ÖZGÜN ARAŞTIRMA ORIGINAL RESEARCH

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EVALUATION OF IMMUNIZATION STATUS OF HEALTHCARE WORKERS AND FACTORS AFFECTING IMMUNIZATION IN SULEYMAN DEMIREL UNIVERSITY RESEARCH AND TRAINING HOSPITAL

SÜLEYMAN DEMİREL ÜNİVERSİTESİ ARAŞTIRMA VE UYGULAMA HASTANESİ SAĞLIK ÇALIŞANLARININ BAĞIŞIKLANMA DURUMLARININ VE BAĞIŞIKLANMAYI ETKİLEYEN ETMENLERİN DEĞERLENDİRİLMESİ

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Öz

Amaç

Süleyman Demirel Üniversitesi Araştırma ve Uygulama Hastanesi sağlık çalışanlarının bağışıklanma durumlarını ve bağışıklanma durumları ile ilişkili olabilecek etmenleri incelemektir.

Gereç ve Yöntem

Kesitsel analitik tipte planlanan bu araştırma Şubat 2020-Temmuz 2020 tarihleri arasında gerçekleştirildi. Araştırmanın evreni Süleyman Demirel Üniversitesi Araştırma ve Uygulama Hastanesi'ndeki sağlık çalışanlarıydı (1827 kişi). Örnek büyüklüğü %50 bilinmeyen prevelans, %95 güven düzeyi, %5 hata payı, 1.25 desen etkisi ile 397 olarak hesaplandı. Bağımlı değişkenler; influenza, hepatit B, KKK, tetanoz, suçiçeği ve hepatit A aşıları ile bağışıklanma durumu, bağımsız değişkenler sosyodemografik ve bağışıklanma durumu ile ilişkili olabileceği düşünülen özelliklerden oluşmaktaydı. İstatistiksel anlamlılık düzeyi p<0.05 kabul edildi.

Bulgular

Araştırmada 382 (%96,2) sağlık çalışanına ulaşıldı. Çalışanların; %6,3'ü grip aşısını, %62,3'ü tetanoz aşısını, %67,5'i hepatit B aşısını, %20,1'i hepatit A aşısını, %28,8'i suçiçeği aşısını, %39,5'i KKK aşısını yaptırmıştı. Çalışanların çoğunluğu mesleğini bulaşıcı hastalıklar açısından riskli (%85,6) ve mesleğinde aşılanmayı gerekli bulduğunu (%76,4) belirtti. Hekimler; 9,4 kat daha fazla grip aşısı, 3,5 kat daha fazla hepatit B aşısı, 2,8 kat daha fazla KKK aşısı yaptırmıştı (sırasıyla p=0,002 GA= 2,278-38,520, p<0,001 GA=1,827-6,807, p=0,002 GA=1,464-5,205). Hekim dışı yardımcı sağlık çalışanı olmanın suçiçeği aşısıyla aşılanmayı 2,8 kat arttırdığı bulundu (p=0,018 GA=1,190-6,510).

Sonuç

Sağlık çalışanlarına yönelik düzenlenecek eğitim ve farkındalık çalışmaları ile aşı programları aşılanma oranlarında artış sağlayabilir. Girişimlerin içeriği her aşı için farklı olmalı ve meslek gruplarının özellikleri göz önünde bulundurulmalıdır.

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Anahtar Kelimeler: Aşı ile önlebilir hastalıklar, Aşılanma, Bağışıklanma, Sağlık çalışanı

Abstract

Objective
The aim of this study was to evaluate the immunization status of healthcare workers in Suleyman Demirel University Research and Training Hospital and factors affecting immunization.

Material and Method
This research, planned as a cross-sectional and analytical type, was carried out between February 2020 and July 2020. The population for the research comprised healthcare workers at Suleyman Demirel University Research and Training Hospital (1827 people). The sample size was calculated as 397 for an unknown prevalence of 50%, 95% confidence level, absolute precision of 5% and a design effect of 1.25. Dependent variables were immunization status for influenza, hepatitis B, MMR, tetanus, varicella, and hepatitis A vaccines. Independent variables included features that might be related to sociodemographic features and immunization status. The statistical significance level was accepted as $p<0.05$.

Results
The study reached 382 (96.2%) healthcare workers. Healthcare workers' vaccination percentages were 6.3% for influenza, 62.3% for tetanus, 67.5% for hepatitis B, 20.1% for hepatitis A, 28.8% for varicella, and 39.5% for MMR. Most of the workers indicated that their occupation is risky for infectious diseases (85.6%), and they found that vaccination was necessary for their profession (76.4%). Physicians had 9.4 times more influenza vaccinations, 3.5 times more hepatitis B vaccinations and 2.8 times more MMR vaccinations ($p=0.002$ CI:2.278-38.520, $p<0.001$ CI:1.827-6.807, $p=0.002$ CI:1.464-5.205, respectively). Being a non-physician assistant healthcare worker increased the vaccination rate for varicella vaccine by 2.8 times ($p=0.018$ CI:1.190-6.510).

