



Missed opportunities for tetanus vaccination in pregnant women, and factors associated with seropositivity

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Summary The aim of this study was to identify the seroprevalance rate of tetanus and to determine missed opportunities for tetanus vaccination. Two hundred and twenty-seven female volunteers who were hospitalized following delivery participated in the study. Blood samples were analyzed using enzyme-linked immunoassay to measure tetanus antibody levels. In addition, a questionnaire was used to investigate the factors associated with vaccination status. Sixty-five percent of the study participants had safe protective levels of antibodies. Factors associated with antibody level were age, level of education and number of doses.

Only 25.7% of women who received antenatal care (ANC) had received tetanus vaccinations. Women who received ANC from primary healthcare facilities were more likely to have been vaccinated than those who received ANC from hospitals or private practice ($P < 0.05$).

Factors associated with both tetanus vaccination and immunizations in pregnant women should be further investigated by qualitative and quantitative studies. Knowledge, attitude and practice surveys of mothers and healthcare providers on provision of the tetanus vaccine to pregnant women need to be undertaken urgently. © 2004 The Royal Institute of Public Health. Published by Elsevier Ltd. All rights reserved.

Introduction

Neonatal tetanus (NT) is a preventable cause of death in newborn infants. Reduction of NT deaths is one of the simplest, most cost-effective ways to reduce the neonatal mortality rate. However,

globally, 289,000 cases of NT occur each year, resulting in 215,000 infant deaths (14% of all neonatal deaths).¹ In 1989, the World Health Organization (WHO) adopted the goal of eliminating NT worldwide. Since 1989, 104 of 161 developing countries have achieved elimination. Maternal tetanus has now been added to the elimination goals. The focus of global efforts with respect to maternal and neonatal tetanus (MNT) is now on the 57 countries that, as of mid-2000, have not

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eliminated MNT in all districts.¹ Turkey, as a Member State of the European Region of the WHO, is one of those 57 countries.

As one of its Health 21 targets, The European Region of the WHO declared that NT should be eliminated in the region by the year 2005.² This would mean that no more new cases would be detected, but all the preventive service strategies would continue. Despite widespread efforts, at present, only 29% of all pregnant women in the world receive two doses of tetanus toxoid during pregnancy.³ Turkey has similar figures in terms of vaccination of pregnant women. Turkey started its NT elimination programme in 1994.⁴ The national policy states that a pregnant woman should receive two doses of tetanus toxoid vaccine unless she was vaccinated during a previous pregnancy. In this case, one dose of the vaccine is sufficient.⁵ According to the 1998 Turkish Demographic and Health Survey (DHS),⁵ 15% of all pregnant women receive one dose, and 29% receive two or more doses of tetanus toxoid. Regions where less than 80% of all pregnant women receive two doses of the tetanus vaccine are defined as high-risk areas by the WHO.⁶ The other two criteria for high-risk areas are having more than one case of NT per 1000 live births, and the presence of a non-reliable case surveillance system. According to the WHO recommendations,⁶ there is no contra-indication to application of tetanus toxoid during pregnancy, and tetanus toxoid should be offered to all pregnant women during antenatal care (ANC). All non-pregnant women should also be offered the vaccine unless their vaccination records indicate that they are immune. Despite all these recommendations and the fact that the vaccine is offered free of charge from primary healthcare facilities, the vaccination coverage is unacceptably low in Turkey. As would be expected in this situation, NT cases occur. Thirty-two cases of NT were notified in 2001, and 19 of these infants have died.⁷ Corresponding figures for the first 6 months of 2002 are 12 and 9, respectively.

It is important to define factors that affect the vaccination of pregnant women so that effective strategies can be identified. Seroprevalance studies are also important to illustrate the extent of immunization against the disease in the community.

This study aimed to identify the tetanus vaccination status, levels of knowledge about the disease and its vaccine, and the tetanus seroprevalance rate among a group of newly delivered women in a state hospital in Istanbul, Turkey. By doing this,

the study also aimed to determine missed opportunities for tetanus vaccination.

Methods

Two hundred and twenty-seven female volunteers, who gave birth in July 2000, were included in this study. The study hospital is a state maternity hospital, serving people with a wide range of socio-economic status but mostly low- and middle-income families. The hospital is ranked as the second hospital in Istanbul in terms of the number of births that are delivered (17,000 births/year).

Women were assessed with respect to their sociodemographic and fertility characteristics, and their level of knowledge about NT and the tetanus vaccine. Serum samples were taken immediately after delivery and serum tetanus immunoglobulin G (IgG) levels were measured. None of the women received the tetanus vaccine after delivery; all vaccinations were given during the pregnancy or when the woman arrived at the hospital for delivery.

