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











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Healthcare personnel's attitude and coverage about tetanus vaccination in Turkey: a multicenter study

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ABSTRACT

The tetanus vaccine is not routinely given to Turkish adults. Protective tetanus immunity decreases with age. Health-care personnel (HCPs), who are role models in the field of health, are a target group in order to achieve a higher rate of tetanus vaccination in the community. This study was designed to evaluate attitudes and coverage regarding tetanus vaccination among a large sample of Turkish HCPs. This cross-sectional epidemiologic study was conducted from July to August 2019. A questionnaire was sent to HCPs using social media. Of the 10,644 HCPs included in the study, 65% were female. Overall, the tetanus vaccination coverage (TVC) among HCPs was 78.5% (95% CI: 77.7%-79.3%). TVC was significantly higher among physicians [83.4% (95% CI: 82%-84.6%); $p < .001$] compared with all other HCPs except nurses. Older age (≥ 40 years) and length of professional experience were significantly correlated with TVC. Of the 8353 HCPs who received tetanus vaccines during their lifetime, 73.03% received tetanus vaccination in the past 10 years. The self-vaccination rate for protection against tetanus was 13.1%. Acute injuries (25.42%) and pregnancy (23.9%) were the most common reasons for having the tetanus vaccine. One-third (33.7%) of HCPs did not have information about whether pregnant women could receive tetanus vaccinations. This survey study provided excellent baseline information about HCPs' coverage rates and attitudes regarding tetanus vaccination. The present results suggested that tetanus boosters for HCPs should be established as soon as possible, and revealed that the HCPs younger than 30 years with relatively less professional experience and all other HCPs except nurses and physicians should be identified as the target population for future intervention programs.

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1. Introduction

Tetanus is an acute, fatal disease caused by the exotoxin of *Clostridium tetani*. Tetanus is the oldest disease known by communities that causes undesirable consequences, especially in the elderly, pregnant women, and newborns. The number of tetanus cases has decreased significantly over the years due to the widespread use of tetanus antitoxin and tetanus vaccine. Despite being a vaccine-preventable disease, it is still an important public health problem in low-income countries where primary immunization program is not active.¹ Also, there is an increased risk of tetanus in adults due to decreased

immunity caused by not receiving booster doses.² The efficacy and safety of the tetanus vaccine have been recognized by communities over the years. Therefore, the tetanus vaccine, in addition to hepatitis B and influenza vaccines, is the most commonly received vaccine among adults.^{3,4}

In Turkey, the tetanus vaccination program began in 1937 and gained momentum in 1985 with the National Vaccination Campaign. The tetanus vaccine is included in routine childhood immunization programs as a primary series of three doses plus three booster doses that are given at 18–23 months, at 6 years of age, and 13 years of age, respectively. It is implemented across the

whole country in the framework of the Expanded Immunization Program of the Ministry of Health of Turkey.⁵ In addition, the tetanus vaccine has been given to pregnant women during every pregnancy since 1990 within the elimination of neonatal tetanus program. Men have an additional dose of monovalent tetanus vaccine during the military service period. Another point related to the prevention of tetanus is the use of tetanus prophylaxis in patients admitted to health-care providers with acute injuries. Tetanus vaccine boosters are not routinely given to Turkish adults; therefore, tetanus antibody levels decrease with age, especially in people aged over 50 years.⁶ Studies showed that the tetanus vaccination rate among adult populations was lower in Turkey.^{7,8}

Tetanus is not transmitted through contact with infected patients and isolation procedures are not used for patients with tetanus. Therefore, tetanus is not considered a high-risk disease for occupational exposure by healthcare personnel (HCP). HCPs may not feel the need for a tetanus vaccine. There has been recently an increase in adult and adolescent patients with pertussis around the world.⁹ In many countries, the pertussis vaccine is recommended for HCPs who are in contact with newborns, babies, pregnant women, and immunocompromised patients. There is no pertussis vaccine alone. Therefore, tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) combined vaccine is given in one dose for pertussis immunization, regardless of the history of tetanus vaccination for HCPs.¹⁰

The World Health Organization has no current recommendation about tetanus vaccination for HCPs. Although there is no published vaccination guideline for HCPs in our country, the tetanus vaccine has been given free of charge since 2002, based on the HCP's request. However, the tetanus immunization status of HCPs has not yet been researched.

This survey study was designed to evaluate the knowledge on tetanus vaccination in pregnancy, and the attitudes and tetanus vaccination coverage (TVC) among a large sample of Turkish HCPs nationwide. Knowing the TVC among HCPs is useful for measuring the impact of vaccination campaigns and preparing educational programs.

2. Materials and methods

This cross-sectional epidemiologic survey study was conducted from July to August 2019. The questionnaire was prepared by an adult vaccination study group in Turkey. A brief note explaining the purpose of the survey together with a descriptive questionnaire was sent to HCPs via a link through specialized societies, social media such as WhatsApp, and HCPs were invited to join the study. The questions were answered anonymously. The participation of HCPs was voluntary.

