

ORIGINAL ARTICLE

A STUDY ON THE KNOWLEDGE OF TETANUS IMMUNIZATION AMONG INTERNEES IN A GOVERNMENT MEDICAL COLLEGE OF KOLKATA

Ranadip Chowdhury¹, Abhijit Mukherjee¹, Saibendu Kr Lahiri²

¹Post graduate trainee, ²Professor & Head of Dept, Department of Community Medicine, RG Kar Medical College & Hospital, 1, Khudiram Bose Sarani, Kolkata 700004

Correspondence:

Dr Ranadip Chowdhury,
Department of Community Medicine,
3rd Floor Academic Building RG Kar Medical College & Hospital,
1, Khudiram Bose Sarani, Kolkata 700004.
E- mail: ranadip84@gmail.com Mobile: +91 9836685913

ABSTRACT

The current study was undertaken to assess the knowledge of the internees regarding tetanus immunization in children, pregnant women and adults as per the NIS and the guidelines regarding tetanus immunization in relation to the wound categories depending on the immunisation status of the patients. A pre tested questioner used to access knowledge among 108 internees. 57.4% internees were not aware of the number of doses of tetanus vaccine recommended for children under the age of 16 years and 76.8% internees were not aware of the number of doses of tetanus vaccine recommended for adults over the age of 16 years. More than 90% of the internees considered contaminated wounds, animal bites, burn injuries and wounds greater than 6 hours old to be tetanus prone. 91.7% of internees had considered wounds greater than 6hours old as tetanus prone and 5.6% did not consider this wound to be tetanus prone. On the other hand 97.2% of internees had considered contaminated wounds and animal bite to be tetanus prone and 2.8% did not consider. While 93.5% of internees considered burn injuries to be prone to the development of tetanus, 6.5% of internees thought otherwise. 13% of the internees did not consider human bite to be tetanus prone. 25% of the internees considered every cut injury to be tetanus prone. Better TT awareness of tetanus prophylaxis recommendations is necessary and tetanus prophylaxis recommendations may be more effective if they are better adhered to at the ED and the other departments that are involved in providing tetanus prophylaxis to their patients.

Keywords: Tetanus, internees, immunization, knowledge, wound

INTRODUCTION

Tetanus is an acute, often fatal, disease caused by an exotoxin and highly potent neurotoxin, tetanospasmin, which is produced during the growth of the anaerobic bacterium *Clostridium tetani*. *Cl. tetani* is not an invasive organism; infection with *Cl. tetani* remains localized. Tetanus spores are widespread in the environment. Tetanus bacilli can also enter the body through contaminated puncture wounds and sometimes seemingly trivial injuries.¹ Once inside neurons, tetanus toxin cannot be

neutralized by tetanus antitoxin. Toxin accumulates in the central nervous system, where it prevents the release of inhibitory neurotransmitters, such as glycine and gamma-aminobutyric acid, thereby leaving excitatory nerve impulses unopposed.²

In neonates, tetanus occurs as a result of unhygienic birth practices, most commonly when tetanus spores contaminate the umbilical cord at the time that it is cut or dressed after delivery. It is a deadly disease for newborns, with a case fatality rate of 70 to 100 per cent.³

Most neonatal deaths due to tetanus occur at home before the baby reaches two weeks of age with neither the birth nor the death being reported. The number of cases of tetanus reported also remains low, representing only the tip of the iceberg.³

Behaviours such as safe delivery practices, training of the traditional birth attendants (TBA) and immunization with tetanus toxoid (TT) are important factors affecting the incidence of tetanus.⁴ Immunisation of pregnant women with TT induces the formation of antibody, primarily of the immunoglobulin G (IgG) class, which passes to the foetus through the placenta and prevents neonatal tetanus. Without that protection and if a birth takes place in unhygienic conditions, the newborn child may get tetanus through infection of the umbilical cord stump. Immunisation is more effective than comprehensive perinatal health care in the prevention of neonatal tetanus.⁵ Thus the primary focus of the neonatal tetanus elimination program is the immunization of women of childbearing age with tetanus toxoid.⁶ Prevention of wound related tetanus is primarily through the administration of the toxoid along with the use of Human Tetanus Immunoglobulin (HTIG) depending on the risk of the wound to develop tetanus. Tetanus immunoglobulin is necessary for immediate protection to tide over the period that the toxoid needs to achieve levels of protective immunity.

