, Nigeria. Tropical Doctor 12: 70-72. April 1983.


6060 Sample survey to estimate the incidence of poliomyelitis and neo-natal tetanus in Gujarat. EPI Section, Directorate of Health and Medical Services and Medical Education (Health Section), Government of Gujarat, Ahmedabad, Gujarat, India. Unpublished paper. 20 pages. 1981.


Tetanus. From Immunization Against Disease. Atlanta, Georgia: Centers for Disease Control monograph, Department of Health and Human Services. 51-52. 1980.


CHAPTER 2
DEFINITION OF TETANUS,
HISTORY, REVIEWS
DEFINITION OF TETANUS, HISTORY, REVIEWS


Tetanus. From *Immunization Against Disease*, Atlanta, Georgia: Center for Disease Control monograph, Department of Health and Human Services. 51-52. 1980.


The entire issue of this paper is about neonatal tetanus. A list of readings is included on page 4. In an article entitled "Undoing the Curse of Neonatal Tetanus", reasons are given for the underreporting of NNT:

1. Women and infants are often secluded after birth for cultural reasons. Infant deaths from NNT may go unnoticed.

2. Births and deaths at home within the first year may go unreported to authorities because mothers may have a fatalistic attitude regarding infant deaths.

3. Often newborns are not taken to health centers for treatment. In addition, NNT is frequently reported as simply "tetanus". Therefore, the disease is not recognized as a child survival problem.

4. Health workers don't report for fear of being blamed.

5. The emphasis by Western medicine on curative rather than preventive medicine excludes attention to NNT.

6. Mothers are often unwilling to discuss a neonatal death because they are ashamed.

Also included in this article:

Each case of NNT reflects several failures in MCH services and should serve as an alarm.

Most developing countries with 5-year plans to reduce infant mortality would achieve their initial target by control of NNT alone.

Article entitled "Sustainability of NNT Prevention Programs".

Experience in Haiti suggests informal education among people themselves is the single most important factor in the sustainability of NNT prevention programs in that country. Conducting investigations on reasons why children continued to die from NNT even after prevention programs were underway lessened the number of future deaths even more.

Article entitled "Training Traditional Birth Attendants for Neonatal Tetanus Prevention".

Training TBAs does not lower NNT incidence enough for the measure to constitute a viable NNT control strategy in its own right. This is true partly because the TBA must often work in unsterile conditions. Also, many other individuals care for a newborn and are possible vehicles of tetanus spores. Studies show many TBAs revert to pretraining practices even when they know proper sterile procedures. TBAs often forget how to use their UNICEF delivery kits or simply do not use them.
NNT was prevalent in the Scottish Islands in the 18th and 19th centuries. In the island of St. Kilda, neonatal mortality reached 690 per 1000 live births and was passively accepted by the community.

The author cites several diaries and journals describing the history of NNT on the island and the anguish of residents who had lost their children. In 1907, MacCallum records "The St. Kildans were so accustomed to the death of their infants that they neglected to provide clothes for their babies until after the danger period. Some expectant mothers however, avoided the risk of tetanus by leaving St. Kilda in late pregnancy, to go to the Island of Harris for their confinement."

Some of the historical ideas concerning the etiology of NNT were:

- the diet of the expectant mothers;
- improper feeding of the infant;
- the smokey atmosphere and bad ventilation of the home environment; and
- bad sanitation and cow-dung within the houses.

Birth trauma was also blamed, as well as intermarriage of the islanders. Later ideas blamed umbilical sepsis or phlebitis as the source of NNT. It now seems that unsanitary environmental conditions perpetuated the existence of the bacteria and in the majority of cases, infection was acquired by way of the umbilical cord.

Preventive treatment of NNT began in 1890 when a nurse arrived on the island at the request of the local minister, the Rev. Angus Fiddes. The nurse stayed for a total of two years, during which time she sought help for the NNT problem. After her departure, Rev. Fiddes went to Glasgow and received instructions in the application of iodoform to the umbilical stump of newborns. With these simple instructions, no further death from NNT occurred in St. Kilda. The island was evacuated in 1930.

Two tables are included in this article: one showing the age at time of death from NNT in St. Kilda during the time period 1830-1930, and the other showing the neonatal mortality rate in St. Kilda during the time period 1830-1930.
NNT is an invisible killer because a vast number of cases go unreported. It is estimated that 800,000 to 1 million children die of NNT each year, yet routine reporting identifies only 2% of the cases. A combination of training TBAs and immunizing women at risk is the best way to curb the disease. There is no contraindication to immunization early in pregnancy, yet TT coverage of pregnant women in developing countries is only 14%. Strategies should aim at reaching all women of reproductive age. TT should be administered during immunization days, when children are also given immunizations.

Training TBAs has less of an impact in preventing NNT than immunization but can have a greater impact on overall infant mortality. Both strategies should be pursued. Few countries have succeeded in training more than half of the estimated total number of TBAs.

Action for countries where NNT has not been eliminated requires the following steps:

1. defining the problem through surveys, identifying high risk areas and population groups, and making NNT a notifiable disease;
2. training TBAs;
3. investigating reasons for cases of NNT and ways of preventing future cases; and
4. immunization.

A table is provided which reports on a country-by-country basis NNT incidence, NNT mortality rates, and coverage of tetanus.
Using survey data, WHO has estimated the extent of NNT in 5 countries in the Middle East and 6 countries in Asia. Less than 5% of these cases had been detected through current reporting systems. Country data from these and other surveys are summarized in a table.

While most data on NNT are obtained through retrospective surveys, prospective longitudinal studies in which all pregnancies are identified and outcomes are followed are a more reliable method for determining the incidence of NNT.

The 7 factors thought to affect the risk of NNT infection are as follows:

1. environmental exposure to tetanus organisms;
2. sex of the child (NNT deaths are more frequently reported in males);
3. place of delivery;
4. type of birth attendant;
5. cord care practice;
6. immunization status of the mother; and
7. socioeconomic status.

The protective effect of TT was demonstrated in a double-blind controlled field trial in Colombia (table included) and in Schofield's 1961 New Guinea study. The success of combined strategies (TBA training, hospital care, immunization of pregnant women, and immunization of all women) was demonstrated in Berggren's 1974 report of a tetanus control program in Haiti.

It is important to recognize that TT will, in addition to eliminating NNT, also eliminate postpartum and postabortal tetanus (Bennet, 1976).
After measles, NNT remains the second leading killer of children among the EPI diseases. In some countries it could soon become the leading cause since accelerated efforts have increased coverage of measles but have little effected coverage of TT. As of June 1987, special community-based mortality surveys have been carried out in 32 countries, including 14 of the 25 most populous countries. This represents 58% of all infants in the developing world, excluding China.

Briefly, estimated regional statistics are the following:

- The African region estimates 200,000 deaths due to NNT, or approximately 25% of all NNT deaths in the developing world, excluding China.
- In the Eastern Mediterranean region, NNT mortality rates range from 2-4 deaths per 1000 live births in Jordan, Democratic Yemen and YAR to 30 deaths per 1000 live births in Somalia.
- In Southeast Asia, there are an estimated 270,000 deaths annually, or 34% of worldwide NNT deaths.
- In the Western Pacific region, NNT mortality rates range from 2-4 deaths per 1000 live births in Vietnam and Laos to 6 deaths per 1000 live births in the Philippines.

NNT still represents about half the neonatal deaths and about 25% of infant mortality. Since 1984, TT coverage of pregnant women has increased from 11% to 18%, only a 7% incremental increase. Low increases in TT coverage is due to 2 major causes:

1. lack of professional awareness of the magnitude of the problem; and
2. lack of public awareness of the efficacy of TT.

A table showing the percentage of births attended by TBAs and the percentage of trained TBAs reported in selected countries in the WHO regions is provided.

A summary of recommendations included in the resolution adopted by the VIII International Conference on Tetanus held in Leningrad is provided. These recommendations were endorsed by the GAG.

A reference list of figures and a list of tables is provided as well.
This brief fact sheet gives basic information about NNT, its incidence, transmission, and symptoms.

Some facts about NNT are:

- It is one of the six vaccine-preventable diseases targeted by WHO's Expanded Programme on Immunization (EPI).
- Treatment of NNT is difficult and generally unsuccessful.
- Almost 100% of babies born with NNT die.
- Tetanus is not a contagious disease.
- The first sign of NNT is the infant's inability to suck:
- Muscular stiffness and spasms develop and may be accompanied by convulsions.

Also included on this fact sheet is information about immunization:

- In the developing world, tetanus immunization coverage rate for pregnant women is estimated at about 20%.
- DPT and TT must be stored between 0 degrees Centigrade (22 degrees Fahrenheit) and 8 degrees Centigrade (46 degrees Fahrenheit).
Protection against NNT infection has lagged behind the results achieved for other immunizable diseases. This paper outlines in detail a number of the country experiences with strategies that have been applied to increase immunization coverage for pregnant women and to use other protective measures to reduce NNT.

The true incidence of NNT is not known because of very limited reporting. The author asserts that routine reporting identifies less than 3% of cases. A table shows community survey results of NNT mortality rates ranging from 2/1000 live births to 67/1000 in 32 countries (1978-87).

Immunization coverage of pregnant women in developing countries with 2 doses of TT is estimated to be less than 20% worldwide. Reasons for this are:

1. a lack of professional awareness of the problem;
2. difficulty in identifying pregnant women;
3. fear of pregnant women to be injected;
4. infrequent availability of female vaccinators;
5. difficulty in reaching illiterate women who are at high risk for unhygienic obstetrical practices;
6. failure to include TT for women in acceleration efforts;
7. inadequate obstetrical care;
8. unfounded rumors;
9. need for trained personnel to administer TT which requires intradermal injection (sic: TT is administered intramuscularly, not intradermally);
10. difficulty in determining coverage rates;
11. failure to set disease reduction targets; and
12. reported coverage may underestimate protection.

Several examples of these constraints are given.

Risk factors for NNT are:

1. environmental exposure;
2. sex;
3. place of delivery;
4. birth attendant;
5. cord care practice; and
6. immunization status of the mother.

Again, several examples are given.

Approaches to improving protection are:

- Sensitize governments, health officials, workers and the public about the extent of the problem. Documentation has been carried out through local community surveys.
• Spread information regarding the efficacy and safety of the TT vaccine. The author cites studies in Sri Lanka, Mozambique and Colombia where the protective effectiveness and safety of TT were firmly established.

• Improve maternity care through TBA training. Several studies are cited which show the benefits of training TBAs. Two tables show the reduction in NNT mortality in Bangladesh and in China after TBA training was initiated.

• Initiate strategies to increase coverage of women with TT immunization. These strategies may include extending the target group to all women of child-bearing age, immunizing girls on entry or exit from school, and using innovative approaches such as training women immunizers, using women's groups, and requiring TT immunization to obtain a marriage license. A table outlining the advantages and disadvantages of immunization approaches is included.

• Use complimentary strategies. Among the more commonly cited strategies are the use of a maternal health card, the issuance of the EPI newsletter, and the use of a computerized information system for comparison and follow-up. Examples of the success of such combined strategies are given.

Recommendations for UNICEF programming include advocacy, social mobilization, education and training of health workers, training of TBAs, inclusion of tetanus immunization in all accelerations of EPI, improvement of maternity care, setting disease reduction targets, and collaboration with other organizations regarding tetanus control.

Lastly, a fact sheet on tetanus, its cause, clinical characteristics, and incidence is included.
Many health services have failed to appreciate the seriousness of the problem of NNT. In some parts of the world, tetanus kills more newborn babies than any other factor. All forms of tetanus, especially NNT, remain substantially underreported in many developing countries.

In most developed countries, NNT has disappeared or its incidence has declined to very low levels. The experience of these countries proves that tetanus can be controlled.