Ethics committee approval was obtained from Izmir Bozyaka Training and Research Hospital (ethics committee number: 08.09.2016/431) and this study was performed with the permission of the Turkish Public Health Institution.

Some HCPs did not answer all the questions about tetanus vaccination in the survey; therefore, statistical analyses were only performed with HCPs who answered all questions. The

questionnaire consisted of three sections and 12 questions; the first section included demographic data such as age, sex, occupation group, workplace, and years in the profession. In the second section, there were three questions that aimed to measure participants' attitudes about tetanus immunization and self-vaccination status. HCPs were asked, "Have you received a tetanus vaccine throughout your lifetime?" "When did you receive the latest tetanus vaccine?" and "Why was your latest tetanus vaccine administered?" The third section evaluated the knowledge levels of HCPs about tetanus vaccination in pregnancy. They were asked that "How many tetanus vaccines are recommended during pregnancy?" and "Can Td vaccine be administered to pregnant women?"

HCPs were accepted as vaccinated against tetanus if they reported being vaccinated during the past 10 years and received at least three primary doses of tetanus vaccine during their lifetime. HCPs were accepted as unvaccinated if they reported to did not receive a tetanus vaccination including the 3-dose vaccination recommended for primary immunization in childhood or adulthood immunization, or had primary immunization but did not receive a booster dose in the last 10 years.

Age was categorized into three groups: ≤ 29 years, 30 to 39 years, and ≥ 40 years. Years of experience in the profession were divided into four groups: ≤ 5 years, 6 to 10 years, 11 to 15 years, and ≥ 16 years. From the occupation groups, auxiliary health personnel and technician groups included dentists, pharmacists, dietitians, physical therapists, laboratory technologists/technicians, radiology technologists/technicians, emergency medical technicians, and paramedics, and non-clinical personnel included medical records secretaries, office staff, patient transport staff, support maintenance staff, food service workers, cleaning staff, and security staff.

The questions were multiple choice and the answers given for each question were evaluated separately and compared with each other. Data were evaluated using the SPSS Ver. 21.0 (Chicago, IL, USA) statistical package program. Descriptive statistics included counts and percentages for categorical variables. The method used to calculate confidence intervals (CIs) was the Wilson score method. The Chi-square test was used to examine associations between demographic data and whether the HCPs had a tetanus vaccine. *P*-values of < 0.05 were considered statistically significant.

3. Results

3.1. Study and HCP characteristics

When all data were analyzed, 12,474 HCPs responded overall, but 14.67% of all respondents did not answer questions regarding tetanus vaccination. Therefore, 10,644 HCPs were included in the study. Table 1 shows the TVC and the demographic data of the HCPs. The majority of HCPs were female (65%), aged 30–39 years (35.3%), were nurses (31.9%), had under 5 years of experience in the profession (36.4%), and worked in university hospitals or education and research hospitals (58.1%). The mean age of the HCPs was 35.51 ± 9.36 (range, 15–76) years. The average number of years of professional experience was 10.65 ± 8.47 (range, 10–50) years.

Table 1. Demographic datas and tetanus vaccination coverage of health care personnels.

Characteristics	Sample size, N	Tetanus vaccination coverage % (95% CI)
Total	10644	78.5 (77.7–79.3)
Age (years)		
18–29	3243	70.2 (68.6–71.8)^a
30–39	3755	80.7 (79.5–82)
≥40	3646	83.5 (82.3–84.7)*
Sex		
Male	3721	75.5 (74.1–76.9)*
Female	6923	80.1 (79.1–81)
Professional experience (years)		
≤5	3878	71 (69.6–72.5)^b
6–10	2728	80.2 (78.7–81.7)
11–15	1740	83.8 (82–85.5)
≥16	2298	84.9 (83.4–86.3)*
Occupation groups		
Physicians	3206	83.4 (82–84.6)*
Nurses	3397	82.3 (81–83.5)
Auxiliary health personal and technicians	924	74.8 (71.9–77.5)^c
Medicine or nursing students	1010	68.9 (66–71.7)^c
Non-clinical personnel	2107	71.1 (69.1–73)^c
Working institution		
University hospital or Education and research hospital	6189	78.5 (77.5–79.5)*
Public or private hospital	3629	77.3 (75.9–78.6)
Family health center or public health center.	826	83.3 (80.6–85.7)

Boldface indicates statistical significance ($p < .01$).

*Reference level.

^a $p < .01$ by chi-square test for comparisons within age with more than 40 years as the reference level.

^b $p < .01$ by chi-square test for comparisons within occupational with ≥16 years in professional experience as the reference level.

^c $p < .01$ by chi-square test for comparisons within occupation with physician as the reference level.

Table 2. Receiving time and the reasons for receiving the last tetanus vaccination.

