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Original Article

Tetanus immunization among healthcare professionals :cross-sectional study in Turkey

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Abstract

Introduction: Vaccine-preventable diseases can be effectively managed through timely vaccine booster doses. In this study, the tetanus vaccination status of healthcare professionals and their level of knowledge about tetanus vaccination were investigated

Methodology: The data were obtained through a survey questionnaire from 336 healthcare professionals. The survey participants were recruited on a voluntary basis among the personnel working in a tertiary hospital between 1 July 2021 and 30 September 2021. The participants were asked about their tetanus vaccination status and general awareness about the tetanus vaccine.

Results: The survey participants included nurses (41.4%, n = 139), doctors (39.9%, n = 134) and support unit personnel (18.8%, n = 63). The support unit personnel had insufficient knowledge about military service period, pregnancy period, vaccination of women aged 15-49 years, and the necessity of booster tetanus vaccine every 10 years. Interestingly, the nurses had significantly inadequate knowledge of geriatric tetanus vaccination.

Conclusions: Although the tetanus immunization program is widely implemented throughout the country, our study concluded that it is necessary to educate healthcare professionals on the importance of the tetanus vaccine.

Key words: Healthcare professionals; tetanus toxoid; vaccination.

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Introduction

There has been a significant decrease in the diseases that pose a public health threat as a result of inclusion of vaccines in the national immunization programs of several countries and the regular creation and implementation of these immunization programs. Although vaccine-preventable diseases are mostly targeted towards early childhood, the World Health Organization (WHO) convened in 2017 to review adult immunization policies [1]. Adult immunization is known to prevent serious illnesses and transmission of vaccine-preventable diseases in high-income countries. However, adult immunization policies are not implemented adequately in low and middle-income countries [2].

The WHO has recommended that ≥ 95% of the population should be vaccinated with 3 doses of the Diphtheria-Tetanus-Pertussis (DTB) vaccine. However, the rate of DTB vaccination is 55% in some countries with a national vaccination program, and can be as low as 24% in countries without a vaccination program [3].

Tetanus is a vaccine-preventable disease that continues to affect people worldwide due to deficiencies in adult immunization. In Turkey, the expanded immunization program was been implemented by the Ministry of Health since 1985 [4]. However, adults are not routinely immunized against tetanus. It is a well-known fact that the level of protective antibodies formed after vaccination to protect against the tetanus disease decreases over time [5].

Tetanus is not considered a high-risk infectious disease for healthcare professionals with respect to hospital transmission because the disease is not transmitted by direct contact and special isolation procedures are not required during medical follow-ups. In 2017, the WHO did not define healthcare staff as a separate risk group in its recommendations regarding tetanus vaccination, but the Advisory Committee on Immunization Practice (ACIP) recommends a single

dose of Tdap (Tetanus, Diphteria, Pertussis) for all healthcare professionals, regardless of the time elapsed since the last Td (Tetanus,Diphteria) vaccination [1,6]. Awareness about tetanus immunization should be high among healthcare professionals. Our aim was to determine the level of tetanus awareness, including knowledge about the tetanus vaccine booster dose, among healthcare professionals.

Methodology

Study design and population

The survey was conducted on 336 healthcare professionals who volunteered to participate between 1 July 2021 and 30 September 2021. The research was conducted in a hospital that was a diagnosis and treatment center, in addition to being a preventative adult vaccination center against diseases such as rabies, tetanus and pneumococcus. The hospital consists of three separate buildings. Healthcare staff working in all the three different buildings were included in the study. The questionnaire was delivered online to the employees who agreed to participate in the study. In the case of participants who could not receive the online questionnaire, a face-to-face survey was conducted by the researchers. The participants were informed about the purpose and design of the study, assured that the results will be used for research purposes only and the information provided will be kept confidential. Oral and written informed consent was obtained from all participants before the study.

Measures

The questionnaire was designed to collect demographic data such as age, gender, occupation, time worked as a healthcare worker, job description and the department within the hospital. In addition, risk of tetanus exposure, immunization status, and knowledge about tetanus immunization was assessed.