Sociodemographic data, fertility characteristics and knowledge-attitude levels were assessed using a questionnaire during face-to-face interviews. Venous blood (5 ml) was collected from each participant for the seroprevalance study. Serum was separated immediately and stored in Eppendorf tubes at -20°C . A tetanus toxin IgG enzyme-linked immunosorbent assay (ELISA) kit (Novum Diagnostica, Lot No: T50G-025) was used to assess IgG antibodies against tetanus toxoid using the micro-ELISA method. Each serum specimen was prepared in 1/100 and 1/1000 dilutions and tested according to the manufacturer's recommendations. In order to obtain quantitative results in IU/ml, the formula and two standard calibration curves that were supplied in the test kit were used. The results were interpreted according to the criteria presented in Table 1.⁸⁻¹⁰

Table 1 Interpretation of assay results.

Result (IU/ml)	Interpretation
<0.01	Non-protective antibody levels. Full-dose prophylaxis with the toxoid should be administered
0.01-0.1	No safe protection
0.11-1.0	Safe protection exists
>1.0	Long-lasting protection

Results

Sociodemographic characteristics of the study participants

The mean age of the participants was 24.6 years (range 15-40 years). Most of the women were elementary school graduates, and 96.9% of all participants were housewives. More than half of the women had no social security (Table 2).

Fertility characteristics of the study participants

Table 3 lists the fertility characteristics of the women. The mean age at first marriage was 19.8 years (range 14-31 years). The mean number of pregnancies was 2.31, with a maximum of eight pregnancies. The mean number of children was 1.81 (range 1-5). Sixty-six percent of subjects stated that their current pregnancy was planned and wanted, and 82% had not used any contraceptives prior to this pregnancy. The difference denotes women with unplanned pregnancies. The most common method of contraception prior to the last pregnancy was withdrawal (27 women).

One hundred and ninety women (83.7%) received ANC during their last pregnancy; most women received this from a physician. One issue that needs to be stressed is that the 10 women who are placed in the 'no ANC' group in Table 3 stated that they had more than one ultrasonographic examination without a doctor's consultation. These women defined these ultrasonographic examinations as sessions of ANC. The mean number of ANC sessions per woman was 4.26 (range 0-13).

Table 2 Sociodemographic characteristics of the study participants.

Characteristics (n = 227)	n	%
<i>Age group (years)</i>		
15-19	28	12.4
20-24	104	45.8
25-29	57	25.1
30-34	27	11.9
35-40	11	4.8
<i>Education level</i>		
No schooling	22	9.7
Elementary school	156	68.7
Junior high school	16	7.0
High school and higher	33	14.6
<i>Social security</i>		
Present	101	44.4
Absent	126	55.6

Table 3 Fertility and related characteristics of the study population (Istanbul, 2000).

Characteristics	n	%
<i>Age at first marriage (years) (n = 227)</i>		
14-19	123	54.2
20-24	78	34.4
25-29	23	10.1
30+	3	1.3
<i>Number of pregnancies (n = 227)</i>		
1-2	151	66.5
3-4	57	25.1
5-8	19	8.4
<i>Antenatal care status (n = 227)</i>		
Received from a physician	186	81.9
Received from a nurse/midwife	4	1.8
Did not receive antenatal care ^a	37	16.3
<i>Timing of the first antenatal care session (n = 190)</i>		
First trimester	105	55.3
Second trimester	65	34.2
Third trimester	20	10.5

^a Ten women had more than one ultrasonographic examination without a doctor's consultation.

Tetanus vaccination status

Twenty-two percent of subjects received at least one dose of the tetanus vaccine irrespective of their ANC status. Sixty-three percent of subjects received two doses, and 36.7% received one dose of tetanus toxoid. Sixty-seven percent of subjects received the vaccine at a maternal-child health and family planning (MCH-FP) clinic or a health centre, both of which are primary healthcare facilities (Table 4).

More than half of the women who received ANC did not have tetanus vaccinations. However, those

Table 4 Tetanus vaccination status, number of doses and place of vaccination among study participants (Istanbul, 2000).

Characteristics	n	%
<i>Tetanus vaccination during last pregnancy (n = 227)</i>		
Vaccinated	49	21.6
Not vaccinated	175	77.1
Do not know	3	1.3
<i>Number of doses received (n = 49)</i>		
1	18	36.7
2	31	63.3
<i>Place of vaccination (n = 49)</i>		
MCH-FP clinic or health centre	33	67.4
Private doctor's office or private hospital	11	22.4
Health unit ^a	3	6.1
State hospital	2	4.1

MCH-FP, maternal-child health and family planning.