Receiving time	N	%
Within the past 10 years	6101	73.0
1 year	1255	15.0
2–5 years	2732	32.7
6–10 years	2114	25.3
More than past 10 years	1270	15.2
Not remember	982	11.8
Reasons		
Acute Injury ^a	2124	25.4
Pregnancy	1995	23.9
During the training period	1351	16.2
Self-vaccination for prevention	1098	13.1
Not answered	427	5.1
During military service period	359	4.3
Admission time to work	337	4.0
Together with rabies vaccine	171	2.0
Others	491	5.9

^aPercutaneous or mucosal injury and traffic accident.

Of the HCPs who participated in our survey, 8353 (78.5%) received tetanus vaccines during their lifetime, of which 73.03% received tetanus vaccination in the past 10 years, and 15.2% received it more than 10 years ago. 11.8% of HCPs could not remember when they last had a tetanus vaccine. The times for receiving the last tetanus vaccine are shown in Table 2.

Acute injuries (25.42%) and pregnancy (23.9%) were the most common reasons for getting a tetanus vaccine. The rate of self-vaccination for protection against tetanus was 13.1%. The reasons for receiving the last tetanus vaccine are presented in Table 2.

3.2. Tetanus vaccination coverage

Overall, the TVC among HCPs was 78.5% (95% CI: 77.7%–79.3%). TVC was significantly higher among physicians [83.4% (95% CI: 82%–84.6%); $p < .001$] compared with auxiliary health personnel and technicians [74.8% (95% CI: 71.9%–77.5%)], non-clinical personnel [71.1% (95% CI: 69.1%–73%)] and medicine or nursing students [68.9.4% (95% CI: 66%–71.7%)]. There was no significant difference between physicians and nurses [83.4% (95% CI: 82%–84.6%) vs. 82.3% (95% CI: 81%–83.5%); $p = .021$]. HCPs aged 18 to 29 years had statistically significantly lower TVC than those aged over 40 years as the reference level [70.2% (95% CI: 68.6%–71.8%) vs. 83.5% (95% CI: 82.3%–84.7%); $p < .001$]. TVC was significantly positively associated with the duration of professional experience (≥16 years) [84.9% (95% CI: 83.4%–86.3%); $p < .001$] and older age (≥40 years) [83.5% (95% CI: 82.3%–84.7%); $p < .001$]. There was no statistical difference between the working institutions but the highest coverage was observed in family health centers and public health centers [83.3% (95% CI: 80.6%–85.7%)].

According to data analysis performed in terms of sex, there was no significantly higher rate of TVC between the sexes. However, female sex was associated with increased TVC in all age subgroups ($p < .01$), professional experience duration subgroups ($p < .01$), and occupation subgroups ($p < .01$) compared with the male sex. There was no significant difference in terms of working institution subgroups regarding sex ($p = .058$).

TVC according to the geographic locations of the HCPs is shown in Figure 1. The Central Anatolia region had the highest percentage of TVC, and the lowest rate was in the Southeastern Anatolia region. The Central Anatolia region, Aegean region, and Eastern Anatolia region had higher rates of TVC compared with the Southeastern Anatolia region as the reference geographic location ($p < .01$).

3.3. Knowledge level about tetanus vaccination during pregnancy

HCPs were confused about the number of tetanus vaccines recommended for pregnancy. It was seen that 33.7% of HCPs did not have information about whether pregnant women could receive tetanus vaccination, the following: 20.2% of HCPs reported that a single dose, 19.7% two-dose, 16.4% five-dose tetanus vaccine should be administered during pregnancy, and 10.2% reported that tetanus vaccine was not needed because births are safe today. Just over half (55.7%) of the HCPs did not know whether the Td (tetanus, diphtheria) vaccine could be given to pregnant women, and 33.4% agreed that Td could be administered during pregnancy.

4. Discussion

This study provides the first estimate rate of TVC in Turkish HCPs. The public takes HCPs as role models in the field of health.¹¹ Therefore, HCPs are a target group for achieving high vaccination coverage in the community. Recently, the vaccination of private adult populations such as HCPs is a new concept