The participants were divided into four categories according to their age: 25, 26–35, 36–50 and > 50 years; three categories according to their occupational status: doctors, nurses and other health workers; four categories according to their department: surgical clinics, internal clinics, intensive care units and other support units. The participants were asked to respond to the following five statements with a 'yes' or 'no' to measure their knowledge about tetanus immunization.

• If the Td vaccine has been completed in childhood, it does not need to be administered again.

Table 1. General characteristics of healthcare professionals.

	Doctor (n: 134) n,%	Nurse (n: 139) n,%	Support unit staff (n: 63) n,%
Age (n, %)			
≤ 25	6, 45%	42, 30.2%	3, 4.8%
26-35	83, 61.9%	46, 33.1%	26, 41.3%
36-50	40, 29.9%	48, 34.5%	33, 52.4%
≥ 50	5, 3.7%	3, 2.2%	1, 1.6%
Gender (n, %)			
Female	76, 56.7%	118, 84.9 %	49, 77.8%
Male	58, 43.3%	21, 15.1 %	14, 22.2%
Marrial status (n, %)			
Single	63, 47%	60, 43.2%	21, 33.3%
Married	71, 53%	79, 56.8%	42, 66.7%
Children (n, %)			
Have children	49, 36.6%	64, 46%	41, 65.1%
No children	85, 63.4%	75, 54%	22, 34.9%
Chronic disease status (n, %)			
Yes	21, 15.7%	25, 18%	8, 12.7%
No	113, 84.3%	114, 82%	55, 87.3%
Educational status (n, %)			
High school and below	-	-	27, 42.9%
University	-	10, 7,2%	36, 57.1%
Above university	134, 100%	129, 92.8%	-
Department (n, %)			
Internal clinics	53, 39.6%	68, 48.9%	31, 49.2%
Surgical clinics	73, 54.5%	30, 21.6%	12, 19%
Intensive care units	8, 6%	28, 20.1%	4, 6.3%
Support units	-	13, 9.4%	16, 25.4%
Time spent as a healthcare professional (Mean ± SD)	1.75 ± 0.89	1.93 ± 0.91	2.2 ± 0.78

• The tetanus vaccine should be administered to women of child-bearing age (15-49 years), pregnant women and soldiers.

• A booster Td vaccine should be given if a woman is pregnant and more than 10 years have passed since her last Td vaccine.

• Contacts with rabies risk should be evaluated in terms of tetanus immunization.

• The tetanus antibody level decreases with age. Therefore, the Td vaccine booster dose should be administered to individuals > 65 years of age.

The answers to the above questions were categorized as 'yes', 'no', and 'no answer'. In addition, the booster tetanus vaccination status of the participants, the reason for taking the booster vaccination and the time elapsed since vaccination were recorded.

Statistical analysis

The Statistical Package for the Social Sciences software version 26.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses of the study findings. Chi-Square and Fisher's exact tests were used for analyses between independent groups. Mann-Whitney U test was used for abnormal distribution groups, and a *p* value less than 0.05 was considered significant.

Results

The mean age of all participants was 33.48 ± 8.5 years. The participants included 243 women and 93 men. The mean age of the women was 32.91 ± 8.15 years. There were 41.4% (n = 139) nurses, 39.9% (n = 134) doctors and 18.8% (n = 63) support unit personnel. The majority of the doctors participating in the study were 26-35 (n = 83, 61.9%) years old, while most of the nurses were 36-50 (n = 48, 34.5%) years old. Among the doctors, 56.7% were women, 54.5% worked in surgical units, 53% were married and 15.7% had a chronic disease. On the other hand, 84.9% of the nurses were women and 18% had a chronic disease. The characteristics of all the groups participating in the study are listed in Table 1.