Conclusion
Vaccination programs may ensure an increase in the vaccination rates through training and awareness studies for healthcare professionals. The content of the interventions should be different for each vaccine and the characteristics of the occupational groups should be considered.

Keywords: Healthcare worker, Immunization, Vaccination, Vaccine-preventable diseases

Introduction

Vaccination is the most effective and safe preventive health service, after environmental health services, in preventing infectious diseases. Immunization with vaccination is as important in adulthood as it is in childhood and is a lifelong process (1). During adulthood, individuals who were not vaccinated in childhood should receive primary vaccinations, and individuals who received childhood vaccinations should receive booster doses. In addition, there are vaccines recommended for all adult individuals or risk groups (2).

The definition of healthcare worker includes physicians, dentists, nurses, psychologists, therapists, laboratory workers, students, interns, domestic staff, morgue attendants, pharmacists, dietitians, technical service workers, secretaries, security personnel, laundry workers, administrative staff, unit staff, and hospital volunteers who have direct contact with patients (3). Healthcare workers are among the risk groups recommended to be vaccinated within the scope of adult immunization (1).

The Center for Disease Control and Prevention (CDC) recommends vaccines at varying intervals and doses for adults, depending on age group and risk factors. These vaccines consist of influenza, hepatitis B, hepatitis A, diphtheria, pertussis, tetanus, varicella, herpes zoster, measles, rubella, mumps, human papillomavirus, meningococcus, 23-valent polysaccharide pneumococcus, 13-valent conjugated pneumococcus, and Haemophilus influenzae type b vaccines (4). Vaccination is recommended by the Republic of Türkiye Ministry of Health for healthcare workers, those who serve immigrants, sewage workers, those who work in medical waste management and other employees at risk (barbers-hairdressers, manicurists-pedicurists, fire personnel, police officers, etc.) due to occupational risks (5).

The aim of this study was to determine the immunization status of healthcare professionals in Suleyman Demirel University Research and Training Hospital and to examine the factors that may be associated with immunization status.

Material and Method

Study Design

This study was a cross-sectional, analytical type of research. The Clinical Research Ethics Committee of Suleyman Demirel University Faculty of Medicine approved the study (Date: 06.02.2020, No:12). The research was conducted at Suleyman Demirel University Research and Training Hospital between February 2020 and July 2020. The population for the research consisted of 1827 healthcare professionals working in the hospital. The sample size was calculated as 397 using the Open Epi program, with an unknown prevalence of 50%, 95% confidence level, absolute precision of 5% and a design effect of 1.25. Multistage sampling method was used: stratified and simple random sampling, respectively.

Healthcare workers were stratified according to their occupational groups such that include 195 faculty members (10.67% of population), 321 research assistants (17.57%), 632 non-physician allied health workers (34.59%), 343 office unit workers (18.77%), 270 cleaning workers (14.78%) and 66 kitchen workers (3.61%).

The sample of 397 people targeted according to the ratio of the layers in the population was determined as 42 faculty members, 70 research assistants, 137 non-physician auxiliary health workers, 75 office unit workers, 59 cleaning workers, and 14 kitchen workers. Participants were selected by simple random sampling method from the stratified lists. While 1.3% (5 participants) of the healthcare workers selected for the sample refused to participate in the study, 2.5% (10 participants) could not be reached despite visiting their units three times. The rate for participants reached was 96.2%. Therefore, the sample results were generalizable to the population.

The dependent variable in the study was the immunization status of healthcare workers. Immunization status was evaluated according to the following; 1) Adult Immunization Guide prepared by the Infectious Diseases And Clinical Microbiology Specialty Society of Türkiye and the Adult Immunization Work Group and 2) influenza vaccine, hepatitis B vaccine, measles-mumps-rubella (MMR) vaccine, tetanus vaccine, varicella vaccine, and hepatitis A vaccine recommended by the Ministry of Health of the Republic of Türkiye for healthcare workers (1,6).

Independent variables in the study comprised sociodemographic characteristics, health status and behaviors, occupational characteristics, working conditions, and other attitude and behavioral characteristics.

Data Collection

The data for the research were collected by the researcher in February 2020, using the prepared survey form. The survey form consists of 40 questions. Participants were informed about the purpose of the research and their informed consent was obtained. The survey administration took approximately 20 minutes for each participant.

Statistical Analysis

SPSS 24.0 (Statistical Package for the Social Sciences, Version 24.0) program was used for data analysis. Descriptive findings are presented with number and percentage distributions for categorical variables, and mean±standard deviation, minimum value, and maximum value for continuous variables. The chi-square test was used for categorical variables to evaluate the relationship of independent variables with the dependent variable. The relationship of continuous variables with the dependent variable was evaluated using the Mann-Whitney U test and Independent Samples T test. Logistic regression analysis was used as multivariate analysis. Variables that were found to be significant in univariate analyses and variables that were not significant but had a p-value below 0.25 were included in the logistic model, and one of the variables with high correlation was excluded (7). The Hosmer-Lemeshow test was used for model fit. Results are presented with odds ratio (OR) and 95% confidence intervals (CI). The statistical significance level was accepted as $p<0.05$.