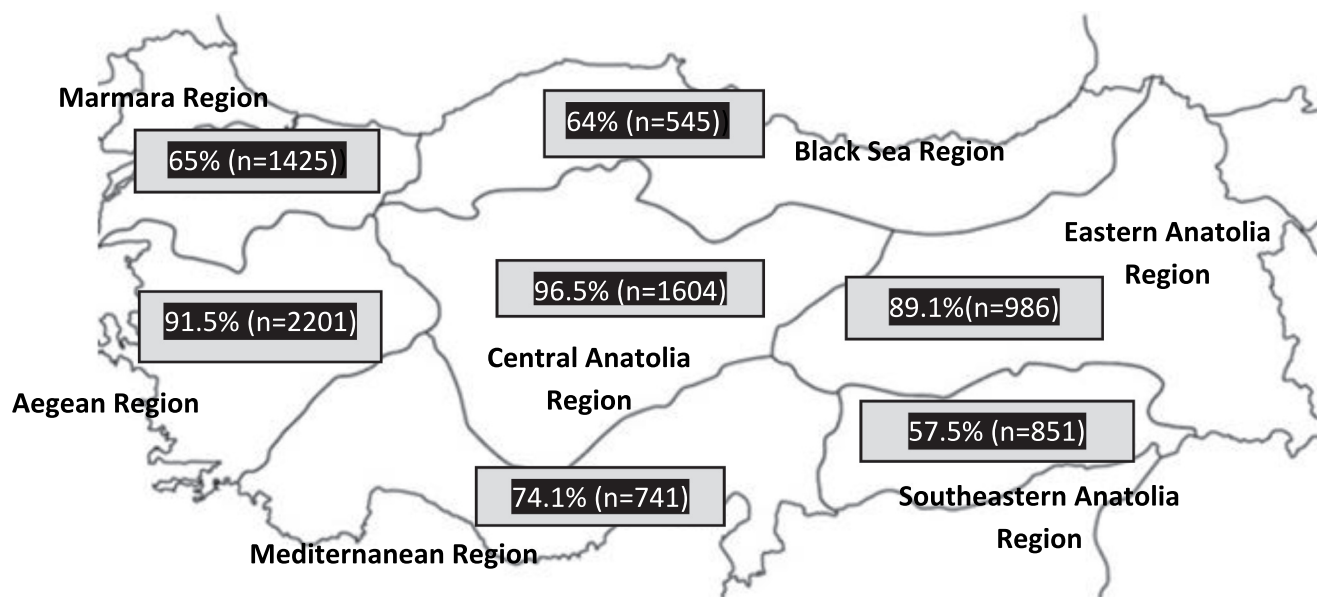


Figure 1. The rates of tetanus vaccination coverage according to the geographic locations of the health care personnels in Turkey.

implemented by many countries. A recent study comparing current national vaccination policies for HCPs in 36 European countries reported that tetanus vaccination programs, which were not recommended in 15 countries, were recommended for all HCPs in 12 countries, and specific HCP groups in three countries (Ireland, Norway, the United Kingdom), and compulsory in only five countries (Croatia, France, Portugal, Slovenia, and Ukraine).¹²

In Turkey, there is no specific national vaccination policy for all HCPs; vaccination is recommended for specific groups of HCPs according to the proposals of occupational health and safety specialists or infection control practice advisory committee of every healthcare center. Also, there are no clear data about national adult or HCPs vaccination rates; however, the vaccination coverage rates among various adult patients such as adults with immunocompromised conditions, HCPs, and the elderly have been researched based on single-center studies.^{6,13–20}

The most commonly recommended vaccines are seasonal influenza, tetanus, hepatitis B, and pneumococcus by physicians for adult immunization in our country.¹³ Although older patients with chronic pulmonary illness are known to carry a high risk of influenza infection and pneumonia, influenza and pneumococcal vaccination rates among risk groups are low. Guclu et al. reported that the rates of influenza vaccination and pneumococcal vaccinations were 20% and 11%, respectively, in 350 patients who were admitted to a pulmonary disease outpatient clinic and a family health center.¹⁴ Similarly, Candemir et al. found low rates of vaccination in patients hospitalized with acute respiratory failure; overall influenza and pneumococcal vaccination rates were 26% and 15%, respectively.¹⁵ Studies showed that getting regular vaccination for influenza among HCPs ranged from 6.7% to 25.7% and only 35.5–55% of HCPs reported never having an influenza vaccine during their lifetimes.^{16,17} In terms of hepatitis B vaccination, the vaccination rates and knowledge levels of healthcare workers and students are high due to the high risk of occupational

exposure.^{18,19} However, the vaccination rates for tetanus are lower than expected for both adults and HCPs. One study investigating tetanus immunity among adult trauma patients admitted to the emergency department reported that tetanus vaccination history was known in 59.1% of patients and 48.1% of them had a booster dose in 10 years.²⁰ Similarly, in another study including patients aged ≥ 50 years, 53.8% of patients knew their tetanus vaccination histories, 36% of whom had a booster dose in the last 10 years.⁶ In a study of 221 primary care physicians (PCPs) who were responsible for primarily childhood immunization, and partially, adulthood immunization, the PCPs' vaccination rates for tetanus, influenza, and hepatitis B vaccines were 47.1%, 54.3%, and 74.2%, respectively.¹³