Wounds can be divided into categories A and B based on the type and duration of wounds. Category A wounds are defined as wounds that were less than 6 hrs old, clear, non-penetrating and with negligible tissue damage & category B included all other types of wounds.⁴ The schedule recommends the use of TT for Cat A wounds and TT and HTIG for Cat B wounds. The schedule also considers the immunization status of the patient while planning tetanus prophylaxis.

It is difficult to justify the fact that despite the disease being entirely preventable through immunisation and the availability of a safe and potent vaccine for the last 82 years the burden of tetanus worldwide still remains high.⁷ Following widespread use of tetanus toxoid--containing vaccine during the 1940s, tetanus has become uncommon in the United States, particularly in children and adolescents. During 1990-2004, a total of 624 tetanus cases were

reported; 19 (3%) cases were among adolescents aged 11-18 years.⁸

The National immunisation Schedule (NIS) has been running successfully in the country since 1986. Despite the apparent success of the programme, tetanus remains an important endemic infection in India.⁴ and the goal of elimination of neonatal tetanus by 2005 remains elusive. Infact, the Central Bureau of Health Intelligence (CBHI) has reported an increase in the total number of neonatal tetanus cases from 625 in 2006 to 937 in 2007⁹ and an increase in the incidence of total tetanus cases from 2815 in 2006 to 7005 in 2007.⁹

Immunisation against tetanus is also the most effective tool for controlling the disease in children and adults.⁵ According to the World Health Organisation (WHO), six doses of TT containing vaccine within the age of 16 years provide life long immunity against the disease.² The NIS in India advocates the administration of 7 doses of TT by the age of 16 years. It provides protection that lasts 3 weeks, throughout the duration of the disease incubation period.¹⁰

Knowledge regarding TT vaccination as per the NIS among all levels of health care personnel is important not only for the prevention of neonatal tetanus but also tetanus in the children and adults. A thorough knowledge of the tetanus immunisation in wounds is also necessary to prevent the occurrence of wound related tetanus.

In West Bengal the interneers constitute the first tier of health care providers in almost all departments of the medical college, more so in the emergency departments. They take down the detailed history of the patient at entry and give out the preliminary treatments. In the emergency departments they are the ones responsible for arranging for immunisation of the patients with injuries before definitive management is instituted. So it is important that they are well aware of the exact guidelines in dispensing the vaccines and immunoglobulin for their patients. Improper or inadequate knowledge would result either in excessive or under utilisation of the vaccine and immunoglobulin putting patients at risk of developing tetanus or unnecessary adverse effects of hyper immunisation.

In their study from Karachi, Ahmed et al reported that,¹¹ among general practitioners in Pakistan, it was observed that doctors had poor

knowledge of tetanus immunization. In another study on doctors in Delhi, Rajesh K and co workers found low knowledge levels regarding tetanus immunization.¹² Studies conducted at 5 university-affiliated emergency departments (ED) in the United States found substantial under immunization in the ED (particularly with regard to use of tetanus immunoglobulin), leaving many patients, especially those from high-risk groups, unprotected. Better awareness of tetanus prophylaxis schedules was recommended.¹⁰

The present study was undertaken to assess the knowledge of the interneers, who comprise an important category of service delivery at all departments of RG Kar Medical College, Kolkata regarding tetanus immunization in children, pregnant women and adults as per the NIS¹³ and the guidelines regarding tetanus immunization in relation to the wound categories depending on the immunisation status of the patients.

ETHICAL CONSIDERATION

The study employed a, cross-sectional questionnaire, which was approved by the Ethical Committee of the R.G.Kar Medical College, Kolkata. Before commencement of interviews, the objectives of the study and the contents of the questionnaire were explained to each of the subjects and consent for participation obtained. Participants were assured that the data which was gathered would be used only for research purposes.

METHODS

It is a descriptive observational cross-sectional study conducted among interneers of 2010-2011 batch of R.G. Kar Medical College and Hospitals, Kolkata during March 2011.