Results

The sociodemographic, health status and health behavior characteristics of the research group are presented in Table 1. When the characteristics of the research group living with individuals in risk groups were evaluated, 13.7% lived with children under 2 years of age, 6.8% lived with elderly people over 65 years of age, 9.5% lived with people with chronic diseases and 1.8% lived with pregnant women. Of those with chronic disease, 34.5% had an endocrine system disease and 20.9% had a cardiovascular system disease. The least common disease group was dermatological diseases (0.9%).

The occupational characteristics and attitudes of the research group are presented in Table 2. Of the participants, 10.7% were faculty members, 17.5% were research assistants, 34.6% were non-physician

Table 1 Sociodemographic, health status and health behavior-related characteristics of the research group

Sociodemographic characteristics		**Number**	**%**
Gender (n=382)	Male	157	41.1
	Female	225	58.9
Marital status (n=382)	Married	283	74.1
	Single	88	23.0
	Widow	5	1.3
	Divorced	6	1.6
Educational status (n=382)	Primary school	13	3.4
	Middle school	16	4.2
	High school	71	18.6
	University	184	48.2
	Master's degree and above	98	25.7
Status of having children (n=365)	Yes	245	67.1
	No	120	32.9
Monthly income (Turkish Lira) (n=370)	0-2499	41	11.1
	2500-4999	110	29.7
	5000-7499	74	20.0
	7500 and more	145	39.2
Age (n=375) Min-Max (Mean±SD)		21-61 (36.7±8.6)	
Number of children (n=354) Min-Max (Mean±SD)		0-4 (1.2±1.0)	
Number of individuals living together (n=357) Min-Max (Mean±SD)		0-7 (2.2±1.3)	
Characteristics of health status and health behavior		**Number**	**%**
Perception of health (n=381)	Very good	29	7.6
	Good	158	41.5
	Fair	154	40.4
	Bad	35	9.2
	Very bad	5	1.3
Chronic disease (n=378)	Yes	100	26.5
	No	278	73.5
Smoking (n=375)	Never	217	57.9
	Still smokes	114	30.4
	Quit	44	11.7
Frequency of alcohol use (n=380)	Never	291	76.6
	1 day or less per month	44	11.6
	2-3 days per month	26	6.8
	1 day a week	15	3.9
	2-5 days a week	4	1.1

Table 2 Distribution of the research group according to occupational characteristics

Characteristic		Number	%
Profession name/group (n=382)			
Faculty member		41	10.7
Research assistant		67	17.5
Non-physician allied healthcare worker	Nurse-midwife	91	23.8
	Medical officer	10	2.6
	Laboratory-biologist	12	3.1
	Health, Anesthesia, Radiology technicians	13	3.4
	Physiotherapist	5	1.3
	Psychologist	1	0.3
Office worker	Officer	39	10.2
	Medical secretary	20	5.2
	Technician	13	3.4
Cleaning worker		56	14.7
Kitchen worker		14	3.7
Shift work schedule (n=370)			
Yes		203	54.9
No		167	45.1
Identifies profession as risky for infectious diseases (n=382)			
Yes		327	85.6
No		43	11.3
I don't know		12	3.1
Need for vaccination (n=381)			
Yes		291	76.4
No		49	12.9
Undecided		41	10.8

allied health workers, 18.8% were office workers, 14.7% were cleaning staff, and 3.7% of them were kitchen workers. Of the research group, 85.6% stated that they found their profession risky in terms of infectious diseases, and the most frequently seen risk factors were hepatitis B (83%), hepatitis C (82.3%) and HIV (73.2%), respectively.

In the last year, 7.1% of the research group stated that they had never had an upper respiratory tract infection, 26.2% had one once, 29.9% had one twice, and 20.4% had an upper respiratory tract infection three times. Of the group, 40.4% stated that they were diagnosed with influenza in the last year, and 24.1% stated that they were absent from work due to flu. The average absence of healthcare workers from work due to flu was 4.3±3.9 (min 1-max 20) days per month.

The influenza, tetanus, hepatitis B, MMR, varicella and hepatitis A vaccination status of the research group are presented in Table 3. Of the group, 58.7% did not plan to get the influenza vaccine next season, and 36.6% were undecided about recommending the influenza vaccine to others. Among the research group, 74.9% stated that they received a tetanus vaccine in adulthood. It was determined that 44.4% of

Table 3 Vaccination status of the research group

Characteristic	Number	%
Influenza vaccine (n=379)		
Yes, regularly every year	10	2.6
Yes, but not regularly every year	89	23.5
No	280	73.9
Influenza vaccine in the last year (n=382)		
Yes	24	6.3
No	358	93.7
Tetanus vaccination in the last 10 years(n=382)		
Yes	238	62.3
No	144	37.7
Hepatitis B vaccine (n=378)		
Regular, had all doses (at least 3 doses)	238	63.0
Irregular but had all doses (at least 3 doses)	17	4.5
Started vaccination but did not complete all doses	27	7.1
Has never been vaccinated	96	25.4
Measles-rubella-mumps vaccine (n=382)		
Yes	151	39.5
No	48	12.6
I can't remember	183	47.9
Varicella vaccine (n=382)		
Yes	110	28.8
No	100	26.2
I can't remember	172	45.0
Hepatitis A vaccine (n=378)		
Regular (2 doses)	69	18.3
Irregular but all doses (2 doses)	7	1.9
Started vaccination but did not complete all doses	15	4.0
Has never been vaccinated	287	75.9

healthcare workers who received tetanus vaccination in adulthood were vaccinated due to pregnancy and 41.5% due to stab wounds.