The intention among HCPs to recommend or receive the tetanus vaccine is weak.^{13,21} Chen et al. reported that there was a lower willingness to receive the Tdap vaccine and a low knowledge score among nurses in Taiwan.²² There is a similar perception in our country. Çataklı et al. evaluated the attitudes of 300 family physicians and 230 pediatricians about rotavirus, human papillomavirus, the meningococcal conjugate vaccine, and Tdap vaccines, which are not included in the national immunization schedule in Turkey. Interestingly, the Tdap vaccine was the least recommended vaccine despite being the oldest and best-known vaccine. Only 24.1% of physicians recommended the Tdap vaccine to their patients due to increasing adult and adolescent pertussis cases in recent years, not tetanus cases. Of the physicians who did not recommend the vaccine, 90.4% declared that Tdap vaccination was not a primary topic for our country.²³

There has been a national guideline on Tdap vaccination of HCPs since 2011 in the United States of America (USA).²⁴ In a study evaluating the Tdap vaccination coverage among 10,229 HCPs in 21 states in the USA, overall, the Tdap coverage was 47.2%.²⁵ Another study conducted among HCPs in the USA reported Tdap coverage of 34.8%, 40.2%, and 42.4% in 2012, 2013, and 2014, respectively.²⁶ In our study, a higher TVC of 78.5% was observed in HCPs compared with studies in

the USA. Similarly, a new Italian survey study that evaluated TVC in HCPs reported a high rate of 93.7%.²⁷ By contrast, in a study conducted among Canadian healthcare providers by MacDougall et al., tetanus vaccination levels were reported much lower (47.5%) than in our study.²⁸ Factors leading to low TVC could include disregarding adult vaccination, targeting the childhood immunization schedule, and lack of vaccination knowledge and awareness among HCPs and the public due to not being given sufficient training around the importance of adult vaccination.

It has been shown that inadequate awareness of vaccination among the public and HCPs is the most important factor for suboptimal coverage.²⁹ Randi et al. reported that not knowing about the Tdap vaccine by HCPs was the main cause of low Tdap coverage. Tdap vaccine was introduced in 2014 in Brazil for pregnant women and HCPs working in close contact with newborns.³⁰ In our survey, 21.5% of HCPs had never had a tetanus vaccine; this high rate indicated inadequate knowledge around tetanus immunization. Higher knowledge levels of HCPs are associated with making recommendations to patients about tetanus vaccination and with planning to receive or have tetanus vaccine themselves.²⁸

The attitude of HCPs about self-vaccination or receiving a booster dose for tetanus immunization is important in terms of showing their attitudes toward vaccination. This attitude also directly helps to increase the vaccination rate in the community. Yilmaz-Karadağ et al. found that recommendation frequencies of vaccines to risk groups were higher among physicians who had chosen to vaccinate themselves for influenza, tetanus, and hepatitis B.¹³ In a study examining vaccination coverage among HCPs aged 18 to 64 years, the rate of having tetanus boosters was found as 70.4%.³¹ In France, Tdap vaccination is compulsory for HCPs, the reported vaccination coverage for 10-year booster of the Tdap vaccine was 95.5%,³² but in Pakistan, this adult booster rate was relatively low among medical students (39.2%).³³ In our study, of 8353 HCPs who received tetanus vaccines, 13.1% received self-vaccination for protection against tetanus. This low rate regarding attitude shows that there is great inadequacy in transforming information to attitude. Booster doses in adolescents and adults are critical for maintaining protection against tetanus. Therefore, guidelines and department-based education along with interventions, such as mandatory immunization, standing orders, reminder billboards, and brochures about tetanus boosters should be prepared to manage waning tetanus immunity for HCPs.

A study performed on medical students reported that 20.3% of students were unaware of Tdap immunization, and 86.0% of medical students were unaware that the university had a vaccination program as a recommended part of the admission process.³³ This result was compatible with the findings of our survey study in which the medicine and nursing students had the lowest TVC. Although student immunization training and practices are up-to-date, these low rates emphasize the importance and necessity of regular education sessions, both at the undergraduate level and post-graduation. The three targets of education policy are to inform, persuade, and perform in HCPs. The 'to know does not mean to believe; to

believe does not mean to apply; to apply does not mean to be maintained' concept should not be forgotten. The end goal of education is that knowledge is applied by HCPs in daily life.

There is a significant difference in Tdap vaccination rates among different personnel such as physicians, nurses, auxiliary staff, and non-clinical personnel. Previous studies found that physicians or nurses had the highest Tdap vaccination coverage rates, and non-clinical personnel had the lowest rates.^{25–27,32,34,35} The results of our study were similar to these studies. In addition, we found that older age (≥ 40 years) and length of professional experience were significantly correlated with TVC. These results may be related to the increase in knowledge levels and professional experience gained over time. It is reported that educational interventions and increased experience have a positive influence on knowledge.³⁵ Contrarily, Napolitano et al. reported that the professional role had a negative correlation with knowledge.²⁷ Generally, studies showed that TVD was significantly higher in younger age groups,^{26,30,31,34} but our HCPs aged 18–29 years had the lowest TVC. This finding may indicate that our younger HCPs had insufficient information on vaccination because their education programs focus mostly on diagnosis, treatment, and patient care. Therefore, education programs on vaccination should be planned for HCPs before and after graduation.