In terms of the relationship between stab wounds and occupational groups; responses from the doctors, nurses and support unit personnel to the question "I apply to Employee Health Unit in case of stab wound", indicated that the doctors gave a significantly higher "no" answer than the other employees (p = 0.006). In addition, it was determined that the doctors applied less to the Employee Health Unit.

The support unit staff were injured by sharps less frequently than other employees (p = 0.000). The nurses had a significantly higher number of stab wounds in the previous year compared to the other groups (p = 0.00) (Table 2).

A significantly higher number of doctors responded with a 'no' to the statement: "If the Td vaccine has been completed in childhood, it does not need to be administered again." (p = 0.00). A significantly higher number of support unit staff rated 'no' to the following statements: "The tetanus vaccine should be administered to women of child-bearing age (15-49 years), pregnant women and soldiers" (p = 0.02); "A booster Td vaccine should be given if a woman is pregnant and more than 10 years have passed since her last Td vaccine" (p = 0.01); "Contacts with rabies risk should be evaluated in terms of tetanus immunization" (p = 0.00). A significantly higher number of nurses responded with a 'no' to the statement: "The tetanus antibody level decreases with age. Therefore, the Td vaccine booster dose should be administered to individuals > 65 years of age" (p = 0.03) (Table 3).

Table 2. Relationship between stab wounds and tetanus vaccination among healthcare professions groups.

Question	Answer	Doctor (n: 134) n,%	Nurse (n: 139) n,%	Support Unit Staff (n: 63) n,%	*p*
I apply to the Employee Health Unit in stab wounds. (n%)	Yes	72, 53.7%	93, 66.9%	42, 66.7%	0.006
	No	33, 24.6%	18, 12.9%	6, 9.5%	
	No answer			15, 23.8%	
Have you ever had stab wounds while working? (n, %)	Yes	57, 42.5%	67, 48.2%	11, 17.5%	0.000*
	No	77, 57.5%	72, 51.8%	52, 82.5%	
Status of applying to the Employee Health Unit (n, %)	Applicant	60, 54.5%	35, 31.8%	15, 13.6%	0.000*
	Non-applicant	23, 27.4%	51, 60.7%	10, 11.9%	
	Total	83, 42.8%	86, 44.3%	25, 12.9%	
I received information about the vaccines that healthcare professionals should have. (n, %)	Yes	94, 70.1%	98, 70.5%	46, 73%	0.737
	No	39, 29.1%	41, 29.5%	17, 27%	
Have you had a booster dose tetanus vaccine? (n, %)	Yes	121, 90.3%	130, 93.5%	61, 96.8%	0.206*
	No	13, 9.7%	9, 6.5%	2, 3.2%	
When did you get the tetanus vaccine? (n, %)	In the last 5 years	76, 63.3%	54, 41.5%	18, 29.5%	0.000*
	≥ 6 years	36, 30%	62, 47.7%	32, 52.5%	
	Do not remember	8, 6.7%	14, 10.8%	11, 18%	

There was no significant difference among the participant groups in terms of who received tetanus vaccination ($p > 0.05$). All participants were vaccinated primarily because of injuries with nails etc. In addition, some of the doctors voluntarily chose to be vaccinated (n = 26, 19.4%) and participants in nurses group were vaccinated due to pregnancy (n = 41, 29.5%). The rate of getting vaccinated in the last 5 years was significantly higher among the doctors ($p = 0.00$).

Therefore, the support unit staff had insufficient knowledge on tetanus vaccination, including geriatric vaccination. Although the tetanus immunization program is widely implemented throughout the country, the results from this study indicated that it is necessary for healthcare professionals to review their knowledge about tetanus.