Of the research group, 84.5% stated that they had been screened for hepatitis B at any time, and 75.5% of the group had immunity according to the screening results. The serological antibody level testing status of the research group for measles, rubella, mumps, varicella and hepatitis A diseases is presented in Table 4. Of healthcare workers, 16.8% received a vaccine other than the ones recommended for them, and when these vaccines are examined, the most frequently administered vaccines were influenza A (H1N1) (15.4%), meningococcus (0.5%), HPV (0.3%) and rabies (0.3%) vaccinations.

Table 4 Status of antibody tests for measles, rubella, mumps, varicella, hepatitis A diseases or their agents

Antibody levels tested	Disease / Agent				
	Measles	Rubella	Mumps	Varicella	Hepatitis A
	n(%)	n(%)	n(%)	n(%)	n(%)
Test + immunity +	66 (19.0)	71 (20.5)	64 (18.6)	74 (21.4)	105 (29.8)
Test + immunity -	8 (2.3)	7 (2.0)	8 (2.3)	7 (2.0)	27 (7.7)
No test	194 (55.7)	190 (54.9)	201 (58.4)	195 (56.4)	146 (41.5)
I can't remember	80 (23.0)	78 (22.5)	71 (20.6)	70 (20.2)	74 (21.0)
Total	348(100.0)	346 (100.0)	344 (100.0)	346 (100.0)	352 (100.0)

When the research group's use of resources to learn current information about vaccines was evaluated, 23.5% did not use any resources. Participants benefited from more than one option as a source of current information, 45% of the group used information they received from colleagues and professional associations, and 27% used information they received from the Ministry of Health's website. Other sources were determined as newspapers-television (22.1%), social media (21.8%), congresses-courses (19.7%), WHO and CDC websites (18.1%), and scientific journals (16.2%). When the research group was questioned about their awareness of the existence of a unit for healthcare personnel immunization in the institution where they work, 52.9% answered "yes", 9.1% answered "no" and 38% answered, "I do not know".

Of the vaccinated individuals in the research group, 91.6% stated that they were vaccinated to protect themselves, 54.1% because they were healthcare workers, and 51.3% to protect their families. The distribution of the reasons for not being vaccinated against some infectious diseases among the individuals in the research group who were not vaccinated is shown in Table 5. In the research group, the most common answer to the reason for not getting influenza, hepatitis B, hepatitis A and tetanus vaccines was not considering the vaccine necessary. Individuals stated that they did not get vaccinated for varicella and MMR because they had had the diseases before.

The results of logistic regression analysis evaluating the factors affecting immunization status for influenza, tetanus, hepatitis B, hepatitis A, varicella, and MMR vaccine are shown in Table 6. The logistic regression analysis model was created separately for each vaccine. Variables with $p<0.25$ were included in the logistic regression analysis model, along with variables that had a significant relationship with vaccination status in univariate analyses, and the "backward elimination" method was used. Since a high level of correlation was determined between age and the variables of duration of employment in professional life, working time in the current institution, and working time in the department ($r=0.824$ $p<0.001$, $r=0.715$ $p<0.001$, $r=0.633$ $p<0.001$, respectively), only the age variable was included in the regression models.

It was found that females were 3.2 times more likely to get the influenza vaccine than males (OR=3.179, p=0.037, 95% CI=1.069-9.453). Vaccination with influenza vaccine was 4.6 times higher among office/ cleaning/kitchen workers than among non-physician allied health workers (OR=4.634,p=0.039,95% CI=1.080-19.885), and 9.4 times higher among faculty members/ research assistants (OR=9.368, p=0.002, 95% CI=2.278-38.520). Those who were aware of the staff vaccination unit were 4.5 times more likely to receive an influenza vaccine than those who were unaware (OR=4.468, p=0.008, 95% CI=1.489-13.403).