Overall, female HCPs received tetanus vaccinations and recommended tetanus vaccination to their patients more frequently than males.^{13,23,27} In our survey, the female sex was associated with increased TVC in all age subgroups, professional experience duration subgroups, and occupation subgroups compared with the male sex. The main reason for this result was more likely related to women having more knowledge and awareness on tetanus vaccination because, in general, women are often responsible for the care and vaccination of their children and are vaccinated against tetanus at pregnancy in routine practice.

Many studies reported that Tdap vaccination coverage was higher among HCPs working in hospitals.^{25,34} In our study, TVC among HCPs working in family or public health centers was significantly higher than among those working in hospitals because they are responsible for applying routine childhood immunization programs and pregnancy follow-up in Turkey, as in many countries.³⁶ Also, it was detected that acute injuries (25.42%) and pregnancy (23.9%) were the most common reasons for having a tetanus vaccine, which supports that HCPs' practice, attitude, and knowledge on immunization are better due to conducting mandatory vaccination education programs and performing childhood vaccination status tracking by our government. However, HCPs working in hospitals receive standard training such as first aid, cardiopulmonary resuscitation, and infection prevention and control every year, but not vaccination. A study that investigated Tdap vaccination coverage reported that in 2012 and 2014, working in settings such as public health, healthcare education, and emergency medical services were associated with increased Tdap vaccination coverage, and it was significantly high in those working in hospitals in 2013.²⁶

This survey study has several limitations. First, current numerous international organizations and medical societies have published guidelines for vaccination of HCPs. The main

purpose of Tdap vaccination is to protect HCPs and their patients such as newborns and babies against pertussis or diphtheria infections by vaccinating adults and adolescents; tetanus immunization is a secondary gain. Our study did not evaluate the status of diphtheria or pertussis infections among HCPs. The increased tetanus vaccination rate among HCPs is indirectly related to that of the public. Second, the way information was learned about tetanus vaccination was not questioned. If deficiencies in accessing information are detected, forward-looking projects and education programs with accurate, objective, and scientific information about tetanus vaccination should be planned both at undergraduate and postgraduate levels. The lack of knowledge, attitudes, and belief about vaccination among HCPs may lead to the spread of unnecessary concern and misdirection of patients in the community and reduce vaccination rates. It is known that there is a correlation between the knowledge level of HCPs about Tdap vaccination and the actual vaccination rates.³⁵

5. Conclusions

If the knowledge and attitude levels on tetanus vaccination of HCPs are increased, the TVC rate of the population together with HCPs will also increase. This survey study provided excellent baseline information about HCPs' knowledge, attitudes about tetanus vaccination, and TVC rates among a large sample of Turkish HCPs nationwide. To the best of our knowledge, this is the third-largest survey trial covering HCPs on tetanus vaccination.³⁷ Therefore, our results were offered to the Ministry of Health of Turkey. According to this information, we hope that a combination of education programs and tailored communication campaigns will be implemented during educational and professional life to improve TVC rates among all HCPs and the issue of mandatory immunization should be considered for HCPs.