Discussion

Although tetanus is preventable through vaccines, developing countries continue to be affected by the disease. Childhood and adult vaccination programs have succeeded in reducing the number of infections; however, migrations, earthquakes, and other natural events lead to disruptions in the vaccination programs and consequent emergence of tetanus cases [7]. The antibody levels resulting from certain vaccines administered during childhood reduce over time, making adults vulnerable to the diseases. In such cases, booster vaccine applications in adults are essential. According to the 2018 USA adult vaccination surveillance data, 62.9% aged ≥ 19 years, 64.5% aged 19-49 years, 62.8% between 50-64 years, and 58.9% ≥ 65 years reported taking any tetanus toxoid-containing vaccine in the last 10 years [8]. A survey study conducted to measure the level of tetanus immunization knowledge among nurses in Greece reported that only 28.2% of the nurses had taken tetanus vaccination in the last 10 years and only 19.6% were aware that vaccine-related immunity lasts up to 10 years [9]. The study concluded that booster dose vaccine administration was related to the level of education and the department that the nurses worked in, and that the tetanus vaccination rates among nurses was insufficient [9]. Tanrıöver *et al*. examined diphtheria, tetanus and pertussis antibody levels in 1303 samples and determined that tetanus protection decreased with age in multivariate analysis [10]. However, when the healthcare staff were evaluated as a subgroup, they found that tetanus seropositivity was higher among healthcare staff than the other patients (71.4% vs. 29.9%, $p < 0.000$) [10]. The rate of booster dose tetanus vaccine in all groups in this study was higher than the rates reported in the Greek study. In addition, they concluded that 93.5% (n = 130) of the nurses' group had taken the tetanus vaccine, and there was no significant difference in vaccination rates between doctors, nurses and support unit personnel *(p:* 0.206). Vaccination rates in all occupational groups were found to be over 90%.

A study conducted in the USA compared tetanus vaccination rates in adults in the last 10 years. The study concluded that the vaccination rate in adults ≥ 19 years was 61.6%, and this rate decreased in some older age groups: 62.1% in 19–49-year-olds, 64.1% in adults aged 50-64 years; 56.9% in adults aged ≥ 65 years [11]. A cross-sectional study in Austria studied the levels of

Table 3. The relationship between the level of knowledge about booster dose tetanus vaccine and healthcare profession groups.

Proposition		Doctor (n: 134) n,%	Nurse (n: 139) n,%	Support unit staff (n: 63) n,%	*p*
If the Td vaccine has been completed in childhood, it does not need to be administered again (n, %)	Yes	1, 0.7%	11, 7.9%	9, 14.3%	0.000*
	No	130, 97%	126, 90.6%	51, 81%	
	No answer	3, 2.2%	2, 1.4%	3, 4.8%	
The tetanus vaccine should be administered to women of child-bearing age (15-49 years), pregnant women and soldiers. (n, %)	Yes	127, 94.8%	131, 94.2%	51, 81%	0.021*
	No	7, 5.2%	7, 5%	10, 15.9%	
	No answer	-	1, 0.7%	2, 3.2%	
A booster Td vaccine should be given if a woman is pregnant and more than 10 years have passed since her last Td vaccine. (n, %)	Yes	129, 96.3%	123, 88.5%	48, 76.2%	0.001*
	No	5, 3.7%	15, 10.8%	13, 20.6%	
	No answer		1, 0.7%	2, 3.2%	
Contacts with rabies risk should be evaluated in terms of tetanus immunization. (n, %)	Yes	131, 97.8%	118, 84.9%	41, 65.1%	0.00*
	No	3, 2.2%	20, 14.4%	18, 28.6%	
	No answer		1, 0.7%	4, 6.3%	
The tetanus antibody level decreases with age. Therefore, the Td vaccine booster dose should be administered to individuals > 65 years of age. (n, %)	Yes	89, 66.4%	76, 54.7%	43, 68.3%	0.035*
	No	44, 32.8%	61, 43.9%	16, 25.4%	
	No answer	1, 0.7%	2, 1.4%	4, 6.3%	

antibodies and concluded that the tetanus-specific antibody concentration decreased over time after the initial increase immediately after vaccination and the antibody concentration was lower in the elderly at all time points [5]. Studies in Spain, Germany, Austria, Belgium, Australia, Italy and France have demonstrated that tetanus and diphtheria-specific antibody levels in adults, especially in the elderly, are below the protective level (> 0.1 IU/mL) [12]. A multicenter study conducted in Catalonia found that 94.7% of healthcare professionals have protective antibodies against tetanus; this rate was 98.5% under the age of < 25 years and 85.1% above the age of ≥ 55 years [13]. The tetanus antibody level decreases with advancing age and this leads to higher frequency of tetanus infection in older age. In a multicenter study conducted by Tosun *et al*. in Turkey it was observed that 53% of the tetanus cases (n = 62) were in individuals ≥ 60 years [14].