According to the tetanus vaccine analysis results, those with children had tetanus vaccination 3.4 times more than those without children (OR=3.393, p<0.001, 95% CI=1.764-6.527). Those who found vaccination necessary in their profession had tetanus vaccination 2.1 times more than those who did not find vaccination necessary in their profession (no/ undecided) (OR=2.091, p=0.008, 95% CI=1.214-3.602). Age was negatively associated with tetanus vaccination status, and each increase in age

Table 5 Distribution of reasons for not being vaccinated against some infectious diseases among individuals in the research group who have not been vaccinated

Reasons for not getting vaccinated*	Influenza (n=281)	Hepatitis B (n=73)	Hepatitis A (n=176)	Tetanus (n=59)	Varicella (n=160)	MMR (n=138)
	n(%)	n(%)	n(%)	n (%)	n(%)	n(%)
I don't see it as necessary	172(61.2)	17(23.3)	51(29.0)	21(35.6)	35(21.9)	34(24.6)
I do not believe in the protection of the vaccine	65(23.1)	4(5.5)	5(2.8)	3(5.1)	3(1.9)	3(2.2)
I don't think I'm in the risk group	38(13.5)	9(12.3)	15(8.5)	11(18.6)	13(8.1)	11(8.0)
Harmful effects of the substances contained in the vaccine	22(7.8)	3(4.1)	4(2.3)	1(1.7)	4(2.5)	3(2.2)
Side effects of the vaccine	21(7.5)	2(2.7)	6(3.4)	1(1.7)	2(1.3)	2(1.4)
I couldn't find free time to get vaccinated	22(7.8)	13(17.8)	31(17.6)	12(20.3)	10(6.3)	12(8.7)
I do not think it is a dangerous disease	22(7.8)	3(4.1)	11(6.3)	0	4(2.5)	3(2.2)
I'm against vaccination	3(1.1)	2(2.7)	1(0.6)	0	0	0
Forgetfulness	11(3.9)	12(16.4)	26(14.8)	9(15.3)	8(5.0)	8(2.1)
I had the disease	20(7.1)	12(16.4)	35(19.9)	2(3.4)	94(58.8)	71(51.4)
Other	5(1.8)	5(6.8)	14(8.0)	5(8.5)	9(5.6)	10(7.2)

*More than one option is marked. Percentages of those who gave the reason for not getting vaccinated were used.

decreased the tetanus vaccination status by 1.1 times (OR=1.082, p<0.001, 95% CI=1.044-1.122).

According to the results of the hepatitis B vaccine regression model, females received the hepatitis B vaccine 2.7 times more than males (OR=2.701, p<0.001, 95% CI=1.563-4.666). Participants without chronic disease were 2.2 times more likely to receive hepatitis B vaccination than those with chronic disease (OR=2.193, p=0.006, 95% CI=1.246-3.859). Physicians (faculty members/research assistants) had 3.5 times more hepatitis B vaccination than office-cleaning-kitchen workers (OR=3.526, p<0.001, 95% CI=1.827-6.807). Those who found the vaccine necessary in their profession had 2.5 times more hepatitis B vaccination than those who did not find the vaccine necessary in their profession (no/undecided) (OR=2.446, p=0.002, 95% CI=1.392-4.300).

The rate of receiving hepatitis A vaccination was 1.9 times higher among those working on shift basis than in those not working on shift schedule (OR=1.868, p=0.045, 95% CI=1.015-3.438). Age was negatively associated with hepatitis A vaccination status, and each increase in age decreased hepatitis A vaccination by 1.04 times (OR=1.038, p=0.047, 95% CI=1.001-1.079).

In the regression results for immunization status with the varicella vaccine, those with a monthly income of 5000 TL and above were 2.2 times more likely to be vaccinated than those with a monthly income of less than 5000 TL (OR=2.211, p=0.017, 95% CI=1.153-4.241). Those who found the vaccine necessary in their profession had 2.7 times higher rates for varicella vaccination than those who did not find the vaccine necessary in their profession (no/undecided) (OR=2.725, p=0.003, 95% CI=1.400-5.307). Getting vaccinated against varicella was 2.4 times higher among faculty members/research assistants than office/cleaning/kitchen workers (OR=2.384, p=0.008, 95% CI=1.258-4.517), and 2.8 times higher among non-physician allied health workers (OR=2.784, p=0.018, 95% CI=1.190-6.510). The number of persons they lived with was negatively related to varicella vaccination status, and each increase in the number of persons they lived with reduced varicella vaccination rates by 1.3 times (OR=1.332, p=0.006, 95% CI=1.008-1.634).

Table 6 Logistic regression analysis results evaluating the factors affecting the vaccination status of the research group