Pioneer studies in some developing countries have provided estimates of NNT incidence per 1000 live births. Mortality rates from these studies could be used as an index of the quality of maternal health services in general. Figures from hospitals in several countries have shown more males than females suffering from NNT. However, one reason for these statistics may be the greater likelihood that males will be brought to the hospital. Another reason may be the customs of some countries - the way in which the cord is cut, the subsequent handling of the cord stump, and the role of early circumcision.

Several questions regarding the control of NNT remain unanswered: What is the significance of the sex differences in mortality? In what ways does contamination occur? Why have the acceptance rates for TT immunization in pregnancy been so low in some regions, despite health education?

NNT should be a notifiable disease and should be reported separately from non-neonatal tetanus. Two major paths will have to be followed in order to achieve the goals of WHO:

1. care in the antenatal, delivery, and neonatal periods; and
2. maternal immunization with TT.

The elimination of NNT calls for a full commitment by governments and by other bodies, public and private. One case of NNT is one case too many.
This extremely thorough review of the data on NNT documents all aspects of the disease.

NNT is an important cause of avoidable morbidity and mortality. NNT has been overlooked by health services in many countries but it is now becoming apparent that this disease is a very serious health problem in developing countries. The results of community-based surveys show that NNT mortality rates range from 3 per 1000 live births in urban Egypt to more than 60 per 1000 live births in rural India. A table shows mortality rates for several countries in the WHO regions (Pakistan, Dem. Yemen, Egypt, Somalia, Syrian, Sudan, Yemen Arab Rep., Ivory Coast, Cameroon, Malawi, Bangladesh, Bhutan, India, Indonesia, Nepal, Thailand, and the Philippines). These deaths represent 23%-72% of all neonatal deaths and the results so far suggest that NNT claims the lives of over half a million newborn children every year. At the same time, tetanus (particularly NNT) remains substantially under-reported in many countries; routine reporting systems identify only about 2-5% of the estimated number of tetanus cases. More reliable and accurate estimates of the incidence and mortality from tetanus are required. No data on mortality rates in Latin America have been obtained.

This report cites some of the landmark studies of NNT occurrence and prevention, i.e., Schofield, 1961; Newell, 1966; Bytchenko, 1966; Miller, 1972; Berggren, 1974.

Some of the factors influencing NNT mortality rates are:

- age at death and onset (often more than 90% of NNT deaths occur in the first 2 weeks of life);
- sex distribution (more males than females are reported to be infected with NNT, however the reasons for this are unclear);
- conditions of antenatal care and delivery (NNT occurs more frequently in home births than hospital births); and
- the status of TT immunization of women of child-bearing age.

The authors purport that a momentum needs to be maintained to eliminate the danger of NNT. Governments must be sensitized, surveys must be extended, and national surveillance must be developed. To control NNT, TBA's must be trained and antenatal TT immunization must become an urgent priority in immunization programs of those countries where there is continuing neonatal mortality from tetanus.

The authors reiterate the recommendations of the WHO meeting in Lahore (1982) as the best strategy for controlling NNT.

Lastly, this review includes several tables showing the NNT mortality rates in many countries (developed and developing), the number of NNT cases and deaths by day of onset and day of death, and the distribution of NNT deaths in some countries. This article should be used as a key article in the review of NNT.
This definition of tetanus includes a brief history, the causes of the disease, its symptoms, prevention, and treatment.

Also called "lockjaw", tetanus is a disorder of the nervous system. Hippocrates (400 B.C.) refers to its rapidly fatal character. The cause of tetanus was discovered in 1889 by Kitasato, a Japanese observer, to be a bacillus, *Clostridium tetani*, which inhabits earth, dust, and manure. The bacillus develops a toxin which finds its way to the motor nerves and the spinal cord, where it does its damage.

Symptoms of tetanus are stiffness in the muscles near the wound and later, stiffness in the jaw muscles (trismus). "Risus sardonicus" is the term for the peculiar expression seen on the face of one inflicted with tetanus. The body may assume a bent position either backward (opisthotonos), forward (emprosthotonos), or laterally (pleurothotonos), and convulsions will ensue. The function of respiration may be involved and asphyxia may take place. High temperature and copious perspiration is also a constant symptom. Death may ensue. In the absence of the highest medical and nursing skills, tetanus is highly fatal.

Immunization with tetanus toxoid provides protection against the disease and tetanus antitoxin is used for both treatment and as a prophylactic measure if given immediately after a wound has been infected. Antibiotics active against *Cl. tetani* are benzathine penicillin (for use with TT), benzylpenicillin, erythromycin, tetracycline, and metronidazole. Quietness, a darkened room, and the absence of excitement are important to prevent convulsions.
CHAPTER 3
IMMUNOLOGICAL ASPECTS


This 1959 report was written in an attempt to assemble the existing basic knowledge on tetanus and to construct a rational set of procedures for the prophylaxis of tetanus. All aspects of tetanus are thoroughly discussed; hence, this document is recommended to health professionals desiring a complete review of the immunology of tetanus.

Subjects discussed are as follows:

**Active and Passive Immunization Against Tetanus**
- passive immunization is rapid but transient while active immunization, as achieved by TT, is longer lasting. Active immunization is the procedure of choice.

**Use and Effectiveness of TT in Routine Immunization**
- Reagents and procedures
- Indications for active immunization against tetanus - recommended for all child health programs, industrial and other immunization programs, allergic individuals, those who have previously been treated for tetanus, higher risk groups (farmer, hunters, machine operators, and for military personnel).
- Effectiveness of TT - a table shows cases of tetanus in immunized persons amongst British troops; the author questions the selection of 0.1 IU/ml as the "threshold of protection" and suggests a lower level may be adequate.
- Immunological response to TT - there are 3 stages to adequate tetanus immunization - the 1st injections, the reinforcing dose, and subsequent booster doses.
- Interval between basic injections.
- Response in young infants - it is suggested in this section that the prevention of NNT can be achieved through immunization of pregnant mothers.
- Competition of antigens.
- Duration of effect of primary immunization.
- Maintenance of tetanus immunity - routine booster dose.
- Frequency of administration of booster dose.
- Reactions to tetanus toxoid - although rare, local reactions have been reported to occur in those who have had numerous inoculations.
Response to booster dose - the author cites several studies (Bigler, Regamey & Schlegel, Looney et al., Turner et al., Peterson et al., Moss et al.) which establish that a routine booster dose of TT, given as long as 15 years after the last injection of toxoid, will induce a rise in antibody level, except in rare cases.

Rate of response to booster inoculation - it appears that about 95% of subjects receiving a booster injection will respond within 4 days, and about 100% within 7 days, even when 10 or more years have elapsed since the last inoculation (Bigler, Regamey & Schlegel, Turner et al., Looney et al., Peterson et al., Moss et al., Miller et al., Schlegel, Volk et al., Ipsen).

Management of Patients with Tetanus-prone Injuries

- the types of injuries that require tetanus prophylaxis are:
  1. wounds over 3-4 hours old;
  2. definitely infected wounds;
  3. wounds through skin probably contaminated by soil;
  4. all deep and punctured wounds;
  5. wounds with devitalized tissue; and
  6. wounds that cannot be closed properly.

Handling of immunized patient.

Interval between booster doses - no basis for an absolute rule; the author recommends a one-year interval.

Effectiveness of combined active-passive immunization in previously immunized persons.

Tetanus prophylaxis in unimmunized patients.

Active-passive immunization in the unimmunized subject.

The journal has not included the author's references for this report - they may be obtained in the author's reprints only.
A brief explanation of the minimum maternal antitoxin antibody level required to prevent neonatal tetanus is provided.

A comparison of adsorbed versus plain tetanus toxoid reports that adsorbed provokes higher titers and longer duration of protective levels of antitoxin antibody, with fewer doses of tetanus toxoid. There is disagreement on the advantages of one or the other for persons with prior tetanus toxoid immunization. Adsorbed vaccines have been reported to cause more frequent reactions when used for boosters.

Toxoid content and potency of tetanus toxoid is discussed with graphs delineating:

1. tetanus antitoxin antibody response in previously unimmunized persons to normal concentration tetanus toxoid; and

2. serum tetanus antitoxin titers 28 days after one dose of tetanus toxoid of varying toxoid and alum content.

Program strategies for immunization are suggested, including pregnant women, women in fertile age range (15-45) and children as target groups. The immunization of pregnant women is discussed in detail; the recommended immunization schedule being two doses of standard adsorbed tetanus toxoid administered at least six weeks apart and at least four weeks prior to delivery.

The safety and effectiveness of single-dose and high potency preparations is discussed, as well as the duration of immunity and the use of recall doses (boosters).

The safety of tetanus toxoid is asserted. However, unconfirmed reports of increased antibodies to blood group substances A and B and of increased incidence of neonatal jaundice are cited.

It is recommended that the primary response to high potency tetanus toxoid and the use of booster doses in adult women are two areas that require further research.

Author abstract - "Immunization of pregnant women in New Guinea with three injections of plain toxoid had previously been shown to prevent neonatal tetanus. In the present study antitoxin levels induced by two oil-adjuvant toxoids (one injection), one AlPO toxoid (two injections) and one plain toxoid (three injections) were compared with those induced by the same plain toxoid as used in the earlier study. At term there was no significant difference in the levels for the five toxoids, but those for the plain toxoids later declined rapidly. AlPO-toxoid titres were significantly higher than the titres for the plain toxoids at the end of a year, but lower than the oil-adjuvant titres, which were the highest and most persistent. However, unacceptable side-effects (induced by subsequent lots of oil-adjuvant toxoids) preclude their routine use at present. The results indicate that a maternal antitoxin level at delivery of 0.01 unit/ml is protective. Aluminum-compound toxoid rapidly achieved titres that were better than this for at least a year, with minimal side-effects. Hence such toxoids are recommended for maternal immunization to prevent neonatal tetanus."

Table 1 shows the composition and dosage schedule of toxoids.

Table 2 shows the number of bleedings in relation to first toxoid injection.

Table 3 shows the antitoxin titres of individual subjects from initiation of immunization through 64 weeks (antitoxin units per millilitre). All five (A-E) toxoid schedules are given.

Table 4 shows the highest titre responses and their means, and the mean titres after approximately one year.

Table 5 shows the interval between first injection and delivery, and antitoxin titre of last antepartum serum.

Table 6 shows the distribution of antitoxin titres of sera obtained nearest to delivery.

Figure 1 shows graphs for each toxoid, showing the mean antitoxin titres and 95% confidence limits in women immunized.

At the time of publication, the authors recommendation was that in those areas where "scientific midwifery" was absent, immunization with an aluminum-adjuvant toxoid, using two injections for primary immunization, was the best means of preventing NNT.
This report was one of the first to document and recommend the use of TT for the prevention of tetanus. The author discusses tetanus due to injuries of soldiers during wartime, the protective level and importance of recall dose (at this point in time, the protective level was still a matter of conjecture), and the duration of protection (several studies showed that considerable amounts of antitoxin could be found in the blood 1-5 years after vaccination). The author also suggests that immunization of women during pregnancy can help prevent NNT. Finally she cites successes in the combination of a diphtheria-tetanus vaccination for infants and children.

Author synopsis - "Both in animal experiments and in the course of two world wars active immunization has proved a safe method of protection against tetanus, and a method superior to passive serum prophylaxis. The three types of vaccine--plain, combined and precipitated or adsorbed--all have their advantages and disadvantages, and the choice between them must be left to individual national health authorities. They should, however, be administered in two or three doses to confer basic immunity. What amount of circulating antitoxin is necessary to give full protection has not been accurately determined, but it is clear that one recall dose should be given about a year after the first injections as part of the routine course of injections. This seems enough to provide a long-lasting immunity, but a dose of vaccine should also be given at the time of injury. General immunization of the population is not practicable, but children, who are among the groups most at risk, can be immunized relatively simply by combined diphtheria and tetanus vaccine; in many countries, indeed, this is being done on an ever-increasing scale."