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References

1. World Health Organization, Tetanus. 2018 [accessed 2020 Apr 10]. https://www.who.int/health-topics/tetanus/#tab=tab_1.
2. Tanrıover MD, Soyler C, Ascioğlu S, Cankurtaran M, Unal S. Low seroprevalence of diphtheria, tetanus and pertussis in ambulatory adult patients: the need for lifelong vaccination. *Eur J Intern Med.* 2014;25:528–32. doi:10.1016/j.ejim.2014.04.010.
3. Vizzotti C, Katz N, Stecher D, Aquino A, Juárez MDV, Urueña A. Assessment of the use in adults of four vaccines: a population survey in Argentina. *Medicina (B Aires).* 2018;78:76–82.
4. Ozisik L, Calik Basaran N, Oz SG, Sain Guven G, Durusu Tanrıover M. Perceptions and attitudes of patients about adult vaccination and their vaccination status: still a long way to go? *Med Sci Monit.* 2017;23:31783184. doi:10.12659/msm.901856.
5. Ministry of Health of Turkey. Adult vaccination. 2018 [accessed 2020 Apr 12]. <https://asi.saglik.gov.tr/asi-kimlere-yapilir/liste/30-yetiskin-asilama.html>.
6. Sahan S, Demirbilek Y, Sonmez C, Temel F, Sencan I. Epidemiological study of tetanus seropositivity levels in different age groups in Ankara Province, Turkey, 2017. *Jpn J Infect Dis.* 2019 Jan 23;72(1):14–18. doi:10.7883/yoken.JJID.2018.222.
7. Ahmad Hamidi A, Gelmez Taş B, Gündüz A, Celebi SN, Esen ES, Toprak D, Dökmetaş İ. Immunization rates of pneumococcal, influenza and tetanus vaccines and knowledge and attitudes of adult patients who receive inpatient treatment at hospital: point prevalence study. *Hum Vaccin Immunother.* 2018;14(11):2649–53. doi:10.1080/21645515.2018.1489187.
8. Oncü S, Onde M, Oncü S, Ergin F, Oztürk B. Tetanus seroepidemiology and factors influencing immunity status among farmers of advanced age. *Health Policy.* 2011;100(2–3):305–09. doi:10.1016/j.healthpol.2010.11.013.
9. Hoffait M, Hanlon D, Benninghoff B, Calcoen S. Pertussis knowledge, attitude and practices among European health care professionals in charge of adult vaccination. *Hum Vaccin.* 2011;7(2):197–201. doi:10.4161/hv.7.2.13918.
10. Haviari S, Bénet T, Saadatian-Elahi M, André P, Loulergue P, Vanhems P. Vaccination of healthcare workers: a review. *Hum Vaccin Immunother.* 2015;11(11):2522–37. doi:10.1080/21645515.2015.1082014.
11. Ozisik L, Tanrıover MD, Altinel S, Unal S. Vaccinating healthcare workers: level of implementation, barriers and proposal for evidence-based policies in Turkey. *Hum Vaccin Immunother.* 2017;13(5):1198–206. doi:10.1080/21645515.2016.1269992.
12. Maltezou HC, Botelho-Nevers E, Brantsæter AB, Carlsson RM, Heininger U, Hübschen JM, Josefsdottir KS, Kassianos G, Kyncl J, Ledda C, et al. Vaccination of healthcare personnel in Europe: update to current policies. *Vaccine.* 2019;37(52):7576–84. doi:10.1016/j.vaccine.2019.09.061.
13. Yılmaz Karadağ F, Sağlam ZA. Assessment of the factors influencing primary care physicians' approach to vaccination of adult risk groups in Istanbul, Turkey. *PeerJ.* 2019;7:e7516. doi:10.7717/peerj.7516.
14. Guclu OA, Demirci H, Ocakoglu G, Guclu Y, Uzaslan E, Karadağ M. Relationship of pneumococcal and influenza vaccination frequency with health literacy in the rural population in Turkey. *Vaccine.* 2019 Oct 16;37(44):6617–23. doi:10.1016/j.vaccine.2019.09.049.