An extensive search of the literature available on the internet did not reveal any information regarding the prevalence of knowledge regarding tetanus immunization among interneers in a medical college. The sample size calculations were thus based on the assumption that 50% of the interneers had the correct knowledge regarding the immunization guidelines.¹⁴ With a 95% confidence limit and 10% allowable error and applying the formula

$$[z^2 p(1-p)/d^2]^{14}$$

the sample size(n) was calculated to be 400. However since the study population (N) was 150, the revised sample size calculation with finite population correction given by the formula

$$Nz^2 p(1-p)/[d^2(N-1)+z^2 p(1-p)]^{14}$$

[Where N= study population, z=1.96 for 95% confidence, p=estimated proportion in study population, d=acceptable margin of error] gave the corrected sample size of 108. These 108 interneers to be interviewed were selected by Simple Random Sampling (SRS) from a total of 150 interneers after complete enrolment.

A pre-tested, pre-designed questionnaire was adapted. Before adaptation of the questionnaire a thorough peer review and discussions were undertaken. The questionnaire was then pre-tested on a group of 20 interneers not included in the final study. Corrections and modifications were incorporated following the pretesting procedure to develop the final questionnaire. The questionnaire consisted of four parts namely; the interneers' profile, evaluation of the interneers knowledge on the number of doses of tetanus vaccine in children, adult and pregnant women as per the National Immunisation Schedule as followed in India, the types of injury that are tetanus prone and TT and HTIG administration in relation to various types of wounds according to the immunization status of the patient.

Analysis

The collected data were entered in the Epi Info software (version 3.5.2, CDC Atlanta) by a RC and double checked by AM for errors in data entry. All calculations were done with the help of the Epi-info software.

RESULTS

All the 108 interneers participated in the study. Out of 108 interneers, 72 were males and 36 were females. The mean age of the interneers was 23.8 ± 1.2 years. The mean age of the male interneers was 24.0 ± 1.4 years and that of female interneers was 23.4 ± 0.9 years.

57.4% interneers were not aware of the number of doses of tetanus vaccine recommended for children under the age of 16 years and 76.8% interneers were not aware of the number of doses of tetanus vaccine recommended for adults over

the age of 16 years. All the internees that participated in the study knew the correct schedule of tetanus immunisation for pregnant women with no history of previous

immunisation. However 18.5% of the internees are not aware of the correct number of doses to be administered to pregnant mother who had their last child birth within the last 3 years.

Table 1: Knowledge of correct doses as per National Immunisation Schedule

	Correct Answer	Incorrect answer	Don't Know	Guidelines
Children<16 years	45(41.66)	62(57.41)	1(.001)	6 doses
Adults>=16 years	25(23.15)	83(76.85)	0	1dose
Pregnant women with no previous history of TT	108(100)	0	0	2doses
Pregnancy within last 3 years	88(81.48)	9(.09)	11(1.02)	1dose

Figure in parenthesis indicate percentage

Table 2: Number of internees who considered a particular wound to be tetanus prone

Type of wounds	Yes	No	Does not Know	Guideline
Any cut injury	27(25%)	80(74.07%)	1(.9%)	No
Wounds >6 hrs old	99(91.67%)	6(5.55%)	3(2.78%)	Yes
Contaminated wounds	105(97.22%)	3(2.78%)	0	Yes
Human bite	90(83.33%)	14(12.96%)	4(3.70%)	Yes
Animal bite	105(97.22%)	3(2.78%)	0	Yes
Burn	101(93.52%)	7(6.48%)	0	Yes

More than 90% of the internees considered contaminated wounds, animal bites, burn injuries and wounds greater than 6 hours old to be tetanus prone. 91.7% of internees had considered wounds greater than 6hours old as tetanus prone and 5.6% did not consider this wound to be tetanus prone. On the other hand 97.2% of internees had considered contaminated wounds and animal bite to be tetanus prone and

2.8% did not consider. While 93.5% of internees considered burn injuries to be prone to the development of tetanus, 6.5% of internees thought otherwise. 13% of the internees did not consider human bite to be tetanus prone. 25% of the internees considered every cut injury to be tetanus prone. There were several internees with no responses to some of the questions asked. (Table 2)