Table 1 shows tetanus incidence in British and U.S. armies during the first and second world wars. The highest incidence was in British troops during WW1 (14.7/10,000 wounded).

Figure 1 gives a schematic curve of antitoxin response to a basic course of tetanus immunization. Three injections cause a maximum level of 0.1 to 1 unit/ml in about 6 weeks. In the next year, antitoxin content may fall to between 0.01 and 0.1 unit/ml.

Figure 2 gives a schematic curve of antitoxin response to recall dose of tetanus vaccine given one year after the basic course of immunization. The titre rises to between 1 and 10 in about 2-3 weeks, then falls to around 0.1 to 1 in the next year.

Figure 3 gives a schematic curve of antitoxin response to recall injection of tetanus vaccine in previously immunized persons. After 4 days, the levels increase rapidly to 10.0 AU/ml. (sic: AU are equal to IU).
This landmark study provided a sufficient basis on which to establish a firm immunization schedule for pregnant women. The main objectives of this study were:

1. to establish a practicable and effective immunization schedule for injections of pregnant women with TT to ensure good immunity against tetanus for the mother and her newborn infant; and

2. to study the administrative and organizational problems likely to arise in the field when this programme was introduced in the State's maternity and child welfare (MCH) and primary health centers.

In this field study, a fluid and an adsorbed toxoid were used in a total of 377 women. Eighty-eight percent and 47% of the cord blood samples from women receiving three doses of adsorbed toxoid and fluid toxoid respectively, had a protective titre of 0.01 IU/ml or more. When they were contacted late in pregnancy and received only one or two doses of toxoid, antitoxin titres were lower both in venous blood and in cord blood.

Table 1 shows the tetanus antitoxin titre of cord blood sera following active immunization of the subject with a fluid tetanus toxoid (a total of 44.6% of sera with titre greater than or equal to 0.01 IU/ml is shown).

Table 3 shows that the percentage of venous blood sera titre greater than or equal to 0.01 IU/ml is the same (44%).

Table 5 shows tetanus antitoxin titre of cord blood sera following active immunization of subjects with adsorbed TT (a total of 61% of sera with titre greater than or equal to 0.01 IU/ml is shown). While titres are nil after one dose, the percentage rises to 42% after two doses and 88% after three doses.

Several tables outline the results of titres either in cord blood or venous blood and either using fluid toxoid, adsorbed toxoid, or a combination of the two.

This trial was conducted in a semi-rural area with well-developed health services. Out of 377 women covered by the trial, 290 (76.9%) received a full course of 3 doses of TT; another 57 (15.1%) received 2 doses and 30 (8%) received one dose. The authors recommend that a two dose regimen be initiated in rural areas where health services are not so well-developed. They also strongly recommend that only a purified adsorbed type of toxoid be used in this case.
CHAPTER 4

IMMUNIZATION COVERAGE
IMMUNIZATION COVERAGE


In Nusatenggara Barat, the incidence of NNT is one of the highest in Indonesia. In addition, the infant mortality rate is 1.75 times the national average and 3 times the figure for the province with the lowest rate. A 1983 national survey showed a rate of 66/1000 in some areas of this province, as compared to the national average of 11/1000. A special intensification of the NNT immunization program was conducted between January and April 1985 amongst a population of approximately 609,000.

Family welfare workers in the area (approx. 8000) were made responsible for the registration of all women of childbearing age. Three days before the immunization, the welfare workers revisited all women identified, informing them of the date and giving them appointment cards. Thirty-one nursing school graduates were trained and health center doctors as well as district and provincial health staff were responsible for supervision. A total of 1086 immunization sessions were organized. Each nurse was able to administer up to 300 immunizations per day.

During this program, 129,728 (96%) out of 135,642 targeted women received TT1 while 125,982 (93%) received TT2. Table 1 shows these results by sub-district.

This program proved successful for the following reasons:

- family welfare workers existed and participated;
- the NNT program met an identified need;
- there was cooperation between the local government, a women's group, the PKK (unidentified in text), and the Ministry of Health; and
- there was a strong political will to reduce the infant mortality rate in this province.
Neonatal tetanus accounts for 30-40% of all neonatal deaths in Bangladesh. The possible relationship between NNT and birth order was studied in an attempt to identify high risk groups. In this study, all neonatal deaths occurring between 1974 and 1982 were selected from computer data files. Only those deaths occurring between 4 and 14 days were included.

Results showed no significant difference between tetanus and non-tetanus neonatal mortality in birth order (see Table 1).

Table 2 shows that half of all neonatal deaths occurred in families where one child had died already. A comparison of tetanus vs. non-tetanus deaths does not suggest that those who die from tetanus are at a higher risk of having a sibling death compared to other neonatal deaths.
The neonatal death rate in Rangpur District (population 800,000) is estimated at over 150 per 1000 live births and a leading cause of neonatal mortality is NNT. An attempt to control NNT was made by using three approaches: administration of TT to pregnant women, sale of delivery kits to pregnant women, and training of dalas (TBAs).

TT was originally offered at immunization clinics; however, low attendance prompted health workers to note all pregnant women in their area and offer TT immunization in their own homes. The number of doses of TT administered increased from about 2,500 in 1978 to over 27,000 in 1982. The number of TT doses per recorded live birth increased from 0.29 in 1978 to 1.28 in 1982. In 1982, over 12,000 pregnant women received TT.

Delivery kits were offered for sale at a subsidized rate of 3.5 takas (US $0.15).

None of the dalas in the training group were literate. The course used stories, questions, and role playing. The main lessons concerned clean deliveries, cutting and dressing the umbilical cord, and recognition of pregnancy complications requiring more qualified help. No remuneration was offered; however, all trained dalas were allowed use of the maternity centers for advice and referral. In addition, the maternity centers were used for refresher courses. In 1980, there were 44 dalas trained. In 1981, this number increased to more than 100.

Direct measurement of changes in morbidity and mortality from NNT has not been possible; however, in 1978, NNT was the 3rd leading cause of death. In 1982, it ranked 7th.

Table 1 shows the population served, number of recorded births and number of deliveries performed in maternity centers, Rangpur District 1978-82.

Table 2 shows the number of TT doses given, delivery kits sold, and dalas trained. In 1978, 483 delivery kits were sold. For every year after, this number increased drastically. In 1982, 8,866 delivery kits were sold.

Table 3 shows a decline in deaths due to NNT from 12% in 1978 to 5% in 1982.
This update discusses the problem of NNT in the developing world, the progress being achieved, and actions needed to guarantee protection against this disease.

In many countries, NNT causes half of all neonatal deaths and accounts for a quarter of infant mortality. Among the 800,000 deaths from NNT, at least 270,000 are in the South East Asian Region and 200,000 in the African Region.

High coverage with TT can be successful in preventing NNT. Examples are given of successes achieved in Mozambique, Indonesia, Haiti and Sri Lanka. Figure 1 shows the dramatic decrease in reported cases of NNT from Central Hospital, Maputo City, Mozambique, between 1976-1986.

Figure 2 shows the progress in reporting of NNT by WHO Region in 1980, 1985, and 1987, as of July 1988. More progress is needed in this area and in the area of immunization coverage surveys.

NNT mortality surveys have been carried out in 57 countries, including 1/3 of the 25 most populous countries in the developing world.

Actions needed are as follows:

- Immunize all women of childbearing age including pregnant women;
- Immunize at child immunization clinics, at antenatal clinics, and at family planning clinics;
- Immunize women in contact with health facilities for any reason;
- Provide TT immunization as part of mass campaigns;
- Carry out missed opportunity surveys;
- Monitor what is happening;
- Investigate each case of NNT notified;
- Inform key people; and
- Alert staff.

A large table shows the number of births in 1987, percentage of TT-2 coverage, the number of NNT cases, and NNT mortality rates for each country in the WHO regions (the table is based on reports received by WHO as of July 1988).
In the period 1981-1986, NNT mortality surveys were conducted in 14 African countries. The percentage of deaths caused by NNT ranged from 23% of total neonatal mortality in Somalia to 69% in Kenya. The annual number of deaths due to NNT in Africa is estimated at 240,000. This represents 30% of the 800,000 NNT deaths in all developing countries, excluding China.

In Africa, about 90% of deliveries occur at home and are assisted by an untrained person. While immunization of women can make an immediate impact on NNT incidence, a combination of immunization and training TBAs is the best strategy.

TT coverage of pregnant women in Africa is only 11%. Besides administering 2 doses of TT at least 4 weeks apart, a 3rd dose is recommended for previously immunized women to protect them for the next 5 years. Other recommendations are:

- carry out mass immunization programs;
- include TT coverage of women of childbearing age in national immunization days or other accelerated immunization strategies;
- register tetanus immunization status on child's immunization records, on maternity records, or on a separate card;
- consider making TT immunization a prerequisite for a marriage certificate; and
- consider immunization of schoolchildren.

An immunization schedule for women of childbearing age, including pregnant women, is provided. Also shown is a map of Africa delineating NNT mortality rates by country, as well as a table of mortality statistics shown by country.

This report summarizes a meeting on the Prevention of Neonatal Tetanus, convened jointly by the Eastern Mediterranean and South East Asia Regional Offices of WHO, in Lahore, Pakistan, from February 22-25, 1982.

Surveys from 14 countries in these 2 WHO regions revealed substantial differences both within and between countries regarding NNT mortality. Based on the mortality rates found in the surveys, it is estimated that 500,000 deaths from NNT occur annually in the 2 regions. Two tables show the number of neonatal and NNT deaths and mortality rates per 1000 live births in each region. Although most NNT deaths occur in the first week of life, a significant number of deaths occurred very late in the neonatal period. In Sudan, 18% occurred during the 3rd and 4th weeks of life. The ratio of male to female deaths showed a larger number of male deaths.

The following recommendations were put forth regarding the prevention of NNT:

- NNT should become a notifiable disease and should be reported separately from non-neonatal tetanus. The control of NNT and other EPI diseases should be used as a spearhead in the development of PHC.

- NNT levels should serve as an index of the quality and utilization of maternal health services.

- All females of child-bearing age visiting any health facility for any reason should be immunized. Immunization at school entry and school leaving should be offered to all children.

- For previously unimmunized women, 2 doses of adsorbed TT should be given and should be spaced at least 4 weeks apart with the 2nd dose, in the case of pregnant women, at least 2 weeks before delivery. Additional doses should be given with each pregnancy. Tetanus immunization should be offered at outreach clinics (ie: markets, festivals) and mobile teams should be used.

The policy of governments should be to increase the percentage of deliveries attended by trained persons and all governments should consider registering all TBAs. Supervision of TBAs should be strengthened.

Lastly, public information and health education should be promoted and the participation of the community in controlling NNT should be secured.
A long-term strategy of training birth attendants in hygienic practices during delivery, combined with immunization of women is recommended as the best way of controlling NNT. Figures showing the relative impact of these strategies on populations in Haiti and Bangladesh are provided. In Bangladesh in the late 1970s, a control group reported a NNT mortality rate of approximately 25 per 1000 live births. A group with trained TBAs reported a NNT mortality rate of 8 per 1000 live births and an immunized group reported a NNT mortality rate of 2 per 1000 live births. It is important to recognize, however, that the benefit of TBA training extends beyond NNT to other causes of neonatal mortality as well.

