



# Influenza vaccination among infection control teams: A EUCIC survey prior to COVID-19 pandemic

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## ABSTRACT

We aimed to describe the influenza vaccination rate and its determinants among infection control team (ICT) across different countries. Online multilingual survey consisting of 23 items, between 17 May – 15 July of 2019 targeting the opinions and practices of ICTs regarding the 2018–2019 influenza season was employed. Participants were reached via European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and European Union Certificate for Infection Control (EUCIC) newsletters, social media, and national societies. In total, 899 participants from 56 countries responded to the survey. The overall vaccination rate was 76%, being the highest in Finland, Portugal, Norway, and Israel (100%), whereas the lowest in Italy (68%) and Turkey (39%). Influenza vaccination rate was 86% among IC physicians and 52% among IC nurses. The most significant factors affecting participants' decision were personal influenza vaccine experience (49%) and attitude of the scientific authorities (48%). In multivariate analysis, vaccination of the ICT head (OR: 16.04, 95%CI: 8.4–30.8,  $p < 0.001$ ) and having free vaccine (OR: 7.56, 95%CI: 2.1–27.4,  $p = 0.02$ ) were found to be the strongest predictors for influenza vaccination, whereas working in Turkey (OR: 0.41, 95%CI: 0.22–0.77,  $p = 0.006$ ) and being an IC nurse (OR: 0.43, 95%CI: 0.24–0.80,  $p = 0.007$ ) were significantly associated with not having been vaccinated. In conclusion, COVID-19 pandemic increased the importance of protection against respiratory viruses including influenza. Vaccination strategies should have a special emphasis on IC nurses, who have a relatively lower vaccination rate, should enhance the vaccination of the ICT leaders, and put effort to provide free availability of the influenza vaccine.

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## 1. Introduction

Influenza is an acute viral infection with a clinical range from mild to severe disease, including complications such as bronchitis, pneumonia, and death, particularly among patients with risk factors [1]. According to a recent modeling study using data between

1999 and 2015, it is estimated that 290,000 to 650,000 influenza-associated deaths occur annually [2].

The risk of exposure to influenza has been increasing in healthcare professionals (HCPs). Up to an estimated 20% of HCPs report influenza-like illnesses in a given influenza season [3,4] and up to 41% of HCPs continue to work while infected, which may result in healthcare-associated influenza epidemics [5]. Moreover, several cases of influenza may be asymptomatic or HCPs may work while infectious but not diagnosed. Influenza vaccination is an effective intervention to prevent influenza among HCPs [6]. It is important to succeed high influenza vaccination rate among HCPs to prevent spread to the patients.

Varying rates of annual influenza vaccination of healthcare professionals (HCPs) are observed, depending on local policies, as well as HCP knowledge and perceptions. One of the tasks of the hospital infection control team (ICT) is to ensure that HCPs are vaccinated

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for influenza. We aimed to examine the opinions of ICT about influenza vaccination and related factors affecting their perceptions across different countries.

## 2. Methods

### 2.1. Study participants

Infection control team (ICT) members were eligible to participate. ICT members, who consist of infection physician(s) and infection control nurse(s), are the main motivators of influenza vaccination among HCPs.

### 2.2. Survey development

A collaborative survey was developed by European Committee on Infection Control (EUCIC) members. A multilingual (translated in English, German, Turkish, French, Croatian, Dutch, Greek, Italian, Romanian, Spanish, Russian) and multinational survey was performed online using Umfrageonline (enuvo GmbH) between May 17, 2019 and July 15, 2019 targeting the opinions and practices of ICTs regarding the 2018–2019 influenza season. Multiple methods were employed to invite participation, including European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and EUCIC newsletters, social media, national societies, and national scientific associations.

A structured self-administered online survey was developed with a focus on ascertaining influenza vaccination history, influ-

enza risk factors, predictors of vaccination and their attitudes towards the influenza vaccine. Vaccine uptake was assessed through questions pertaining to the number of influenza vaccinations in the last 5 years and vaccination status in the 2018–2019 season. The online survey consisted of 23 items covering potential factors that may have influenced participants' decision to receive or refuse the vaccine, influenza vaccination history, influenza risk factors, predictors of vaccination, and their attitudes towards the influenza vaccine was employed. A pilot test was performed with 10 individuals. Participation was anonymous, voluntary and without compensation. Consent to complete the survey was declared on the first page of the questionnaire.

The survey methodology was in accordance to the *Clinical Microbiology and Infection* journal guidance for surveys which is composed of a checklist including five subheadings and 35 items for standardization of the surveys. [7].