Table-3: Knowledge of internees of tetanus immunization in Cat-A wound according to immunization status of the patients

Immunisation status	Nothing required	TT 1	TT 1 + HTIG	TT complete	TT complete +HITG	Can't say	Guideline
<5 years	100(92.6)	6(5.5)	1(.9)	1(.9)	0	0	Nothing required
5-10 years	21(19.4)	84(77.8)	3(2.8)	0	0	0	TT 1 dose
>10 years	9(8.3)	74(68.5)	10(9.3)	13(12.0)	2(1.85)	0	TT 1 dose
No history of Immunization	0	1(0.9)	2(1.8)	81(75.0)	23(21.27)	1(0.9)	TT complete dose

Figure in parenthesis indicate percentage

Respondents were questioned on the recommendations for tetanus immunization for category A and Category B wounds. Table 3 and Table 4 show the responses for Category A and Category B wounds respectively.

In case of Cat-A wound with a history of complete immunisation within the last 5 years,

almost 7% of internees recommended a single dose of Tetanus toxoid. For patients who received a full course of tetanus within the last 5 to 10 years, almost 20% internees had recommended nothing and also 35 internees had recommended tetanus immunoglobulin. Again in patients where complete immunisation had

been done 10 years back and where one dose of TT is sufficient almost 32% internees had not recommended that. And 11% internees had recommended tetanus immunoglobulin. Where no previous history of immunisation is present complete dose of TT is sufficient in Cat-A wound but 23% internees had recommended

tetanus immunoglobulin. Thus there is a lacunae of knowledge regarding wound related tetanus immunisation among internees in Cat-A wound, the patients may not get TT where they shouldn't or vice versa or would get tetanus immunoglobulin where it is not recommended.

Table-4: Knowledge of internees of tetanus immunization in Cat-B wound according to immunization status of the patients

Immunisation Status	Nothing Required	TT1	TT1+ HTIG	TT complete	TT complete +HTIG	Can't Say	Guideline
<5 Years	80(74.1)	19(17.6)	4(3.7)	1(.9)	4(3.7)	0	Nothing Required
5-10 Years	12(11.1)	52(48.1)	33(30.6)	5(4.6)	5(4.6)	1(.9)	TT1
>10 years	1(.9)	6(5.6)	69(63.9)	12(11.1)	20(18.5)	0	TT 1+HTIG
No history of immunisation	0	0	2(1.8)	2(1.8)	104(96.3)	0	TT complete +HTIG

Figure in parenthesis indicate percentage

In Cat-B wound if the patient had taken complete immunisation within last 5 years there is nothing required while 25.9% internees had not recommended that. In case of complete immunisation done within 5-10 years where just one TT dose is sufficient just 48.2% internees had recommended that and 35% internees had recommended tetanus immunoglobulin in this sub-group of patients. In another sub group of patient where complete immunisation was done 10 years back and TT one dose and tetanus immunoglobulin is recommended 17% internees didn't recommended tetanus immunoglobulin and 18.5% internees recommended complete dose of TT. But contrary to all in case of no previous history of immunisation in Cat-B 96.3% internees had recommended correct schedule.

DISCUSSION

The objectives of this study was to evaluate the knowledge among internees in tetanus immunization in children, pregnant women and adults as per the NIS¹³ and the guidelines regarding tetanus immunization in relation to the wound categories depending on the immunisation status of the patients. The present study reveals that among the internees the knowledge regarding immunization of pregnant women during their first pregnancy was universal. Better health care provider education regarding immunization in subsequent

Pregnancies is needed to fill the gaps in their knowledge as they have lacunae of knowledge

in non immunised pregnant mothers but they have lacunae of knowledge regarding tetanus immunisation in children and pregnancy within last 3 years.

A quarter of the internees seemed to be overcautious in their use of tetanus vaccination for cut injuries considering any cut injury to be tetanus prone. Similar result was found in a study in UK among various staff members in the accident and emergency (A&E) departments, where 22.1% of respondent considered any cut injury to be tetanus prone.¹

Many of the internees did not know the appropriate course of action regarding tetanus immunization in wounds and either did not recommended booster doses of TT when needed or recommended TT and tetanus immunoglobulin unnecessarily.