A large table summarizes the advantages and disadvantages of different approaches to immunizing women and lists the most favorable conditions for each approach. Approaches include:

1. immunization of pregnant women attending antenatal services;
2. immunization of women of child-bearing age through regular health services;
3. immunization of women coming with a child to an immunization session;
4. immunization of women coming with or without children to the immunization session;
5. special outreach clinics (markets, meetings);
6. immunization of school children; and
7. mass campaigns.

A recommended immunization schedule is provided. The risk of adverse reactions is negligible even for pregnant women. The basic record for the registration of TT administrations is the "Tetanus Protection Card" or a similar home-based record. For monitoring, the denominator used to estimate coverage should depend on the immunization strategy employed. Administratively, the simplest strategy is immunization of all pregnant women. In this case, the following rate would be used:

\[
\text{pregnant women receiving a 2nd dose (or more) of TT} \quad \text{total number of pregnancies}
\]

Where immunization of all women of child-bearing age is the target group, the following rate would be used:

\[
\text{women of child-bearing age receiving a 2nd dose (or more) of TT} \quad \text{total number of women of child-bearing age}
\]

Sample surveys should supplement routing reports. Methodologies may vary.

Actions for countries where NNT has not yet been eliminated should focus on:

1. defining the problem;
2. training;
3. investigating; and
4. immunizing.
During a trial of a cholera vaccine in Bangladesh in 1974, injections of adsorbed tetanus-diphtheria toxoid (Td) were given to a randomly selected group of non-pregnant women age 15 or above as a placebo. In 1978, TT vaccine was included in MCH service (2 doses of 0.5 ml TT with a 1 month interval were given from the 6th month of pregnancy - this was originally 3 doses but was later changed). The number of live births for a 13-month period in the study area was recorded at 9856. Of those births, 7237 of the mothers had never been immunized against tetanus. The rest had been immunized, either in 1974 or in 1978 when they were pregnant.

The results showed significant differences between the groups of women with respect to deaths in newborns in the 4-14 day period. When a woman had been given 2 doses of TT during pregnancy, there was nearly a 70% reduction in neonatal deaths compared to babies of those who were not immunized. Giving 2 doses before and 2 doses during pregnancy did not give a result statistically different from only 2 doses during pregnancy. When a woman had been given 2 doses of TT 3-4 years before pregnancy, there was a 40% reduction in neonatal deaths in the 4-14 day period.

A table summarizes the findings of this study. In a previous study, it was shown that 1 injection of TT gave significant protection only when given 20 months or less before delivery.
This article summarizes the conclusions and recommendations which came out of the VIII International Conference on Tetanus, held in Leningrad from 25-28 August, 1987. This conference called for the elimination of NNT by the year 2000. Among commonly cited recommendations for responding to the NNT problem, there was a call for the continuation of basic and operational research to further improve and simplify tetanus prevention strategies and methods.

General strategies, immunization strategies, an immunization schedule for women of childbearing age, and monitoring and surveillance are briefly outlined in this paper. Among the commonly cited recommendations were:

- Women's groups, religious and community leaders, and school children should be used to promote TT immunization of women of childbearing age in the community and to increase awareness that NNT can be prevented by TT immunization and by proper care of the umbilical cord at delivery.

- Routine reporting of TT immunization should be by target population, by age group, and by dose (TT1, TT2, TT3, and boosters).

- Always include an evaluation of the TT immunization status of mothers in immunization coverage surveys for children.
Questions remain regarding the practical schedule of primary immunization, the duration of immunity after the primary series of 2 doses, and the recommended frequency of boosters. This thorough report reviews those questions.

Usually it is recommended that the first dose of TT be given during the 2nd trimester of pregnancy. However, in high risk areas it is advisable to immunize women at their first antenatal visit, even if this occurs during the first months of pregnancy. TT is one of the safest of all vaccines. The author cites 3 studies supporting this. However, unconfirmed observations in India report an increased incidence of neonatal jaundice among ABO-incompatible infants of women given TT at any time during their pregnancy.

A tetanus antitoxin level of .01 IU per ml of serum, as determined by the in vivo neutralization test, is considered as a minimal protective level. There is good evidence that prolongation of the interval between two initial doses of TT increases the degree and duration of the antibody response. The amount of tetanus antibody transferred from mother to fetus also depends on the interval between the last dose and delivery. Although long intervals are best, if a pregnant woman is immunized with two doses of adsorbed TT spaced at least 4 weeks apart and at least 3 weeks elapse between the 2nd dose and delivery, the newborn will receive satisfactory, although not maximal, protection.

This paper reviews the most favorable and other acceptable intervals between the first dose and 2nd dose of TT and between the 2nd dose and delivery. The immunity induced by a 3rd dose is high and long-lasting. The efficacy of a single dose of TT is also discussed. Figures illustrate the efficacy of various doses and duration of immunity.

The author cites several studies which show the practicability and effectiveness of maternal immunization in controlling NNT. Several tables show mortality rates in various populations.

Guidelines are proposed for the immunization of pregnant women and all women. Two primary doses followed by a 3rd dose given 6 to 12 months later is the recommended schedule for immunization of both groups. TT should be offered to all women who attend a health facility for any reason. Where they cannot be reached by routine or outreach health services, mobile teams should be used.
This document reports on the EPI Global Advisory Group (GAG) meeting held in Washington, D.C., in November, 1987. The GAG recommended that countries take urgent steps to improve coverage with TT immunization and to launch special initiatives to eliminate NNT. Issues and recommendations in NNT elimination are discussed.

Previous achievements in NNT control include a series of workshops planned in the African region. The major achievement of the first workshop (Harare) was the development of country-specific action plans for NNT control. A resolution concerning the elimination of NNT from the African region by 1995 was endorsed by the regional committee in September, 1988. It was recommended that other regions follow the example set by the AFRO initiative.

Other issues that were addressed include TT immunization of all women of child bearing age, adoption and implementation of the 5 dose TT immunization schedule, innovative immunization strategies (the most common strategy is immunization of pregnant women during antenatal care visits), NNT incidence and surveillance (successes in high TT coverage include Pidie District, Indonesia and Maputo, Mozambique), monitoring of TT immunization coverage (a maternal home-based record is recommended), missed opportunity surveys, safe delivery practices, and social mobilization activities.

Major recommendations and conclusions for NNT control and elimination include widening the target group for TT immunization to all women of child bearing age with special emphasis on pregnant women, reporting the 5 doses of TT administered to the target groups and including evaluation of the TT immunization status of mothers in all coverage surveys for children, the development and distribution of policy papers by EPI regarding the 5 dose schedule, guidelines on monitoring TT coverage, and safe delivery practices. Finally, countries are encouraged to develop action plans.

Several tables and figures demonstrate many aspects of NNT elimination for each of the WHO regions. Tables 2 and 3 give data regarding missed opportunity surveys in Comoros and Zimbabwe, respectively. Annex 1 is the GAG 1987 resolution of the Eighth International Conference on tetanus.
This brief article explains the "invisible" nature of NNT. Quotes Stanfield's (1984) estimation that only 2-5% of cases are recorded.

A table shows that globally between 1982-84, coverage with TT fell by 4% while the rate for DPT-3 increased by 2%.

There are a number of reasons why the problem of NNT is largely silent:

- home births;
- organizational barriers to reporting;
- cultural factors;
- low priority for TT coverage;
- no access to immunization for those at highest risk; and
- a failure to emphasize the significance of NNT to those studying the health professions.

Radford also cites unhygienic practices by TBAs as contributing to the incidence of NNT. Citing Yusuf (1984), he states that in some instances, the use of trained TBAs has had no impact on neonatal mortality.

In conclusion, Radford introduces eleven strategies to reduce the incidence of NNT.

1. The hiring by WHO and UNICEF of a full time TT immunization advocate in high incidence areas of the world.

2. The declaration of "war" on NNT by each nation.

3. An increased level of consciousness in government health ministries and increased education to health care workers.

4. At EPI annual meetings, a greater priority be given to: recording/reporting incidence of NNT, evaluation of strategies to improve coverage, random surveys and sentinel stations, establishing recommendations for the following year.

5. The ascertainment of the immunization status of all women (in-patient and out) and the upgrading of their status, irrespective of their reason for attending the hospital or clinic.

6. An adult immunization card and education program; the later development of a more comprehensive home-based card. Child health records should include the mother's immunization status.

7. Proof of immunization before marriage.

8. The development within 2 years of immunization programs for all women aged 15-44 integrated with national immunization programs for children; a policy of immunization for all girls/children about to leave school.

9. Education of women's groups about the preceding programs.
10. The acceleration of such programs in areas where there is high incidence and well-developed women's groups.

11. Media publicity.
CHAPTER 5

MISSED OPPORTUNITIES
MISSED OPPORTUNITIES


65
Comoros - Immunization coverage of pregnant women with at least 2 doses of TT only progressed from 9% to 26% between 1984-1987, while immunization coverage for children (BCG, OPV, DPT, Measles) increased from 21% to 50% in the same 3-year period (Table 1).

The Ministry of Health carried out missed opportunities for immunization surveys in order to identify and choose the most appropriate strategies for increasing coverage, particularly in women. Exit interviews were carried out at immunization posts, antenatal clinics, a pediatric clinic, and immunization sessions for children. Women of childbearing age and children 0-23 months were interviewed. A missed opportunity was defined as a visit by a woman or a child in need of immunization, which ended without the immunization being given, in spite of the absence of any contraindication. Participants were also asked if they would have accepted immunization for themselves or their children if it had been offered.

Table 2 shows the results of the survey for children 0-23 mos. of age. At the pediatric clinic, 91% of the cases showed a missed opportunity for immunization. At the immunization clinic, 33% showed a missed opportunity.

Table 3 shows the results of the survey for women of childbearing age. At the antenatal clinics, a total of 82% of the cases showed a missed opportunity for immunization. At the immunization clinic, 39%; at the Bangol-Kouni Health Center, 44%; and at the pediatric clinic, 95% showed a missed opportunity.

Missed opportunities for children arose from confusion about the OPV vaccine on the child's immunization card. In addition, in an effort to reduce wastage, measles vaccine is offered only once a week and vials of DPT and OPV are opened only if there are enough children presenting to warrant it.

Missed opportunities for women stemmed from the location of the immunization post--it is 100 metres away from the antenatal clinic--and women are not systematically referred. In addition, TT is presently only given to pregnant women. Finally, the program ran out of TT for 2 months.

Recommendations include:

* Modifying the children's immunization card to include a space for the dose of polio given at birth;
* changing the TT target group to all women of childbearing age;
* introducing a TT immunization card for non-pregnant women;
* immunizing women who bring their children in; and
* setting immunization posts in hospitals at the entrances of antenatal and pediatric clinics in order to screen women and children for immunization status and give all vaccine doses needed each and every time.
This document explains the concept of missed opportunity for immunization and offers a framework for national immunization programs and health facilities to assess the magnitude of missed opportunities on a local basis.

The protocol recommends four questions to be answered regarding missed opportunities and routine immunization of women and children. The study population should be all women and children who come to the health facility during the day that the survey is carried out. Study sites fall into two general categories: Clinics which **routinely** offer immunizations to women and children (immunization clinics, "under-five" clinics, MCH clinics, antenatal clinics, family planning clinics) and Health Facilities where immunization is **not** at present offered on a routine basis (pediatric inpatient wards, children's sick-care clinics, hospital emergency departments).

The procedure for the missed opportunity survey should include two trained interviewers who are supervised by the primary investigator. Permission should be sought from the health facility, and health care workers at the facility should be briefed. Analysis and data compilation should be carried out while still at the facility so that results may be immediately presented to the person in charge.