In our study, when healthcare professionals were asked whether there is a decrease in tetanus immunity with age, 32.8% (n = 44) doctors, 43.9% (n = 61) nurses and 25.4% (n = 16) support unit staff responded 'no', indicating their lack of knowledge. We observed that the level of knowledge about adult tetanus immunization was insufficient in all groups. This inadequacy will negatively affect the attitudes and practices of healthcare professionals towards tetanus vaccines. Moreover, there was a significant lack of information about tetanus immunization among the nurses group compared to the doctors and support unit personnel. Since nurses and physicians communicate the most with patients, it is necessary to organize trainings on tetanus immunization for this group.

Needlesticks and sharps injury are an important parameter that increase the risk of exposure to infectious diseases among healthcare workers. Kaya *et al*. investigated stab wounds in 83 healthcare workers and determined that nurses were the most frequently injured group at 48%, while only 7% of the doctors were exposed to such injuries [15]. This observation was confirmed by Karakoç *et al*. who demonstrated that nurses are exposed to high rates of stab wounds [16]. We investigated the correlation between stab wounds and occupational group and concluded that that a significantly higher proportion of doctors provided a negative response to the question "I apply to the Employee Health Unit in case of injury" ($p = 0.006$). Based on the responses to the question "Have you experienced a sharp object injury", it was concluded that support unit employees experienced less injuries than other groups ($p = 0.000$). When the number of stab wounds in the previous year was compared, it was observed that the nurses were injured more frequently ($p = 0.00$). These conclusions on the attitude of the doctors in the case of injury and the fact that the nurses are more frequently injured are similar to other studies.

Post-traumatic tetanus immunization is frequently used in healthcare institutions in adulthood. A cross-sectional point prevalence study by Hamidi *et al*. on hospitalized adult patients, reported that tetanus vaccination was significantly higher in the group without any risk factors such as chronic diseases, and this was related to post-traumatic tetanus prophylaxis practices [17]. Childhood vaccination programs provide sufficient protection against tetanus; however, this immunity decreases with age. Therefore, it is important that healthcare professionals encourage adult patients to take the booster tetanus vaccine. Glenton *et al*. investigated the perceptions and experiences of healthcare professionals in communicating with adults over ≥ 50 years and reported that patients' vaccination decisions are affected by the level of trust between the healthcare professional and the patient [18]. The findings from our survey and analysis are significant due to the position of healthcare workers in the society. In this context, it is necessary to evaluate the knowledge level of healthcare workers about vaccines and to eliminate the deficiencies.

Conclusions

In addition to the doctors and nurses working in healthcare institutions, the personnel working in the support units should also be informed about the vaccination practices. The healthcare professionals should be especially informed about tetanus vaccination in geriatric patients.

Limitations

Although our questionnaire was delivered to all hospital personnel, the participation rate was only 7.17% due to low motivation among healthcare professionals during the COVID- 9 pandemic. Thus, the survey responses may not be representative of all the healthcare professionals in the hospital. Further studies with larger groups of healthcare professionals are needed, especially focusing on their level of knowledge to identify any gaps.

Authors' Contributions

Conception and design: Merve Sefa Sayar, Ali Asan; data acquisition: Mustafa Özgür Akça, Ali Gümüş, Sibel Yorulmaz Göktaş, Özgür Dağlı; analysis and interpretation: İsmail Necati Hakyemez, Özgür Dağlı; manuscript preparation: Merve Sefa Sayar, Mustafa Özgür Akça.

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