Vaccines	Variables		OR (95% CI)
Influenza [1]	Gender	Male (ref.)	1.00
		Female	**3.179 (1.069-9.453)***
	Perception of health	Very good/good (ref.)	1.00
		Fair/bad/very bad	2.557 (0.905-7.224)
	Profession	Faculty member/research assistant	**9.368 (2.278-38.520)***
		Non-physician allied health worker (ref.)	1.00
		Office/cleaning/kitchen worker	**4.634 (1.080-19.885)***
	Considers vaccination necessary in their profession	Yes	3.182 (0.680-14.891)
		No/undecided (ref.)	1.00
	Awareness of the unit for healthcare personnel immunization	Yes	**4.468 (1.489-13.403)***
		No/I don't know (ref.)	1.00
Tetanus [2]	Shift work schedule	Yes (ref.)	1.00
		No	1.546 (0.935-2.557)
	Has children	+	**3.393 (1.764-6.527)****
		- (ref.)	
	Considers vaccination necessary in their profession	Yes	**2.091 (1.214-3.602)***
		No/undecided (ref.)	1.00
	Age	Negative relationship	**1.082 (1.044-1.122)****
Hepatitis B[3]	Gender	Male (ref.)	1.00
		Female	**2.701 (1.563-4.666)****
	Presence of chronic disease	+ (ref.)	
		-	**2.193 (1.246-3.859)***
	Profession	Faculty member/research assistant	**3.526 (1.827-6.807)****
		Non-physician allied healthcare worker	1.776 (0.957-3.297)
		Office/cleaning/kitchen worker (ref.)	1.00
	Considers vaccination necessary in their profession	Yes	**2.446 (1.392-4.300)***
		No/I'm undecided (ref.)	1.00
Hepatitis A[4]	Educational status	High school and below	1.879 (0.963-3.665)
		University and above (ref.)	1.00
	Shift work schedule	Yes	**1.868 (1.015-3.438)***
		No (ref.)	1.00
	Perception of health	Fair/bad/very bad (ref.)	1.00
		Very good/good	1.721 (0.964-3.071)
	Age	Negative relationship	**1.038 (1.001-1.079)***

Table 6 continued Logistic regression analysis results evaluating the factors affecting the vaccination status of the research group

Vaccines	Variables		OR (95% CI)
Varicella[5]	Monthly income	<5000 Turkish lira (ref.)	1.00
		≥5000 Turkish lira	**2.211 (1.153-4.241)***
	Profession	Faculty member/research assistant	**2.384 (1.258-4.517)***
		Non-physician allied healthcare worker	**2.784 (1.190-6.510)***
		Office/cleaning/kitchen worker (ref.)	1.00
	Considers vaccination necessary in their profession	Yes	**2.725 (1.400-5.307)***
		No/undecided (ref.)	1.00
	Number of individuals living together	Negative relationship	**1.332 (1.008-1.634)***
MMR [6]	Profession	Faculty member/research assistant	**2.761 (1.464-5.205)***
		Non-physician allied healthcare worker	1.503 (0.824-2.742)
		Office/cleaning/kitchen worker (ref.)	1.00
	Considers vaccination necessary in their profession	Yes	**1.816 (1.004-3.283)***
		No/undecided (ref.)	1.00
	Awareness of the unit for healthcare personnel immunization	Yes	**1.625 (1.008-2.620)***
		No/I do not know (ref.)	1.00
	Current information source usage status	Does not use any resources (ref.)	1.00
		Uses at least one resource	1.637 (0.888-3.018)

*p < 0.05, **p < 0.001; OR – Odds Ratio; CI – Confidence Interval
Variables included in the logistic model
[1] Age, gender, marital status, having a child, perception of health, presence of chronic disease, profession, considers vaccination as necessary in the profession, awareness of the unit for healthcare personnel immunization, frequency of upper respiratory tract infection (URTI) in the last year
[2] Age, number of individuals living together, marital status, having children, presence of an individual in the risk group at home, presence of chronic disease, considers vaccination necessary in their profession, risk perception about their profession, shift work schedule, current information source usage status
[3] Age, gender, educational status, monthly income, presence of a chronic disease, perception of health, smoking status, profession, considering vaccination necessary in their profession, risk perception towards their profession, shift work schedule, current information source usage status, awareness of the unit for healthcare personnel immunization
[4] Age, number of individuals living together, educational status, monthly income, having children, health perception, smoking status, shift work schedule
[5] Age, number of individuals living together, marital status, educational status, monthly income, having children, profession, considering vaccination necessary in their profession, risk perception towards their profession, current information source usage status, alcohol use status
[6] Age, number of individuals living together, marital status, educational status, monthly income, having children, perception of health, alcohol use status, presence of an individual in the risk group at home, profession, considering vaccination necessary in their profession, risk perception towards their profession, current information source usage status, awareness of the unit for healthcare personnel immunization.

Those who found the vaccine necessary in their profession received the MMR vaccine 1.8 times more often than those who did not (no/undecided) (OR=1.816, p=0.048, 95% CI=1.004-3.283). Physicians (faculty members/research assistant) were 2.8 times more likely to receive the MMR vaccine than office/cleaning/kitchen workers (OR=2.761, p=0.002, 95% CI=1.464-5.205). Those who were aware of the unit for healthcare personnel immunization were 1.6 times more likely to have received the MMR vaccine than those who were not aware (OR=1.625, p=0.046, 95% CI=1.008-2.620). The number of persons they lived with was negatively associated with the status of receiving the MMR vaccine, and each increase in the number of people they lived with reduced the rate for receiving the MMR vaccine by 1.2 times (OR=1.225, p=0.034, 95% CI=1.015-1.481).