15. Candemir I, Turk S, Ergun P, Kaymaz D. Influenza and pneumonia vaccination rates in patients hospitalized with acute respiratory failure. *Hum Vaccin Immunother.* 2019;15(11):2606–11. doi:10.1080/21645515.2019.1613128.
16. Korkmaz N, Nazik S, Gümüştakım RŞ, Uzar H, Kul G, Tosun S, Torun A, Demirbakan H, Seremet Keskin A, Kaçmaz AB, et al. Influenza vaccination rates, knowledge, attitudes and behaviours of healthcare workers in Turkey: a multicentre study. *Int J Clin Pract.* 2021 Jan;75(1):e13659. doi:10.1111/ijcp.13659.
17. Çiftci F, Şen E, Demir N, Çiftci O, Erol S, Kayacan O. Beliefs, attitudes, and activities of healthcare personnel about influenza and pneumococcal vaccines. *Hum Vaccin Immunother.* 2018 Jan 2;14(1):111–17. doi:10.1080/21645515.2017.1387703.
18. Karadeniz A, Akduman Alaşehir E. Seroepidemiology of hepatitis viruses, measles, mumps, rubella and varicella among healthcare workers and students: should we screen before vaccination? *J Infect Public Health.* 2020 Apr;13(4):480–84. doi:10.1016/j.jiph.2020.01.309.
19. Acikgoz A, Yoruk S, Kissal A, Yildirimcan Kadicesme Ş, Catal E, Kamaci G, Ersin F. Healthcare students' vaccination status, knowledge, and protective behaviors regarding hepatitis B: a cross-sectional study in Turkey. *Hum Vaccin Immunother.* 2021;6:1–8. doi:10.1080/21645515.2021.1973321.
20. Toker I, Kılıc TY, Kose S, Yesilaras M, Caliskan F, Atilla OD, Unek O, Hacı S, Kılınc Tokar A. Tetanus immunity status among adult trauma patients in an ED. *Turk J Emerg Med.* 2017 Feb 20;17(3):95–98. doi:10.1016/j.tjem.2017.02.001.
21. Kumar R, Taneja DK, Dabas P, Ingle GK. Practices and knowledge regarding prevention of tetanus among doctors in Delhi. *Asia Pac J Public Health.* 2006;18(3):30–32. doi:10.1177/10105395060180030601.
22. Chen IH, Hsu SM, Wu JJ, Wang YT, Lin YK, Chung MH, Huang PH, Miao NF. Determinants of nurses' willingness to receive vaccines: application of the health belief model. *J Clin Nurs.* 2019;28(19–20):3430–40. doi:10.1111/jocn.14934.
23. Çataklı T, Duyan-Çamurdan A, Aksakal-Baran FN, Güven AE, Beyazova U. Attitudes of physicians concerning vaccines not included in the national immunization schedule. *Turk J Pediatr.* 2018;60(3):290–97. doi:10.24953/turkped.2018.03.009.
24. Centers for Disease Control and Prevention. Immunization of health-care personnel: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2011;60(RR-7):1–45.
25. O'Halloran AC, Lu PJ, Meyer SA, Williams WW, Schumacher PK, Sussell AL, Birdsey JE, Boal WL, Sweeney MH, Luckhaupt SE, et al. Tdap vaccination among healthcare personnel—21 states, 2013. *Am J Prev Med.* 2018;54(1):119–23. doi:10.1016/j.amepre.2017.09.017.
26. Srivastav A, Black CL, Lu PJ, Zhang J, Liang JL, Greby SM. Tdap vaccination among healthcare personnel, internet panel survey, 2012–2014. *Am J Prev Med.* 2017;53(4):537–46. doi:10.1016/j.amepre.2017.04.002.
27. Napolitano F, Bianco A, D'Alessandro A, Papadopoli R, Angelillo IF. Healthcare workers' knowledge, beliefs, and coverage regarding vaccinations in critical care units in Italy. *Vaccine.* 2019;37(46):6900–06. doi:10.1016/j.vaccine.2019.09.053.
28. MacDougall D, Halperin BA, MacKinnon-Cameron D, Li L, McNeil SA, Langley JM, Halperin SA. Universal tetanus, diphtheria, acellular pertussis (Tdap) vaccination of adults: what Canadian health care providers know and need to know. *Hum Vaccin Immunother.* 2015;11(9):2167–79. doi:10.1080/21645515.2015.1046662.
29. MacDougall DM, Halperin BA, MacKinnon-Cameron D, Li L, McNeil SA, Langley JM, Halperin SA. The challenge of vaccinating adults: attitudes and beliefs of the Canadian public and healthcare providers. *BMJ Open.* 2015;5(9):e009062. doi:10.1136/bmjopen-2015-009062.
30. Randi BA, Miyaji KT, Lara AN, Ibrahim KY, Infante V, Rodrigues CCM, Lopes MH, Sartori AMC. Low tetanus-diphtheria-acellular pertussis (Tdap) vaccine coverage among healthcare workers in a quaternary university hospital in São Paulo, Brazil: need for continuous surveillance and implementation of active strategies. *Braz J Infect Dis.* 2019;23(4):231–36. doi:10.1016/j.bjid.2019.06.007.
31. Lu PJ, Euler GL. Influenza, hepatitis B, and tetanus vaccination coverage among health care personnel in the United States. *Am J Infect Control.* 2011;39(6):488–94. doi:10.1016/j.ajic.2010.10.009.
32. Guthmann JP, Fonteneau L, Ciotti C, Bouvet E, Pellissier G, Lévy-Bruhl D, Abiteboul D. Vaccination coverage of health care personnel working in health care facilities in France: results of a national survey, 2009. *Vaccine.* 2012;30(31):4648–54. doi:10.1016/j.vaccine.2012.04.098.
33. Siddiqui AA, Khan M, Khan JA, Haseeb SS, Mohib A, Kadri HM. Awareness, knowledge, and coverage of vaccination against tetanus, diphtheria, and pertussis among medical students of Karachi: a cross-sectional analysis. *Cureus.* 2019;11(4):e4472. doi:10.7759/cureus.4472.
34. Lu PJ, Graitcer SB, O'Halloran A, Liang JL. Tetanus, diphtheria and acellular pertussis (Tdap) vaccination among healthcare personnel—United States, 2011. *Vaccine.* 2014;32(5):572–78. doi:10.1016/j.vaccine.2013.11.077.
35. Jiang C, Whitmore-Sisco L, Gaur AH, Adderson EE; Tdap Working Group. A quality improvement initiative to increase Tdap (tetanus, diphtheria, acellular pertussis) vaccination coverage among direct health care providers at a children's hospital. *Vaccine.* 2018;36(2):214–19. doi:10.1016/j.vaccine.2017.11.071.
36. Campos-Outcalt D, Jeffcott-Pera M, Carter-Smith P, Schoof BK, Young HF. Vaccines provided by family physicians. *Ann Fam Med.* 2010;8(6):507–10. doi:10.1370/afm.1185.
37. Randi BA, Sejas ONE, Miyaji KT, Infante V, Lara AN, Ibrahim KY, Lopes MH, Sartori AMC. A systematic review of adult tetanus-diphtheria-acellular (Tdap) coverage among healthcare workers. *Vaccine.* 2019;37(8):1030–37. doi:10.1016/j.vaccine.2018.12.046.