This protocol includes definitions of relevant terms and the following annexes:

- **Annex 1** - Recommendations for sampling methodology
- **Annex 2** - General information sheet
- **Annex 3** - Policy on contraindications to immunization
- **Annex 4** - Questionnaire for the children
- **Annex 5** - Questionnaire for the accompanying women
- **Annex 6** - Basic analysis worksheets
- **Annex 7** - Suggested table for presentation of findings

(An example of the summary table completed with fictitious data is included.)
CHAPTER 6

BEYOND IMMUNIZATION: TRAINING TBAS, DETERMINING PERCEPTIONS, BUILDING ON CULTURAL PATTERNS
BEYOND IMMUNIZATION: TRAINING TBAS, DETERMINING PERCEPTIONS, BUILDING ON CULTURAL PATTERNS


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<td>Knowledge about tetanus among selected women in the urban centre of Ile-Ife, Nigeria.</td>
<td>Odumosu, M.O.</td>
<td>Tropical Doctor 12: 70-72.</td>
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<td>5026</td>
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<td>31 pages</td>
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The objectives of this research were to discover the socio-cultural perceptions of NNT and immunization acceptability among Aymara, Quechua and Spanish-speaking (Tupi-Guarani) communities of Bolivia, to identify cultural obstacles to TT immunization, and to develop social communication strategies for NNT control.

This report contains information on how to strengthen TT delivery to peasants of the aforementioned cultures. It includes detailed information on how these peasants perceive tetanus and TT vaccination and it suggests ways that native concepts can be used to educate and motivate them to participate in programs.

Research was conducted in the Department of Santa Cruz (formerly Tupi-Guarani culture), the Department of Cochabamba (predominantly Quechua culture), and the Department of Oruro (predominantly Aymara culture). Some of the key findings were:

- While NNT is relatively unknown in District III of the Department of Santa Cruz, it is common in Districts I and II, with a mortality rate of 13.2/1000 in District I.
- NNT is often called "pasmo de ombligo", meaning "rigidity from the umbilical cord", which is a syndrome rather than a well-defined disease.
- TBAs cut the umbilical cord with unsterile instruments and place unsterile powder and herbs on it.
- NNT is common in the Department of Cochabamba but it is often not reported.
- The Quechua do not have a distinct name for tetanus. They report that they oppose vaccinations because of reactions, lack of confidence in health personnel, and fear of being sterilized.
- Health personnel themselves know little about NNT.
- The Aymara peasants do not specify diseases but rather symptom complexes or syndromes.
- They often use TBAs or husbands to deliver babies.

Some of the recommendations include:

- TT vaccination of all women 15-44;
- Health education tailored to each culture with a focus on the specific symptoms of tetanus;
- More training and supervision in proper and sterile vaccination techniques;
- Cross-cultural training about tetanus in medical schools;
- Recruitment of personnel who speak the native language and know the local culture;
- The endorsement of TT immunization by the Catholic Church (it was reported that a pamphlet was circulated saying that TT vaccinations sterilize women and violate papal teaching); and
- Training of and coordination with TBAs and curanderos.

It has been estimated by Verderese and Turnbull that in the rural areas of South-east Asia, 50% to over 80% of births are attended by TBAs. At the same time, several studies (Stahlle, Barten, Chen) have shown that neonatal tetanus continues to take its toll of life in the rural areas. This paper discusses the experience in Malaysia and suggests means of prevention of neonatal tetanus in the rural areas.

In Malaysia, the "bidan kampung" (TBA) does not associate neonatal tetanus with unhygienic practices and, in fact, she performs several tasks which increase the risk of neonatal tetanus to newborns. The "bidan kampung" cuts the umbilical cord only after the placenta has been expelled, and while doing so, she rubs the cord with ashes and cuts it with a bamboo sliver. In addition, the "bidan kampung" dusts the umbilical stump with a powder derived from pepper, tumeric, and ginger and then wraps it in a small piece of cloth.

According to official statistics, neonatal tetanus mortality rates are low. However, in an earlier study (1975), Chen estimated the mortality rate from neonatal tetanus among births attended by untrained "bidan kampung" at 34 per 1000 live births.

The use of aseptic techniques, sterile instruments and the avoidance of dirty cord dressings by the TBA can help reduce the incidence of neonatal tetanus. Although such a program of training has existed in Malaysia for 25 years, the success rate has never been high. Nonetheless, mortality rates from neonatal tetanus are lower amongst partially trained TBAs than untrained TBAs. Chen estimated that the death rate is about 12 per 1000 live births in the case of births attended by partly trained TBAs.

Lastly, it is clear that training alone will not suffice. Chen cites several examples advocating complimentary strategies (Berggren in Haiti) or immunization strategies (Cvjetanovic, Jackson, Schofield). In late 1975, the Malaysian Ministry of Health adopted immunization of rural mothers as a routine antenatal measure introducing neonatal tetanus.
The purpose of this study was to evaluate the attitude and knowledge of the parents of neonates who were hospitalized for NNT and to find out a possible suggestion as a guidance for reducing the incidence of NNT.

Author abstract - "Knowledge and attitude of 44 parents of neonates admitted with tetanus neonatorum to the Department of Child Health, Dr. Hasan Sadikin General Hospital, Bandung, from January 1975 through April 1976 were evaluated. Twenty-eight (63.7%) cases with tetanus neonatorum were from illiterate and elementary-school educated parents. Fourteen (31.8%) parents were aware of the disease: 10 (22.7%) mothers did not join prenatal care; 40 (90.9%) neonates were delivered by "perajit" (indigenous/traditional midwives) and 4 (9.1%) by midwives. The decisions which were made by the parents to choose "perajit" for the delivery and to admit their newborns with tetanus neonatorum to the hospital were found in 85% and 75% of the cases respectively."

A multiple-choice questionnaire was used for this study, covering the following topics:

- educational status and the choice of birth attendance;
- awareness of the name, etiology and mode of infection of the disease;
- decision makers for the choice of birth attendance;
- reasons for choosing indigenous traditional midwives;
- materials used for umbilical cord care;
- symptoms and signs as reasons for seeking medical help;
- type of medical personnel chosen for the treatment of their sick babies;
- decision makers for hospitalization; and
- awareness of prevention and mode of prevention of the disease.

Table 1 shows the educational status of the parents and the choice of birth attendance.

Table 2 shows the educational status and awareness of the name, etiology of the disease and umbilical cord involvement. Out of 44 parents, only 12 were aware of the name and only 6 were aware of the etiology of the disease.

Table 3 shows the decision makers for the choice of birth attendance. In the majority of cases, the parents (rather than the grandparents) were the decision makers and the majority used indigenous midwives.

Several other tables give data regarding answers obtained from the questionnaire. Results show that there was a basic lack of knowledge about NNT and ignorance still forms a major part of health problems. The authors recommend the training of indigenous midwives by medical center personnel with periodic and continuous refresher courses offered. Finally, they recommend TT for pregnant women.
The International Center for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) initiated a Maternal Child Health/Family Planning program in 1977, covering 70 villages with a population of 90,000 in Matlab Thana, Comilla district. TT immunization for pregnant women was introduced in 1978. Sixteen months after the start of the program, it was realized that only 34% of the eligible women identified accepted 2 doses of TT and only 5% accepted one dose.

In 1979, a survey was conducted to find reasons for poor acceptance of TT. The results showed no difference between acceptors and non-acceptors in relation to socio-economic characteristics. The main reasons for non-acceptance were objections by husbands or mothers-in-law (35%), mothers' fears (33%), failure of the female village workers to inform the mothers (14%), and identification too late in pregnancy (5%). Among women who received only one dose, main reasons for not receiving a 2nd dose were: moving to parents' residence for confinement (32%), objections by husbands or mothers-in-law (15%), mothers' fears (13%), and delivery before the 2nd dose (13%).

An important observation resulting from this study was the effect of community perception on the effectiveness of the vaccine. NNT was traditionally subsumed in a syndrome comprising several illnesses and a misdiagnosis of NNT of a child born to a tetanus-immunized mother might create the belief that the vaccine was ineffective.

Table 1 shows tetanus immunization of pregnant women, rates of identification by village workers, immunization acceptance and coverage, Matlab, Bangladesh, September 1978 - December 1979. Only 27% of pregnant women had been adequately immunized during this period.
A study was conducted in Bangladesh to compare the effects of training TBAs and of the use of tetanus toxoid during pregnancy on the reduction of neonatal mortality. The study population was divided into three groups: a TBA group (in which trained TBAs conducted deliveries), a tetanus toxoid group (in which two doses of tetanus toxoid were given during pregnancy), and a control group (deliveries were conducted by untrained TBAs and no tetanus toxoid was given during pregnancy). A total of 2482 women who gave birth to a living infant were included in the study.

The result showed that either hygienic cutting and dressing of the cord by trained TBAs or immunization with tetanus toxoid of women during pregnancy greatly reduced the overall mortality of 24/1000 in the TBA group and 39/1000 in the tetanus toxoid group. While tetanus toxoid immunization had a greater effect on the neonatal tetanus mortality rate, the training of TBAs had a greater effect on other causes of neonatal mortality as well. These results are shown in two tables; the first delineates the neonatal mortality rate by type of maternity care and by cause of death, the second table gives the neonatal mortality rates by type of maternity care and age at death.

In conclusion, this study showed that while tetanus toxoid immunization during pregnancy reduces neonatal tetanus, training TBAs is more important to reduce overall neonatal mortality due to birth injury and respiratory distress syndrome.
These guidelines are intended for district level managers responsible for maternal child health and family planning programs (i.e., the district midwife or public health nurse). It is intended to promote safer delivery through appropriate technology. Throughout the guide the concept of clean delivery is emphasized. After reading this guide, one should be able to address all aspects of a program designed to introduce the simple delivery kit into a community.

The minimum goals for safe delivery should be the "three cleans" (clean hands of the birth attendant, clean cut and care of the umbilical cord, and clean surface), the use of a locally produced delivery kit, and the assurance that the newborn will be dry, warm, put to the breast, weighed, registered, and referred for follow-up care.

This guide reports that all countries can produce the simple delivery kit from locally available materials. Included in the kit should be soap, nail sticks, razor blade, cord ties, cotton balls, a plastic sheet, and a towel or sheet. Detailed information is given for each component of the kit.

Also included in this guide are instructions on how to use the kit, how to organize the supply of kits, how to promote the use of the kit, how to pay for the kits, and how to tell if the program succeeds.

This guide is one module of a set of eight texts which make up a WHO training manual for health workers who give vaccines.

In simple English, all aspects of tetanus are described for the health worker. Issues discussed are as follows:

- What is tetanus?

- The tetanus immunization schedule.

  Five doses are recommended; length of protection and the minimum interval between doses is given; side effects are explained.

- How to give a tetanus toxoid immunization.

  This section explains the care of the TT vaccine, how to prepare for the TT injection and inject TT into a woman, and how to record TT immunizations.

- How to reach more women with TT immunization.

  The easiest time to reach women is when they are pregnant; however, the importance of immunizing women in other situations is stressed. Different times to reach women for tetanus immunization are suggested: during pregnancy, when they bring children to the health clinic for care, at the hospital, at the market, with mass campaigns, at school, and in early childhood.

- Promotion of TT immunization.

  The role of the TBA is important as well as health education.

- Steps to be taken before, during, and after delivery.

  This section describes preparation by both the mother and the health worker, care of the umbilical cord, and care of the newborn after delivery.

Several case studies are included throughout the text, with points to discuss for each one. This guide is quite thorough and would be useful for anyone involved in NNT immunization at the community level.

This report evaluates the types of birth attendants, methods of cutting and dressing the umbilical cords and their relationship with the incidence of neonatal tetanus for a cohort of 1351 live births occurring between July, 1976, and June, 1977, in Teknaf, Bangladesh.