Mortality from neonatal tetanus still remains an important but preventable, cause of neonatal mortality in India.¹⁵ The Government of India had set the goal of neonatal tetanus elimination by the year 2005 through the coverage of all pregnant women with 2 doses of tetanus toxoid. A single booster dose of the toxoid is recommended for repeat pregnancies within a period of 3 years since the last pregnancy.¹⁶

Vaccination with two doses of TT immunization given at least 4 weeks is the chief priority in preventing neonatal tetanus. The vaccine is cheap and available at the government subcentres for free. It is indeed surprising that even then the goals of elimination of neonatal

tetanus in India are yet to be achieved. In addition to proper knowledge of the immunization schedule among all levels of health care workers including internees, it is imperative that access to the health care delivery systems for all mothers is ensured.

Although not specified in the NIS in India the WHO¹⁷ states that three doses of TT gives 5 years protection, four doses of TT gives 10 years protection and five doses of TT gives lifelong protection against neonatal tetanus starting from 15 days after the date of dose in each cases. So tetanus immunisation schedule for pregnancies after the second need to be planned based on the number of vaccines received and the timing of the subsequent pregnancies.

WHO² updated its tetanus policies and recommendation to achieve and sustain a high coverage of 3 doses of tetanus containing vaccine (DPT) in infancy and of appropriate booster doses in order to prevent tetanus in all age groups. The primary series of DPT coverage in infancy only gives protection for approximately 5 years and reinforcing doses of TT in children of school age and adolescents are critical in maintaining antibody levels which can persist for decades.² Evidence of this is supplied by serological surveys of countries with an established programme of tetanus immunization. Based on the recommendations of the WHO the National Immunisation Schedule of India has proposed 3 doses of DPT in the first year of life as primary immunisation and then one booster of DPT at 16-24 months and then at 5-6 years one dose of DT and at 10 years and 16 years one dose of TT respectively.¹⁸

Immunisation with TT in HIV positive patients is safe as the vaccine is an inactivated toxoid. HIV-positive children given three doses of TT (DTP) at 6, 10 and 14 weeks had similar proportions protected at nine months of age as HIV-negative children.¹⁹ Moss et al²⁰ concluded that 40%–100% of HIV-infected children develop protective levels of tetanus antitoxin following primary immunization in infancy. HIV-infected children appear to respond well to booster immunization with between 74%–90% reported to have protective antibody levels following a booster dose at various ages and times since primary series.^{21,22,23} In HIV-infected adults the response to a booster dose induces protective levels;²⁴ however the response tends to be lower than in uninfected controls.^{25,26,27}

Tetanus toxoid, as a monovalent vaccine or as a component of combined vaccines, is recommended for HIV-infected children or adults, regardless of the presence or absence of symptoms of AIDS, as most vaccine recipients, both children and adults, appear to achieve protective antitoxin levels

However, there are many barriers preventing successful immunization throughout infancy, childhood, and adolescence in some regions, including cost, logistics, and rate of school attendance. In addition to imparting knowledge regarding the number of doses of vaccines to the care providers and beneficiaries it is equally important that availability and access to the health care facilities be ensured.

Considering a cut injury to be tetanus prone can result in the unnecessary use of toxoid and tetanus immunoglobulin. Although both the toxoid and HTIG are considered relatively safe, there have been reports of adverse reaction in the form of Arthus type of hypersensitivity following the use of tetanus toxoid-containing vaccine.²⁸ A large number of respondent internees considered contaminated wounds, animal bites, and burn injuries to be tetanus prone, many did not consider human bites to be tetanus prone²⁹, putting patients with such injuries at risk of developing tetanus. Talan et al¹⁰ reported that in about one third of patients with baseline “nonprotective” tetanus antitoxin titers, toxoid boosters increase antibody titres to protective levels within 7 days, leaving these patients vulnerable to develop tetanus. Tetanus immunoglobulin provides immediate protection that lasts 3 weeks, throughout the duration of the disease incubation period.