Discussion

In this study, 2.6% of healthcare workers received regular influenza vaccinations every year, and 6.3% of them were vaccinated with the influenza vaccine in the last year. In the systematic review by Hofmann et al., the vaccination rate was found to be between 2.1% and 82% (8). In a study in India, vaccination rates were found to be 4.4% (9). A systematic review of 15 studies and a meta-analysis of 6 studies by La Torre et al. reported that the influenza vaccination rates for nurses and allied health workers were 13.5% and 12.5%, respectively. In other European countries such as England, Germany and France, the average prevalence of influenza vaccination varies between 15% and 29% (10). In another study conducted in Belgium, the vaccination rate was 40.4% (11). Vaccination rates among healthcare workers in the USA were 75.2% in the 2013-2014 season, 77.3% in the 2014-2015 season, 78.6% in the 2016-2017 season, 78.4% in the 2017-2018 season and 81.1% in the 2018-2019 season (12-14). In a study conducted in a chest diseases hospital in Denizli province in our country, the influenza vaccination rate of healthcare workers was found to be 4.3% (15). The vaccination rate for physicians and nurses working in university hospitals in the southeastern region of Turkey was found to be 9.2% (16). In a study conducted among physicians working at a university hospital in Samsun, the influenza vaccine vaccination rate was stated to be 13.1% (17). In a study conducted in Burdur, 22.1% of primary healthcare workers reported they received seasonal influenza vaccinations every year (18). In this study, the influenza vaccination rates for the participants were found to be low, similar to other studies in our country and around the world. It is noteworthy that high vaccination rates are achieved in countries where influenza vaccination is legally mandatory for healthcare workers. In this study, the rate of receiving influenza vaccines was 4.6 times higher in office/cleaning/kitchen workers and 9.4 times higher in physicians than in non-physician allied health workers. The results are similar to studies conducted in our country (16,19,20) and abroad (9,11,21). It is noteworthy that although physicians are in close contact with patients and are role models for patients and other healthcare professionals, the rate of vaccination for the influenza vaccine (10.2%) was much lower than expected. In our study, females were 3.2 times more likely to be vaccinated with the influenza vaccine than males, while this result contradicts the literature (15,19,22,23).

In this study, 74.9% of healthcare workers were vaccinated against tetanus in adulthood and 62.3% were vaccinated with tetanus vaccine in the last ten years. Using 2007 US National Immunization Survey-Adult data, Lu and Euler found the tetanus vaccination rate for healthcare workers in the last 10 years was 70.4% (24). Srivastav et al. analyzed Internet Panel Surveys data from 2012, 2013, and 2014 to evaluate the TDaP vaccine rate in healthcare workers. As a result of their studies, the vaccination rates in 2012, 2013 and 2014 were 35%, 40% and 42%, respectively (25). In a study conducted in Greece, 47.3% of healthcare workers received the Td vaccine (26). In our country, tetanus vaccination rates vary between 30-78% (27-30). The tetanus vaccination rate determined in this study was similar to other studies conducted in our country and around the world. In this study, the main reasons for healthcare workers to receive tetanus vaccination in adulthood were pregnancy (44.4%) and stab wounds (41.5%), while fewer participants stated that they received tetanus vaccination due to their profession (11.6%). These results are similar to studies conducted on both healthcare professionals and the general population (30,31). In our study, females with children had tetanus vaccinations 3.4 times more often than those without children. This situation is thought to be caused by the immunization program (Td vaccine) applied to pregnant women in our country (32).

In this study, 67.5% of healthcare workers received all doses of the hepatitis B vaccine. When this rate is examined in studies conducted in different countries, it was 24.7% in Africa, 77.3% in Italy and 93.8% in Austria (33-35). There are studies in our country where the hepatitis B vaccination rate varies between 59% and 90% (29,30,36,37). In studies conducted at the hospital where this study was conducted, Çakmak et al. (1998) found that 76.0% of healthcare workers received hepatitis B vaccination, while Uzun et al. (2006) found that 81.7% of healthcare workers received the full dose of hepatitis B vaccine (38,39). This study was conducted in the same hospital as the 2 studies mentioned above, and although the vaccination rates of healthcare workers are expected to increase over the years, rates were observed to be lower. In the other two studies, the study group consisted of physicians, nurses, biologists, health technicians, health officers, and laboratory workers, while our study also included administrative unit, cleaning and kitchen employees. It is thought that the low hepatitis B vaccination rate is due to differences in the study group. In this study, physicians were 3.5 times more likely to receive hepatitis B vaccination than office/cleaning/kitchen workers. Kişioglu et al. also conducted a study in 2002 at the hospital where this study was conducted and found that the hepatitis

B vaccination rate was highest among doctors (83.1%) and lowest among cleaning workers (4.1%) (40). In the study by Öncül et al., the highest hepatitis B vaccination rate was found for nurses (89.6%) (41). The high direct contact of physicians and non-physician allied health workers with patients and the professional training they receive may explain the high rates of vaccination for the hepatitis B vaccine in this group. In this study, females were 2.7 times more likely to receive the hepatitis B vaccine than males. Vaccination rates vary according to gender in the literature (23,41-43). Health workers without chronic diseases were 2.2 times more likely to receive hepatitis B vaccination than those with chronic disease. This situation is thought to be due to the higher vaccination rates of young healthcare workers.