The births were attended by relations of the mother, neighbors or dais (TBAs) in equal proportion. A few births were unattended; trained midwives or physicians attended a negligible number of births. Bamboo-splits (78%) and razor blades (22%) were the most frequently used tools to cut the umbilical cords. There was no significant difference in mortality rate of neonatal tetanus between the groups using bamboo-splits (29 deaths per 1000 live births) or razor blades (21 deaths per 1000 live births). The mortality rate due to neonatal tetanus was 24 deaths per 1000 live births when umbilical cords were tied with a thread, with or without application of ash or burnt earth. In a smaller number of cases when the umbilical cords were left untied, the mortality rate of neonatal tetanus was 111 deaths per 1000 live births. This difference was statistically significant (P<0.01). It appears that leaving the umbilical cords untied predisposes the development of neonatal tetanus.

Table 1 shows the distribution of live births according to type of birth attendants.

Table 2 shows the types of tools used to cut the umbilical cord.

Table 3 shows that 76% of the umbilical stumps were tied with a thread, 20% tied with a thread in addition to application of ash or burnt earth as dressing and 4% were left untied.

Table 4 shows the neonatal tetanus mortality rates by method of cutting the umbilical cord. The overall neonatal mortality rate due to tetanus was 27 per 1000 live births.

Table 5 shows the neonatal tetanus mortality rates by method of dressing the umbilical cord. The neonatal tetanus mortality rate was 22 per 1000 live births when the umbilical cords were tied with a thread along with application of ash or burnt earth compared to 24 per 1000 live births when tied with thread only.
This report documents a self-sustaining and highly successful routine program for tetanus toxoid immunization.

According to a 1985 survey, neonatal tetanus is the leading cause of infant mortality in Indonesia. In addition, only 29.9% of pregnant women received TT2 in 1987. Since 26% of all births in Indonesia are first births and many of these births occur soon after marriage, providing TT immunization to prospective brides could have a great impact on reducing neonatal mortality.

Over 90% of the Indonesian population identify themselves as Moslem. The religious channel has been found to be an important vehicle for dissemination of information and over 95% of all marriages are registered by local religious or government staff. In a study of three provinces, only recently married women in central Java were found to have high TT1 coverage (72%) or information about immunization which came from their religious leaders. It was determined that a case study would be conducted to understand the process by which this achievement in Java had been made.

In October, 1988, the case study was conducted. It was found that the program in Java involved intersectoral collaboration between the Ministries of Health, Religious affairs and Interior; it relied on communication by local Islamic leaders; and it was supported by a small administrative fee levied on the prospective brides prior to marriage registration. In Indonesia, couples are required to show proof of TT1 immunization prior to registration. After a 10 day waiting period, the couple may be married. Receipt of the marriage certificate requires proof of receiving TT2 from the health center. The entire process is done under the supervision of a local religious leader, or “modin”. While several couples mistakenly thought that TT immunization was actually provision of the injectable contraceptive depoprovera, this did not stop compliance with the compulsory pre-marriage immunization.

This case study documents the vital role which can be played by religious institutions, both governmental and non-governmental, in raising immunization coverage of high-risk women. However, several operational problems remain. TT2 coverage remains low due to several factors:

1. brides often move out of the area after marriage;

2. couples do not need to pick up their marriage certificates if they intend to remain in the sub-district;

3. TT1 administration is linked to a marriage registration process which occurs 10 days before the wedding and does not allow for 2 doses one month apart; and

4. misinformation about TT immunization continues.
Some recommendations are:

- the customary waiting period for the wedding could be extended from 10 days to one month;

- a stronger role for the village Islamic leaders could promote earlier referral for brides to obtain their TT1 and TT2 could then be required at the time the couple register their intent to wed; and

- following a couple's marriage, the "modin" could still play a vital role in motivating new brides to obtain their immunizations and obtain prenatal care.

Although the Indonesian EPI presently gives priority for TT immunization to pregnant women and to female primary school students, the Central Java experience may serve to promote accelerated TT coverage of high-risk women into ongoing national EPI activities.

While the authors report a high rate of success with TT1 coverage, TT2 coverage remains low and booster vaccines are not discussed. The authors recommend that national programs to institute TT immunization requirements at the time of marriage registration be started in all districts throughout Indonesia.

Two tables are included: the first shows TT coverage results for prospective brides in Wonogiri District, central Java in 1987, the second shows TT coverage results for prospective brides in Pekalongan District, Central Java in 1987. Both tables show high TT1 coverage rates (69.4% and 77.04%, respectively, and lower TT2 coverage rates (29.9% and 17.64%, respectively).

An author abstract is included in the beginning of this report.
This article may be used as an excellent example of the success of training TBAs in hygienic delivery practices for the control of neonatal tetanus.

Before 1949, infant mortality in China was as high as 200 per 1000 live births, with neonatal tetanus one of the main causes of neonatal deaths. At that time, almost all deliveries were handled by TBAs. Since 1949, maternal and child health has been one of the main components of community health and a nationwide program to promote modern delivery practices was carried out in the 1950s. The main components of the program were:

1. the training of TBAs with emphasis on "the 3 cleanesses: (clean hands, clean perineum, clean cut of the cord).
2. equipping the TBAs with a delivery kit after training.
3. working regulations which were agreed upon by the trainees themselves and took the form of a service pledge.
4. education of the public.

A table showing the number of live births, incidence of neonatal tetanus and percentage of modern deliveries in Jiading County between 1948-1971 shows the decrease in incidence of neonatal tetanus from 31.9 per 1000 live births in 1948 to .01 per 1000 live births in 1971. Since 1973, no cases of neonatal tetanus have been reported. In addition, the decrease in neonatal tetanus incidence was paralleled by a decrease in infant mortality.

Trained TEAs have gradually been replaced through the strengthening of the primary health care system. A retrospective study of 12 hospitals determined a perinatal mortality rate of 13.1 per 1000 for the period 1979-1982.

Since immunization with tetanus toxoid has never been used as a means to control neonatal tetanus in China, the experience related here clearly shows that the promotion of modern delivery practice can also contribute greatly to the control of this disease.
Odumoso, M.O., Knowledge about tetanus among selected women in the urban centre of Ile-Ife, Nigeria. Tropical Doctor 12: 70-72. April 1983.

In a 1977 study of mass media and immunization awareness by pregnant women the author discovered that the majority of women claimed "injection" to be the method known to prevent tetanus. However, the study also revealed that these women had little understanding of the type of protection they were receiving and he inferred that injections given in private clinics had been mistaken for immunization.

The object of this study was to investigate among women in Ile-Ife, Nigeria whether:

1. they could describe what tetanus is;
2. they could mention a way of preventing tetanus;
3. there was any relationship between their socioeconomic status and their knowledge of the prevention of tetanus; and
4. an educational program could be suggested for increasing their knowledge.

Eighty two women were interviewed by means of a three-part questionnaire, giving the following results:

- Forty-eight of the respondents had never heard of tetanus before.
- Fourteen women could not describe tetanus and 51 admitted they did not know that tetanus can affect babies.
- Twenty-six women said that tetanus could be prevented (by various means) and the remainder did not know.
- There was no relationship between educational or socioeconomic status of the respondents and their knowledge of the prevention of tetanus.
- It was found that previous contact with government health institutions had contributed to the knowledge which 38% of the women had on neonatal tetanus.
- In all, 43% of the respondents had protection against tetanus at the time of the interview.

The author suggests that the practice of restricting immunization, preceded by usual health talks, to the period of antenatal care alone needs to be reappraised in view of the above facts.

A mass campaign followed by immunization by mobile units is suggested, as well as education programs in the community, at infant welfare clinics, and during radio programs on health.

A table showing the place of previous antenatal care and of protection received against tetanus of the 82 pregnant women interviewed shows that the majority of women receive antenatal care and tetanus protection at government maternity centers (39% and 25.6%, respectively), although many attend government hospitals.
This letter to the editors addresses the March 4, 1989 report by Traverso et al of increased risk of NNT upon application of ghee to the umbilical cords of newborns in Pakistan.

The author asserts that the higher frequency of NNT in males with onset after one week (but not before) could be due to later cord separation in boys. The later the cord stump separates, the longer the umbilicus is a possible portal of entry for the tetanus spores.

The author also points out that cord care has been surrounded by deep-rooted customs and rituals in many societies. While many practices are unhygienic, some of these practices have actually had a favorable effect - in China, the cord was seared with heat and in Guatemala, a candle flame was used. This was reported to be the reason for the low incidence of NNT in some areas of Guatemala. The author states that attempts to change cord care practices may be ineffective. She supports immunization of mothers as a more fool-proof method of NNT control and suggests the need for immunization of the whole family.
This study evaluates the effect of trained TBAs and use of tetanus toxoid in the reduction of neonatal mortality in Bangladesh.

In rural Bangladesh, almost all births are attended by untrained TBAs. In addition, neonatal tetanus mortality has been reported to comprise between 30-40% of all neonatal deaths. In this study, researchers divided the study population into 3 groups: one which was attended by trained TBAs, one which TT was given to pregnant women; and a control group. Findings showed that while neonatal deaths due to tetanus were lowest in the TT group (1.29:1000), deaths due to other causes were comparable to that of the control group. In the TBA group, deaths due to tetanus were significantly reduced (5.61/1000). Furthermore, neonatal mortality due to all causes was lowest in the TBA group, with a neonatal mortality rate 23.8/1000. The TT group and the control groups had neonatal mortality rates of 38.9 and 85.1, respectively. Table 2 shows neonatal deaths by number of days after birth. Here it is apparent that training TBAs is important in reducing not only tetanus and other infection, but deaths due to mishandling at delivery as well (i.e., birth injury and respiratory distress syndrome; in both cases, death would occur soon after births). Although the TBA and TT groups had comparable mortality rates during the 4-28 day period (the time at which NNT mortality would occur), the TT group had a much higher neonatal death rate during the first 24-hour period.

Demographic characteristics were considered in this study as well.

In conclusion, the author recommends the promotion of training female village health workers as TBAs as well as the encouragement of parents to seek antenatal care.
Strategies to prevent NNT fall into 2 major groups: immunization and improved perinatal care. There are 2 main ways in which perinatal care can be improved: by increasing the proportion of deliveries conducted by paramedical and medical staff, and by training TBAs. This paper discusses in depth the impact of TBA training on the prevention of NNT. The author asserts that if a substantial reduction in NNT incidence was achieved in TBA practice, this alone would decrease perinatal mortality rates appreciably. However, for this to occur, TBA practices must change. There have been very few good, long-term follow-up studies of whether changes in TBA knowledge, attitudes and practices are sustained after training. The Danfa Project in Ghana and the Lampang Project in Thailand are mentioned.

Studies of TBA training in the absence of TT immunization include that of St. Kilda (Scotland - late 1800s) and of Haiti (1940s to 1960; Berggren, et al). In Haiti, however, results were based on retrospective questioning about events which occurred up to 30 years earlier. Data on the decline in NNT incidence due to TBA training in Senegal have also been presented (UNICEF - 1977; Ross - 1979). However, TT immunization was not controlled for.

Studies of TBA training in the presence of TT immunization include that of Serabu Hospital, Sierra Leone (1976) and the Sohol Project, Philippines (1979, 1983). In these studies, it is not possible to assess what proportion of the observed declines in NNT was due to improved perinatal care and what proportion was due to increased TT immunization rates in pregnant women.

Uncontrolled studies based on NNT hospital admissions tell us nothing about whether training TBAs decreases the incidence of NNT, but only that it did not totally eliminate NNT among the children they delivered.

Controlled trials of TBA training include three cohort studies which contribute to the current debate: rural Punjab (Gordon, 1965), Malaysia (Chen, 1976), and rural Bangladesh (Rahman, 1982).