Immediate protection through passive immunization by tetanus immunoglobulin is of utmost importance in the prevention of tetanus in heavily contaminated wounds. Tetanus immunoglobulin is given to neutralize circulating toxin and unbound toxin in the wound, antitoxin effectively lowers mortality. The present guidelines regarding the use of tetanus immunoglobulin and TT in injuries are rather complicated. In case of Cat-A wound with complete course of TT or booster within last five years nothing is required, within five to ten years TT one dose, more than ten years TT one dose and if no previous history of immunisation then TT complete dose. In case of Cat-B wound with complete course of TT or booster within last five years nothing is required, within five to

ten years TT one dose, more than ten years TT one dose and tetanus immunoglobulin and no previous history of immunisation TT complete dose and tetanus immunoglobulin.⁴

This could be because of the non adherence to the guidelines by the medical officers and senior doctors at the ED where tetanus immunizations are mainly given. Majority of the patients needing tetanus for injuries cannot remember their last dose of tetanus immunisation. The dangers of under immunisation probably outweigh those of extra doses. Although considered generally safe HTIG still carries the risk of local and generalised side effects and therefore unwarranted use of the same should never be encouraged. Some of the reported side effects are short term discomfort at the site of injection. Very rarely a hardened area may develop where the injection was given chest pain, shortness of breath, shaking, dizziness, swelling of the face, coating of the tongue, mouth ulcers, joint pains and fever.³⁰

Talan et al,¹⁰ while reporting on tetanus immunity and physician compliance with tetanus prophylaxis practices among emergency department patients presenting with wounds identified certain subpopulation in the United States that were relatively unprotected. This subpopulation comprised specifically the elderly, immigrants, and persons with education limited to grade school. The existence of similar subpopulation in patients from the country need to be examined through further research.

Better TT awareness of tetanus prophylaxis recommendations is necessary and tetanus prophylaxis recommendations may be more effective if they are better adhered to at the ED and the other departments that are involved in providing tetanus prophylaxis to their patients. National recommendations should be followed at all times while administering the vaccine. An immunisation card containing the details of tetanus immunisation can be kept with the patient at all times. This will enable the health care personnel to know the immunization status of the patient when needed. In the absence of such a health card the use of rapid tests for tetanus immunity can be used for appropriate wound management in the emergency department.

Acknowledgement

All the interneers who had participated in the study had been acknowledged.

Competing Interest

The author's declare that they have no financial and personal relationship(s) which may inappropriately influenced them in writing this paper.

Authors' Contribution

R.C has contributed in concepts, design, definition of intellectual content, data acquisition and manuscript preparation. A.M has contributed in literature search, data analysis, statistical analysis and manuscript preparation. S.K.L has contributed in manuscript editing and manuscript reviewing.

REFERENNCES

- 1 Savage EJ, Nash S, McGuinness A, Crowcroft NS. Audit of tetanus prevention knowledge and practices in accident emergency departments in England. *Emerg Med J* 2007;417-421
- 2 Borrow R, Balmer P, Roper HM. Tetanus Update. The immunological basis for immunisation series Module 3: Tetanus update 2006.WHO;2006.
- 3 WHO. Maternal and Neonatal Tetanus Elimination by 2005.WHO 2000 (Available at www.who.int/vaccines_documents last accessed on 1.10.2011)
- 4 Park K. Park's Textbook of Preventive & Social Medicine 20th Edition Banarsidas Bhanot Publishers 2009:272
- 5 Peeters RF, Alisjahbana, Meheus AZ. Preventing neonatal tetanus: traditional birth atetanus toxoidendants or immunization. Downloaded from www.heapol.oxfordjournals.org on January 17, 2011
- 6 Neonatal Tetanus Elimination. Pan American Health Organization 2005. Available at [htetanus toxoidp://www.paho.org/english/ad/fch/im/FieldGuide_NNT.pdf](http://www.paho.org/english/ad/fch/im/FieldGuide_NNT.pdf) last accessed on 1.10.2011)
- 7 Abrutyn E. Principles of Harrison's Internal Medicine 17th Edition Mcgraw hill Medical 2008:898-900
- 8 Srivastava P, Brown K, Chen J, Kretsinger K, Roper MH. Trends in tetanus epidemiology in the United States, 1972--2001. 39th National Immunization Conference, Washington, DC,2005; March: 21--24
- 9 Kishore J. National Health Programmes of India 9th Edition Century Publications 2011:158
- 10 Talan DA, Abrahamian FM, Moran GJ, Mower WR, Alagappan K, Tiffany BR, Pollack CV, Steele MT, Dunbar LM, Bajani MD, Weyant RS, Ostroff SM. Tetanus immunity and physician compliance with tetanus prophylaxis practices among emergency department patients presenting with wounds. *Annals of Emergency Medicine* 2004; 43(3):305-14
- 11 Ahmed SI, Baig L, Thaves IH, Siddiqui MI, Jafery SI, Javed A. Knowledge atetanus toxoiditude and practices of general practitioners in Karachi District Central about tetanus immunization in adults. *J Pak Med assoc* 2001;367-369
- 12 Dabas P, Agarwal CM, Kumar R, Taneja DK, Ingle GK, Saha R. Knowledge of general public and health professionals about tetanus immunization. *Indian J Paediatr* 2005;1035-1038