^a A private health facility run by a nurse and/or paramedic.

Table 5 Distribution of tetanus vaccination status with respect to receiving antenatal care (ANC) (Istanbul, 2000).

	Received ANC		Did not receive ANC	
	n	%	n	%
No vaccination	101	53.2	27	73.0
Received at least one dose of the vaccine	49	25.7	-	-
Received the vaccine upon hospital admission for delivery	37	19.5	10	27.0
Do not know	3	1.6	-	-
Total	190	100.0	37	100.0

Chi-squared test, $P < 0.01$ (three women who did not know their vaccination status were excluded from the statistical analysis).

Table 6 Tetanus antibody levels among the study participants (Istanbul, 2000).

Status	n	%
No safe protection	80	35.2
Safe protection	120	52.8
Long-lasting protection	27	12.0
Total	227	100.0

who received ANC were more likely to be vaccinated than those who did not receive ANC, and this difference is statistically significant (Table 5). Another point worth indicating is that 47 women were given tetanus shots when they arrived at the hospital for delivery.

Knowledge about the tetanus vaccine and the disease

The study participants were asked whether they knew of any vaccines that should be administered to pregnant women. One hundred and thirty-one

women (57.7%) stated that they did not know any such vaccine. Eighty-eight women (38.8%) named the tetanus vaccine, and eight women reported other vaccines. The study participants were also asked seven true-false-type questions about the mode of transmission of the infection, existence of NT in Turkey, target groups for the tetanus vaccination, etc. The question that received the fewest number of correct responses was about whether NT exists in Turkey (46.7% correct answers). The question that received the highest number of correct responses (81.0%) was about who is protected by the tetanus vaccine administered to pregnant women.

Of the 99 women who planned to have another pregnancy, 94 stated that they would want to receive the tetanus vaccine during their next pregnancy.

Tetanus seroprevalance

It was observed that 35.2% ($n = 80$) of the subjects were not safely protected against tetanus. This fact should also be interpreted in terms of the health status of their infants. Almost 53% (120/227) of the subjects are safely protected today, while only 12% (27/227) of the subjects have long-term protection against the disease (Table 6).

Table 7 shows the levels of protection of women with respect to their vaccination status. Ninety-two percent of women who received at least one dose of the vaccine during ANC have protective antibody levels. Fifty-three percent of those who were not vaccinated and 68.1% of those who received the vaccine upon hospital admission are safely protected against tetanus; this difference is not statistically significant.

Table 7 Distribution of tetanus antibody levels with respect to vaccination status of women in the study (Istanbul, 2000).

Vaccination status	Protective antibody levels exist (>0.1 IU/ml)		No protective antibody levels (≤ 0.1 IU/ml)		Total	
	n	%	n	%	n	%
	Vaccinated during antenatal care ^a	45	91.8	4	8.2	49
Vaccinated upon hospital admission for delivery	32	68.1	15	31.9	47	100.0
Never been vaccinated	70	53.4	61	66.6	131	100.0
Total	147	64.8	80	35.2	227	100.0

Chi-squared test, $P < 0.05$.

^a The group that creates the statistical significance.

Discussion

For countries that have not yet eliminated NT, it is important to identify the reasons for the problem. This study found that 84% of the subjects received ANC during their last pregnancy. However, only 25.7% of those who received ANC had their tetanus vaccinations. This figure reflects a common problem in many developing countries, namely that prenatal services miss opportunities to vaccinate pregnant women. Buekens et al.¹¹ proposed the TP index (the number of women who received at least one dose of tetanus toxoid compared with the number who received at least one prenatal care visit, expressed as a percentage) as a practical indicator of the quality of prenatal services, and reported in 1995 that this figure was below 75% in 15 of 38 developing countries. In this study, the TP index was 25.7%. A similar study conducted in Turkey reported the TP index to be 49.3%.¹²

In this study, 46.2% of the subjects were having their first babies. Among the women who had given birth twice or more, 22.7% had received the vaccine at least once during previous pregnancies. These data clearly suggest the existence of missed opportunities for tetanus vaccination during pregnancy.