In this study, 20.1% of healthcare workers had received all doses of the hepatitis A vaccine. The hepatitis A vaccination rate of employees working in primary health care centers in Greece was 5.8% (26). In a multicenter cross-sectional study conducted in Italy, the vaccination rate was 7.1%, and in another study in South Australia, 29.7% of healthcare workers were vaccinated against hepatitis A (34,44). Vaccination rates with the hepatitis A vaccine are similar to other studies conducted in our country (30,36). In this study, 17.6% of physicians, 19.2% of non-physician allied health workers, and 22.9% of office/cleaning/kitchen workers were vaccinated against hepatitis A, but no significant relationship was found. In another study, the highest vaccination rate was found for cleaning staff and security guards (27). In the current study, the vaccination rates for office, cleaning and kitchen workers were determined as 8.6%, 39.3% and 28.6%, respectively, and the high vaccination rate of cleaning workers is remarkable.

In this study, 28.8% of healthcare workers stated that received the varicella vaccine, and 45.0% did not remember their status regarding the vaccine. The rate of varicella vaccination in our study is low, similar to other studies (27,29,34,35,44,45). It is noteworthy that nearly half of healthcare workers do not remember their vaccination status. The low rate of varicella vaccination may be due to the fact that healthcare workers had this disease in childhood. It is important to reveal the immunization status of employees through serological tests and to vaccinate non-immune employees. Although the occupational group with the highest vaccination rate in our study was non-physician allied health workers, vaccination with the varicella vaccine was low among all health workers. There are studies in which nurses or physicians have higher vaccination rates (34,46).

In this study, 39.5% of healthcare workers stated that they had received the MMR vaccine, and 47.9% did not remember their status regarding the vaccine. The vaccination rates among healthcare professionals working in primary healthcare centers in Greece were 23.3% against measles, 23.3% against mumps and 29.8% against rubella (26). In a study in Italy, measles, rubella and mumps vaccination rates were found to be 30.3%, 30.9% and 23.7%, respectively (34). In studies conducted in our country, MMR vaccination rates vary between 18% and 56% (30,42,45). Vaccination rates identified in our study are at low levels. When examined by profession, the highest vaccination rate was among physicians, similar to other studies in our country (42,46).

In our study, when the reasons that encourage healthcare workers to get vaccinated were evaluated, the three most common answers were because they want to protect themselves (91.6%), because they are healthcare workers (54.1%), and because they want to protect their family (51.3%). The reasons that encourage vaccination are similar in this study and other studies (44,47). However, the motivational sources mentioned alone are not sufficient for vaccination. In our study, those who found vaccination necessary in their profession were more likely to receive tetanus vaccination, hepatitis B, varicella and MMR vaccination, but this did not affect the status of receiving hepatitis A and influenza vaccinations. The results obtained also reveal the need for awareness studies, especially for these two vaccines. In our study, the most common risk factors were hepatitis B (83%), hepatitis C (82.3%) and HIV (73.2%), respectively. It is thought that the high-risk perception of healthcare workers against HBV, HCV and HIV factors stems from both the frequency of blood-borne diseases in the daily work environment and their negative effects in the long term. In our study, the main reason for not getting influenza, tetanus, hepatitis A and hepatitis B vaccines was that the participants did not consider the vaccines necessary. In the case of MMR and varicella vaccines, the majority of individuals did not get vaccinated because they had the disease. The fact that the working group consisting of healthcare workers does not consider vaccination necessary is quite striking and it is necessary to work on initiatives to increase vaccination.

There are some limitations to our study. The high number of questions on the survey form used in the research caused missing data, especially in the last sections. For some questions regarding the past, the recall factor should be taken into consideration.

Conclusion

Healthcare workers have a higher risk of contracting infectious diseases than the general population due to their working environment. This poses a risk to patients, their family members, community contacts and other healthcare professionals. The emergence of vaccine-preventable infectious diseases in healthcare workers can cause both medical consequences and direct or indirect costs. Healthcare professionals also have a positive impact on patient behavior and are seen as role models. For all these reasons, immunization of healthcare workers is very important. Training and awareness activities for healthcare workers may increase vaccination rates. The content of the interventions should be different for each vaccine and should take account of the characteristics of the professional groups. A vaccination program that covers all personnel should be created in institutions to increase the vaccination rates for healthcare workers. Within the scope of this program, the current immunity status of healthcare personnel should be determined, and susceptible healthcare workers should be vaccinated. In addition, all healthcare professionals should be informed about the vaccination unit and program in their institution.

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Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Ethical Approval
The study was conducted in line with the principles of the Helsinki Declaration. Suleyman Demirel University Faculty of Medicine Clinical Research Ethics Committee, Date: 06.02.2020, No:12. Permission to Conduct Surveys: Suleyman Demirel University Research and Training Hospital, Date: 02.01.2020, No:26515734-605.99-E.

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Data available on request from the authors.

Authors Contributions
HK: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Validation; Visualization; Writing-original draft.

ÖÖ: Conceptualization; Formal analysis; Investigation; Methodology; Supervision; Validation; Writing-review & editing.

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