The author demonstrates that evidence that TBA training on its own leads to a reduction in NNT incidence is by no means conclusive. None of the studies reviewed stand up to scrutiny. It is essential that more rigorous field studies are conducted on the effectiveness of training in changing TBA knowledge, attitudes and practices in the long term. Vaccination is the method of choice for prevention of NNT wherever it is economically feasible. Finally, where TBAs are trained, their tasks should include promotion of TT vaccination coverage.
In this detailed review, the author presents the argument that the training of TBAs could make a major contribution to reducing the incidence of NNT in developing countries. The author cites studies in which TBA training had an effect on the incidence of NNT mortality but he also states that these studies are inconclusive. There have been very few long-term follow-up studies of whether changes in knowledge, attitudes, or practices persist subsequent to training.

To test the effectiveness of TBA training in relation to NNT incidence and mortality, four types of studies should be performed:

1. those programs that include the training of TBAs and TT immunization;
2. those that include training of TBAs only;
3. case studies and
4. controlled studies.

Examples of studies in Colombia, Ghana, Thailand, Sierra Leone, the Philippines, Haiti, Senegal, India, Malaysia and Bangladesh are cited, some with accompanying tables.

Ross asserts that the training of TBAs and TT immunization are not mutually exclusive and that it is advisable to employ a strategy of combining the two for the prevention of NNT. He suggests the most important study that should be conducted on the health impact of the training of TBAs would be one in which the impact of TT immunization alone was compared with the impact of a program combining TT immunization with such training, to establish whether the addition of the training component was associated with an incremental decline in tetanus-specific neonatal mortality or total neonatal mortality.

Finally, Ross stresses that the improvement of practices affecting the umbilical cord is not the only potential benefit from the training of TBAs. Many other components of the training program would help to improve the health of mother and child if training were effective.
This article discusses the uses and benefits of a home-based record to document the health of women and children. Home-based records have been used in Botswana, Kenya, Papua New Guinea, Tanzania and Zambia. However, none of these records were designed for use by primary health care workers of women themselves.

In 70 villages of Maharashtra, India, a home-based card with space for information on four pregnancies and inter-pregnancy periods of time was used by community health workers during home visits. It served as a source of health statistics from the community, minimized waiting time for women, and was useful for doctors when they took referrals. A home-based maternal and neonatal record, using pictures and symbols, was used in 54 villages in Haryana, India by illiterate TBAs. An evaluation of the program showed correct records for 90% of the women and 85% of them had received a full course of tetanus toxoid immunization. Home-based records with illustrations have also been used in Guinea Bissau, Indonesia, and Vellore, India.

To further promote the use of home-based maternal records, WHO has produced a prototype home-based maternal record (HBMR) with guidelines for its use. Interim reports from 13 centers in countries where HBMRs are in use show improved coverage, acceptability and quality of MCH/FP care.

The HBMR has led to increased use of family planning and tetanus toxoid immunization. In the Philippines, prenatal care increased from 53% to 85% of pregnant women, nearly all of the latter having completed a course of tetanus immunization. In Zambia, nearly 80% of the women with the HBMR received antenatal care compared to less than 20% in the control area.

Focus group discussions have revealed that women, community members, health care workers, and doctors alike appreciate the records. The HBMRs have been useful in identifying women at risk, in increasing understanding of the benefits of antenatal care, and in increasing efficiency of care. However, while the HBMRs have been useful in indicating a need for increased supervision and/or referral, some doctors and consultants have refused to honor them.

From the evidence accumulated to the present, it can be summarized that a home-based maternal record can function as the most suitable tool to promote self-reliance and the mother's and her family's participation.
CHAPTER 7

SURVEILLANCE
SURVEILLANCE


6005 Babaniyi, O.A. How to improve surveillance of neonatal tetanus through routine and sentinel reporting. Unpublished paper. 6 pages. No date.


This paper reviews several surveillance methods relevant to NNT and discusses their applicability for programme monitoring with special emphasis on how to improve routine and sentinel reporting.

Methods of NNT surveillance include special surveys, routine reporting, sentinel reporting and NNT case investigation.

A single survey, if properly designed, can measure the disease incidence to help set immunization priorities, serve as a baseline and estimate the reliability of the routine or sentinel surveillance systems. The completeness of routine surveillance data is usually limited to 2% - 8%, but this method can be useful in documenting trends over time. Sentinel surveillance for NNT can be insensitive because those at highest risk for infection tend to be those with limited access to health care. It can be useful in documenting trends in NNT incidence in areas where hospital attendance is high.

General problems with surveillance in Africa concern the diagnosis and clinical definition of NNT, supervision and responsibilities, and feedback or communication from higher levels of program management to lower levels.

NNT surveillance can be improved by reviewing the routine reporting system (several key activities are listed) and by establishing a network of sentinel reporting sites.
In a geographically defined population of 1629 women between the ages of 15 and 60 years, NNT was determined retrospectively to have caused the death of 1143 of their 7248 live-born children. Analyzing the data by age cohorts of mothers, the authors showed that, whereas losing a child due to NNT was relatively infrequent among the younger mothers, over half the older mothers had endured this experience. When the data were analyzed according to birth cohorts of children, they showed the frequency of death due to NNT to have diminished over a 30-year period from 25% of live births to 0% of live births. Declines in frequency could be directly related to a succession of preventive programs. A program that immunized all women with TT, whether or not they were pregnant, provided the means of eliminating NNT as a public health problem.

Table 1 provides the number and percent of mothers in each age cohort who had lost one child or more because of tetanus. More than 3/4 of mothers over 40 years old had lost at least one child from NNT while only 7% of mothers younger than 20 years old had lost one or more children.

Table 2 shows the frequencies with which 1 to 9 deaths due to NNT were reported by each cohort of mothers.

Table 3 shows the number and percent of children, born in each of several time periods, who were reported to have died. A marked decline in frequency of NNT is documented.

The data indicate that NNT was responsible for the death of about 1/6 of the children born alive to the mothers interviewed. The decline of the incidence of the disease from 25% to 0% during the 30-year time period may be explained by health programs that were initiated during that period.
The second part of a two-part article, this paper looks at the use of health services by mothers of babies with NNT and at the role of health services in NNT prevention. From December 1978 to February 1979, a mass immunization campaign was held in which tetanus vaccine was offered to all women between the ages of 15 and 45 years. This campaign, part of a national campaign which also offered smallpox, measles, and BCG vaccines, had an estimated coverage of 95%.

Researchers used a standard questionnaire to obtain information about the use of health services by mothers of 175 babies with NNT. Results showed that 100 of the mothers had attended antenatal clinics but only 18 had documentation of tetanus vaccination. Eleven mothers gave a history of vaccination but had no record of it. Table 1 shows the number of mothers of babies with NNT by month of vaccination. This table shows that before the campaign, only 23% had a history of at least one dose of vaccine. After the campaign, this proportion rose to 84%.

The study showed that many mothers attended antenatal clinics and had delivered at home. The author suggests that the antenatal clinic may be the only contact with health services for many women and that immunization in the clinics is essential. She also states that many of the failures found in this study have been overcome since the implementation of the EPI.

Figure 1 shows the seasonal distribution of NNT and other tetanus admissions at Central Hospital, Maputo between 1976-1978. A bimodal seasonal distribution is shown, with NNT admissions peaking in March and again in August.

Figure II is a bar graph of admissions of and deaths from NNT according to age on admission. The majority of deaths occurred to those patients who were 6-7 days old upon admission.

Using the WHO formula, the author calculates the protective efficacy of the vaccine used in the campaign as 73%. Finally, she states that insufficient evidence exists to recommend a one dose regimen in the control of NNT. However, in Mozambique, the vaccine's cost was low, some babies were protected, and the campaign created a base for an effective 2nd dose.
This brief report gives the results of a health facility-based (Katangi Dispensary) survey in Machakos, Kenya. 575 mothers of about 1712 infants born during a ten-year period were interviewed. 89% of the children were born at home and 11% were born in hospitals or clinics and were attended by trained health personnel. Only two deaths from NNT were reported in this group. In both cases, deliveries were at homes possessing livestock and the births were attended by female relatives. The infant mortality rate from NNT for children born at home was 1.3/1000 live births. The overall rate was 1.2/1000 live births, as no cases were found for children born in hospitals.

Questions about this retrospective survey regard the following:

- Three different figures are given for the percentage of live births taking place in the home (80%, 89%, and 86%-Table 1).

- The authors point out that in this "low cost" survey, only every 7th mother attending either the under-five clinic or the antenatal clinic was selected for an interview.

- The questionnaire covered the obstetrical history of the women for the previous ten years; the survey relied solely on self-reporting to two Danish nurses and a local Kamba female health worker.

A landmark study, this paper reports on the role played by neonatal tetanus as a cause of neonatal mortality in Thailand during the period 1953-1957. Although dated, this survey was one of the first conducted for the purpose of estimating a realistic incidence of neonatal tetanus.

In this survey, researchers questioned 1755 women about 2349 pregnancies they had during 1953-1957. Of the 2364 children born (15 pairs of twins), 20 were stillborn. Of the 2344 children born alive, 94 had died by the time their mothers were questioned and 37 had died during the neonatal period.

It was established that 14 of those deaths were definitely due to NNT while 5 more had suggestive symptoms.

Table I shows the number of neonatal deaths occurring by region and according to age at death. This table shows a majority of the deaths occurring on the eighth day. In addition, this majority is reached by the number of deaths occurring in rural areas. This fact alone, the author states, makes a strong argument for NNT as a cause of neonatal deaths. In Graph I, the cause of death or at least the main symptoms preceding death are pictured for the neonatal period. Tetanus outweighs other causes.

Of the women surveyed, more than 85% had been assisted by unskilled birth attendants. Beginning in 1957, these TBAs, or mothamye, were offered two-week training sessions in elementary obstetric techniques with an emphasis on cleanliness and avoidance of injections. The mothamye were given UNICEF simple midwifery kits on completion of the course along with a small stipend (US $7.50). The author believed this program to be promising and hoped that the effectiveness of the training would lead to a decrease in NNT mortality. Lastly, the author advised that tetanus be incorporated into the national list of notifiable diseases because he believed it to be an excellent measure of the efficiency of MCH services in general.

This report documents the results of surveys conducted in Burma in 1985. The major purposes of the surveys were to measure the extent of NNT and to determine whether the Expanded Programme on Immunization (EPI) had been effective in Burma.

Author abstract - "Surveys to determine mortality from neonatal tetanus were conducted in March and April 1985 in accessible areas of Burma, where pregnant women had been immunized with tetanus toxoid and, for comparison, also in areas where such immunization had not been given. Neonatal mortality rates were three times greater in areas where tetanus toxoid immunization had only recently or had not yet been introduced by the national expanded programme on immunization. Analysis of the data indicates that the impact on reduction of neonatal mortality from tetanus of three interventions (immunization of pregnant women with tetanus toxoid; delivery in hospital; or birth at home attended by a trained health worker) was greatest for immunization."

Figure 1 shows the survey areas covered in the study. Areas were either Non-EPI areas, EPI areas, or they were excluded.

Table 1 gives the distribution of townships covered in the surveys. Of 314 townships, 123 were excluded from the survey, 114 were in an EPI area, and 77 were in a non-EPI area.

Table 2 gives data collected on NNT in 114 townships surveyed. Included is demographic data and data associated with live births. This table shows a much greater percentage of mothers who have been immunized with TT2 in the EPI area (55.2%) than in the non-EPI area (8.1%). In the non-EPI area, 30.6% of deliveries had potentially infectious material on the umbilical stump as compared to 15.9% in the EPI area.

Table 3 summarized data for mortality from NNT. Mortality is higher in almost every category in the non-EPI area.

Table 4 gives characteristics of NNT mortality.

Tables 5 and 6 show the effect of the three interventions on mortality from NNT.