Vaccination coverage is also affected by the location of the ANC session. Participants in this study were asked where they received ANC during the last and all other previous pregnancies. Half of the participants received ANC from primary health-care facilities, and the other half received it from private practice offices (data not shown). However, 67% of the subjects who received the tetanus vaccine received ANC in primary healthcare facilities (Table 4). Maral et al.¹² reported that women who received ANC from primary healthcare facilities were more likely to be vaccinated than those who received ANC from hospitals or private practice (85% and below 50%, respectively). Since ANC is one of the major responsibilities of primary healthcare facilities, this may be considered as a pleasing fact. However, it is worth noting that other facilities providing ANC are in a less than acceptable condition. One possible explanation is that doctors (mostly gynaecologists) who practice in hospitals and private clinics do not consider tetanus toxoid vaccination to be absolutely necessary during pregnancy.¹² This argument would only be valid in a situation where all the deliveries are performed under ideal conditions, which is hardly the case in Turkey. Furthermore, ideal delivery conditions would still not be enough to protect women and babies from MNT. This study found that only 53.4%

of women who were not vaccinated during pregnancy are protected against tetanus (Table 7).

This study revealed that 64.8% of the subjects have safe protective levels of antibodies. Other studies conducted in Turkey using the ELISA method report protective levels of antibodies in 73.8%,¹³ 50%,¹⁴ 35%¹⁵ and 58.9%¹⁶ of study participants. This study found that the tetanus antibody levels decreased with advancing age. There are significantly higher levels of protective antibodies in women under 30 years of age compared with women aged more than 30 years ($P < 0.05$, data not shown). Çetin et al.¹⁶ reported similar results in the relationship between age and antibody levels.

Tetanus toxoid is a highly effective vaccine.¹⁷ This study found that 91.8% of women who stated that they were vaccinated during their last pregnancy have safe protective antibody levels. There is no significant difference between the antibody levels of women who were not vaccinated and those who were vaccinated at the time of hospital admission for their most recent delivery (Table 7). The practice of vaccinating women at the time of hospital admission for delivery is considered beneficial for future pregnancies and births. However, such applications seem to cause confusion over correct timing and dosing of the tetanus vaccine.

Another variable affecting the antibody levels is the number of doses of vaccine that the woman receives. All the participants who were vaccinated twice and 76% of women who were vaccinated once during the last pregnancy are safely protected and this difference is significant ($P < 0.05$). Studies from Turkey and elsewhere report varying proportions of non-immunity. This may be due to many factors, including use of different serological tests and kits, inclusion of different age and occupational groups, and groups of different socio-economic levels.¹⁸ None of the participants in the present study had an antibody level lower than 0.01 IU/ml. This may be due to the fact that the mean age of the group (24.6 years) is lower than the age (30+ years) where antibody levels start to decrease significantly. Alternatively, it may be due to the fact that 20% of women received the tetanus vaccine at the time of hospital admission for delivery.

The level of antibodies is also associated with women's level of education. This study found that immunity increases with increasing levels of education ($P < 0.05$). However, there was no association between the level of education and vaccination during pregnancy. This result was also found in a similar study where tetanus vaccination coverage was not significantly influenced by level of education.¹²

Fifty-eight percent of all women do not know of the necessity of tetanus vaccination during pregnancy. Another point worth mentioning is that

some of the participants stated that they were aware that the tetanus vaccine is administered during pregnancy and that they even talked about this with their ANC providers. They were, however, told (incorrectly) that they did not need the vaccine because their planned delivery conditions excluded the risk of NT. The recommendation is, however, that no matter what the anticipated delivery conditions are for a pregnant woman, she should be vaccinated against tetanus.¹⁹

The results of this study have supplied new information about tetanus seroprevalance and associated factors to the currently available database in Turkey. Only one-quarter of the women who received ANC received at least one dose of the tetanus vaccine. More than one-third of pregnant women do not have adequate levels of the tetanus antibody to protect themselves and their babies against tetanus. These results show that it is vital to vaccinate women of childbearing age, especially pregnant women, against tetanus.

Although this study population was similar to the general female Turkish population of childbearing age, with respect to levels of education, age at first marriage, mean number of children, mean number of ANC sessions received during pregnancy, and the type of the ANC provider,⁵ they differ in two ways, namely the women were admitted to hospital for delivery and 88% received at least one session of ANC. In Turkey, 26.7% of deliveries take place at home, and 32% of all pregnant women do not receive any ANC. This suggests that the actual tetanus immunization rates for pregnant Turkish women may be lower than our results suggest.

Starting with the results of this study, factors associated with tetanus vaccination and immunization in pregnant women should be further investigated by qualitative and quantitative studies. Knowledge, attitude and practice surveys of mothers and healthcare providers on provision of the tetanus vaccine to pregnant women need to be undertaken urgently.

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