- 13 Ministry of Health & Family Welfare, Government of India. Review of Universal Immunisation Program in India 2004. New Delhi, 2005.
- 14 Abramson JH, Abramson ZH. Survey Methods in Community Medicine 5th edition Churchill Livingstone 1999:102
- 15 Blencowe H, Lawn J, Vandeleur J, Roper M, Cousens S. tetanus toxoid immunisation to reduce mortality from neonatal tetanus International Journal of Epidemiology. 2010;102-109
- 16 Kishore J. National Health Programmes of India 9th Edition. Century Publications 2011:158
- 17 Monitoring immunization services using the lot Quality technique. Department of Vaccines and Biologicals. WHO
- 18 Govt. of India (2006). Health information of India 2005, Ministry of Health & Family Welfare, New Delhi.
- 19 Ryder RW et al. Safety and immunogenicity of bacille Calmette-Guérin, diphtheria-tetanus-pertussis, and oral polio vaccines in newborn children in Zaire infected with human immunodeficiency virus type 1. The Journal of Pediatrics 1993; 122:697-702.
- 20 Moss WJ et al. Immunization of children at risk of infection with human immunodeficiency virus. Bulletin, Geneva, World Health Organization 2003;81:6170
- 21 Borkowsky W et al. Cell-mediated and humoral immune responses in children infected with human immunodeficiency virus during the first four years of life. The Journal of Pediatrics 1992; 120:371-375.
- 22 Rosenblatt HM et al. Tetanus immunity after diphtheria, tetanus toxoids and acellular pertussis vaccination in children with clinically stable HIV infection. The Journal of Allergy and Clinical Immunology 2005;116:698-703.
- 23 Melvin AJ, Mohan KM. Response to immunization with measles, tetanus, and Haemophilus influenzae type b vaccines in children who have human immunodeficiency virus type 1 infection and are treated with highly active antiretroviral therapy. Pediatrics 2003; 111:641-644.
- 24 Kurtzhals JAL et al.. Immunity against diphtheria and tetanus in human immunodeficiency virus –infected Danish men born 1950-1959. APMIS: acta pathologica, microbiologica, et immunologica Scandinavica 1992; 100:803-808.
- 25 Kroon FP et al. Immunoglobulin (IgG) subclass distribution and IgG1 avidity of antibodies in human immunodeficiency virus-infected individuals after revaccination with tetanus toxoid. Clinical and Diagnostic Laboratory Immunology, 1999; 6:352-355.
- 26 Dieye TN et al. Immunologic and virologic response after tetanus toxoid booster among HIV-1 and HIV-2-infected Senegalese individuals. Vaccine 2002;20:905-913
- 27 Bonetti TCS et al. Tetanus and diphtheria antibodies and response to a booster dose in Brazilian HIV-1 infected women. Vaccine 2004; 22:3707-3712.
- 28 Immunisation Practice advisory Committee tetanus toxoid (CIP), CDC Atlanta. Diphtheria, tetanus and pertussis: Recommendations and other preventive measures. MMWR 1991;1-28
- 29 Eilbert WP. Dog, Cat and human bites: Providing safe and cost effective Treatment in the ED. Emergency Medicine Practice 2003;5(8)
- 30 Downloaded from info@bpl.co.uk. Last accessed on 1/10/2011.