Recommendations from this report include the development of a program to educate mothers and indigenous medical practitioners on NNT to increase recognition and referral of cases to health facilities. The focus should be on preventive measures- care of the umbilical stump, avoidance of potentially infectious dressings, and timely and adequate immunization of pregnant women with TT.

Prepared to accompany the document "The EPI Coverage Survey", this document serves to offer guidelines in doing a field survey. Step-by-step directions are given for each of the exercises covered in "The EPI Coverage Survey".

An immunization coverage survey is defined as a survey of a small number of individuals to determine their immunization status. The purpose of the immunization coverage survey is to identify ways to improve an immunization program, and thereby reduce morbidity and mortality from vaccine-preventable diseases.

Guidelines for exercises A through L are given. It is suggested that major points should be summarized and all questions should be answered. A time schedule is given.

Also included in this document are answers to each of the exercises. Many of these exercises allow participants to practice skills they have learned (i.e., recording responses on forms, performing calculations). Cluster forms, summary forms, and evaluation forms are included.

At the end of this training, participants should be able to perform a tetanus immunization coverage survey for both women and children. In fact, they will have conducted a survey and reviewed the results with the facilitator.
Neonatal tetanus affects 1 in every 82 and kills 1 in every 110 infants born in the town of Juba, southern Sudan. It is also an important cause of death in adult life both in southern Sudan and in other parts of the developing world.

This report discusses a survey conducted in Juba in 1983. All patients with tetanus admitted to Juba Teaching Hospital were examined. Researchers also met with a traditional midwife and obtained samples of materials she uses.

Incidence was determined at 12.2 per 1000. Tests indicated that the mode of infection could be the fine string-like roots used to tie the umbilical cord.

NNT can be prevented in two ways: first, by immunization of pregnant women and second, by strict hygienic handling of the umbilical cord and stump. The authors advocate the issuance of a simple kit containing a sterile blade, a sterile ligature, 2-3 adhesive dressings for the stump, and 2-3 sterile swabs.
CHAPTER 8

COST ANALYSES
COST ANALYSES


Author abstract - "This paper compares the cost per completed maternal tetanus immunization and an estimate of the cost per death averted in the routine EPI program with similar results from an experimental mass campaign in Aceh Province, Indonesia. The mass campaign is shown not to be less cost-effective in achieving complete immunization but is less cost-effective in averting neonatal tetanus deaths, due to its broader targeting. Factors affecting efficiency, coverage, and financing of tetanus immunization programs are assessed. While expansion of the routine EPI program is the preferred goal, mass campaigns are judged to be a reasonable part of a multi-year strategy for tetanus control in the province. Recent experiments with an accelerated routine program may provide further alternatives."

Table 1 shows the total cost and cost per T22 for both the routine program in four sub-districts in Aceh and the crash program inPidie, 1985-86. Total costs per sub-district ranged from 90,130 rupiah to 1,225,901 rupiahs. However, population varied widely as well. Cost per T22 ranged from US $0.52 to US $2.40. This table shows that the much greater spending on the mass campaign was more than offset by its higher efficiency in producing T22s.

Table 2 estimates the cost per death averted.

There are 3 types of costs in the immunization programs studied in Aceh: fixed, semi-variable, and variable. Table 3 gives the fixed costs for the routine immunization program.

Results of this study showed that the mass immunization program or "crash" program was marginally more efficient than the routine program in terms of completed immunizations. However, the mass program was quite expensive by local standards. Despite its success in achieving a high rate of coverage, this program's efficiency has been questioned. The authors recommend mass campaigns where TT immunization is a high priority for the province and suggest a flexible schedule for the implementation of different strategies over time. However, the authors purport that the development of a comprehensive, high coverage, routine immunization program is better.

This handbook provides quick methods for calculating incremental resource requirements and costs of TT immunization programs above and beyond those costs for routine immunization of infants and children. The resource requirements for any TT immunization strategy will be country-specific and will depend upon the level of coverage and the organization and delivery of health services.

The costs outlined have been divided into variable and fixed costs. Variable costs are those which are directly linked to each vaccination (i.e., vaccine, syringes, needles) while fixed costs are those which are required for the vaccination program (i.e., training, personnel, supervision, transportation).

Variable costs are delineated in tables A and B. Fixed costs are delineated in tables C through J. Table K may be used to summarize a particular strategy and provides a format for calculating and comparing cost-effectiveness.

Table A: Variable Costs for TT Immunization Programs - these would be influenced by the target population chosen (pregnant women or all women of childbearing age) and the coverage objective (TT2 or TT5).

Table B: Incremental Personnel Costs for TT Immunization

Table C: National Cold Chain System Requirements

Table D: Estimation of Additional Cold Chain Requirements for Alternative TT Immunization Strategies

Table E: Additional Cold Chain Operation Requirements

Table F: Transportation Costs for TT Immunization

Table G: Training Costs for TT Immunization - this includes trainee salaries, trainer salaries, per diem, transportation, and production of training materials.

Table H: Supervision Costs for TT Immunization - this includes supervisor salaries, per diem for supervisors, and transportation for supervisors.

Table I: Monitoring Costs for TT Coverage Surveys

Table J: Additional Media Costs for TT Immunization (social mobilization)

Table K: Summary Table for Cost and Cost-effectiveness of alternative TT Immunization Strategies

Appendix 1 contains a chart of Capital Annuiting Factors from WHO/GEN/79/5.

Appendix 2 provides a bibliography and Appendix 3 provides a glossary of terms. This report would be of use in training workshops for those involved program management.
CHAPTER 9

WORKSHOPS/MEETINGS
WORKSHOPS/MEETINGS


8002 Action plans for the accelerated control of neonatal tetanus presented at the workshop held in Cotonou, Benin, September 19-26, 1988, for the following countries: Burkina Faso - 10 pages; Zaire - 12 pages; Niger - 15 pages; Republique de Guinee - 13 pages; Chad - 25 pages; Republique Federale Islamique des Comores - 17 pages; Cote d'Ivoire - 16 pages; Republique Populaire du Benin - 27 pages; Togo - 12 pages; Madagascar - 20 pages. All in French. Unpublished. 1988.

8003 Action plans for the elimination of neonatal tetanus presented at the workshop held in Dakar, Senegal, December 12-19, 1988, for the following countries: Republique du Cameroun - 21 pages; Republique Populaire du Congo - 16 pages; Republique Centrafricaine - 17 pages; Republique Populaire Democratique Algerienne - 17 pages; Republique Gabonaise - 18 pages; Republique du Rwanda - 18 pages; Republique du Senegal - 17 pages; Republique du Mali - 19 pages; Republique Islamique de Mauritanie - 14 pages. All in French. Unpublished. 1988.

8004 Action plans for the elimination of neonatal tetanus presented at the WHO workshop held in Nairobi, Kenya, April 10-18, 1989, for the following countries: Botswana - 11 pages; Kenya - 8 pages; Lesotho - 7 pages; Malawi - 8 pages; Seychelles - 7 pages; Swaziland - 12 pages; Uganda - 13 pages. Unpublished. 1989.


This report includes all proceedings of the NNT workshop held in Harare, Zimbabwe by the WHO Regional Office for Africa in July 1988. Participating countries were: Ethiopia, Gambia, Ghana, Liberia, Nigeria, Sierra Leone, Tanzania, Zambia, and Zimbabwe. This workshop was the first of five planned for 1988-1989 in the Africa region.

The overall objective of this workshop was the development of country-specific action plans to accelerate the reduction of incidence and mortality from neonatal tetanus by immunization of women with TT and by improved MCH services. Annex 2 gives further objectives.

Topics covered in this workshop were:

- situation analysis;
- NNT in Africa;
- assessment of the magnitude of NNT at the country level;
- surveillance of NNT;
- monitoring TT coverage of women by routine reporting and cluster surveys;
- alternative immunization strategies to increase TT coverage;
- social mobilization and communication strategies for NNT control; and
- action plans for the accelerated control of NNT.

Several presentations were given and case studies were used whenever possible. At the end of the workshop, countries were expected to turn in specific action plans for NNT control.

Table 1 gives a summary of country presentations.

Table 2 shows the major problems identified in the assessment of the magnitude of NNT at the country level by country.

Table 3 refers to demand creation and gives a summary of proposed activities for each country.

Table 4 shows proposed TT immunization policies, strategies, and activities.

Some of the proposed activities resulting from the workshop are as follows:

- Eight countries are committed to immunizing all women of childbearing age, rather than only pregnant women.
- Five countries propose to adopt the recommended WHO immunization schedule of 5 doses of TT. This will then be the policy of all nine countries.
- All countries are now committed to immunizing women at all contacts with the health system.
- All countries emphasize TT in future communication strategies and all are committed to enhancing TBA training.
• Six countries have proposed conducting NNT mortality surveys, including the two most populous countries in sub-Saharan Africa - Nigeria and Ethiopia.

• All countries will report NNT separately from other tetanus and all propose either to establish a sentinel surveillance system and/or to continue local area monitoring.

• Six countries proposed to conduct missed opportunity surveys for TT immunization.

Several annexes (1-8) list the agenda, objectives, participants, materials used, and other workshop-specific details.
This paper describes the most recent directives by the WHO regarding NNT to date.

In 1989, the World Health Assembly has adopted a resolution to eliminate NNT from the world by 1995. As of July 1989, surveys in 62 countries (including 18 of the 25 most populous in the developing world) had shown the magnitude of the NNT problem in many countries. In 1989, routine surveillance for NNT has not been able to detect more than 2-8% of NNT cases. Coverage of pregnant women in developing countries with 2 or more doses of TT is less than 30%.

A clean delivery is defined as a delivery attended by a health staff in a medical institution or by a trained birth attendant at home. More up-to-date information is needed on the percentage of deliveries by trained staff.

A major objective is monitoring the progress of the elimination effort by key indicators: coverage of pregnant women or women of childbearing age with at least 2 doses of TT or births delivered by trained attendants, incidence of NNT (estimated and reported). Supporting activities include plans of action, advisory bodies, training materials, separate reporting of NNT, monthly reporting.

A case definition of NNT is described as:

Normal suck and cry for the first 2 days of life; onset of illness between 3-28 days of life; inability to suck followed by stiffness and/or convulsions.

All aspects of the NNT elimination effort are discussed. These include:

- separate reporting;
- monthly reporting including zero cases;
- sentinel reporting;
- NNT case investigation;
- cause of death for all neonatal deaths;
- immunization coverage;
- target groups;
- immunization schedule (recommended is 5 doses with a minimum interval between each dose - shown in text);
- immunization strategies;
- TT immunization cards (shown in text); and
- hygienic delivery practices.

Also discussed are supporting activities such as country-specific plans of action (national and district), training workshops, supervision, social mobilization, monitoring progress, and research (operative research and vaccine development - a TT which is effective with fewer doses is needed).
The provisional classification of countries is discussed. The basic requirement for entering the classification system is to report NNT cases separately. Classification is based on NNT incidence and the percentage of women of childbearing age protected by 2 or more doses of TT or the percentage of deliveries by trained attendants. It is recommended that each year, every country should reanalyze its data on incidence and coverage to determine its classification.

There are five classes:

Class 1: Countries in which NNT has been eliminated
Class 2: Countries in which NNT is close to elimination
Class 3: Countries in which NNT persists
Class 4: Countries in which NNT is a serious public health problem
Class 5: Countries in which NNT incidence is a serious health problem but with weak programs.

Priority activities are suggested for each class and are shown in a matrix. Several tables show the classification of countries by WHO region as well.

Finally, responsibilities on the part of the WHO are listed and resource requirements are discussed. The cost of fully protecting a woman for her childbearing age period with 5 doses of TT is estimated to be US$5.00. Costs are shown in a matrix.