### 2.3. Data analysis

Descriptive statistics were used for qualitative and quantitative parameters. Data were presented as counts (%) for categorical variables. Potential associations of knowledge, attitudes and perceptions with participants' gender, level of education and urbanization were assessed using the Chi-square test or Fisher's exact test. Multivariate analysis was performed for prediction of influenza vaccination. Independent variables were selected from the significant variables in univariate analyses those were presented in [Tables 1](#) and [2](#). If necessary, a variable was included in

**Table 1**  
Demographic features based on vaccination status.

	Unvaccinated n = 213	Vaccinated n = 675	Total n = 888	P
Mean age (sd)	41(9)	45 (11)		<0.001
Age groups				
21–30	24 (27)	64 (73)	88	
31–40	90 (32)	190 (68)	280	
41–50	63 (25)	192 (75)	255	
51–60	31 (16)	160 (84)	191	
>60	5 (7)	69 (93)	74	
Age > 50	40 (14)	251 (86)		<0.001
Gender				<0.001
Female	171 (29)	427 (71)		
Male	42 (15)	247 (85)		
Occupation				
Physician	86 (14)	525 (86)		<0.001
Nurse	112 (48)	120 (52)		<0.001
Others	15 (33)	30 (67)		
Hospital types				
State University Hospital	47 (17)	232 (83)		
State Research and Training Hospital	39 (29)	97 (71)		
Private University Hospital	3 (7)	41 (93)		0.006
State Hospital	84 (33)	168 (67)		<0.001
Private Hospital	22 (24)	69 (76)		
Chronic disease	22 (10.3)	46 (6.9)		0.1
Country				
Turkey	108 (61)	70 (39)	178	
Romania	15 (15)	84 (85)	99	
Spain	8 (8)	87 (92)	95	
Italy	26 (32)	54 (68)	80	
France	7 (10)	66 (90)	73	
Austria	6 (16)	31 (84)	37	
Netherlands	4 (12)	30 (88)	34	
Germany	3 (9)	29 (91)	32	
United Kingdom	6 (19)	25 (81)	31	
Greece	2 (7)	28 (93)	30	
Switzerland	1 (6)	17 (94)	18	
Finland	0 (0)	17 (100)	17	
Slovenia	1 (7)	14 (93)	15	
Portugal	0 (0)	14 (100)	14	
Norway	0 (0)	12 (100)	12	
Israel	0 (0)	12 (100)	12	
Other countries	25 (23)	82 (77)	107	

**Table 2**

Factors affecting vaccination status of Infection Control Team.

	Unvaccinated n = 213	Vaccinated n = 675	Total n = 888	p
Opinion about efficacy of influenza vaccine (%)				
<21	32 (80)	8 (20)	40	
21–40	33 (39)	51 (61)	84	
41–60	63 (21)	231 (79)	88	
61–80	65 (20)	252 (80)	280	
>80	20 (13)	132 (87)	255	
Vaccination status of head of infection control committee				<0.001
Unvaccinated	69 (57)	52 (43)	121	
Vaccinated	20 (4)	492 (96)	512	
Price of the influenza vaccine for HCPs				<0.001
Free or discount	185 (22)	652 (78)	837	
Paid	28 (60)	19 (40)	47	

HCP: Healthcare professional.

multivariate analysis to eliminate the confounding although it was not statistically significant. Collinear variables were avoided. The selected independent variables included in the logistic regression model were gender, age > 50 years, working in Turkey, being IC nurse, working in state hospital, having a chronic disease, vaccination of head of ICT, having free influenza vaccine. Statistical significance was set at significance level of 5%. Data were processed and analyzed using STATA 16v (Texas, USA).

### 3. Results

In total, 899 participants from 56 countries from all continents completed the survey. The mean age was 44.2 years (10.76 SD, range: 21–80 years), and 67.6% (n = 607) were female. The majority of the participants were physicians (69%), followed by nurses (26%). Most (281 out of 883) survey respondents reported to work in a state university hospital, 252 in a state hospital, 136 in a state research and training hospital, and 91 in a private hospital (Table 1).

Vaccination status in 2018–2019 season was available among 888 participants. Overall reported vaccination rate was 76%, with highest rates in Finland, Portugal, Norway and Israel (100%), and lowest rates in Italy (68%) and Turkey (39%). Influenza vaccination rate was 86% among physicians and 52% among IC nurses; 93% among the HCPs working in private university hospitals, whereas 67% among the HCPs working in state hospitals. The highest vaccination rate (93%) was reported in survey respondents in the age group of over 60 years (Table 1).

The vaccination rate of participants was 20% among the individuals who believed that the efficacy of influenza vaccine is lower than 21%, while it was 87% among the survey respondents who believed that the efficacy is >80%. The reported vaccination rate was 96% among participants whose head of infection control

committee (ICT) was vaccinated and 43% among the survey respondents whose head of ICT was not vaccinated ( $p < 0.001$ ). The vaccination rate was 78% among participants from hospitals where the vaccine is administered free or discounted, while it was 40% if the vaccine was not free or discounted ( $p < 0.001$ , Table 2).

Personal influenza vaccine experience (49%) and scientific authorities (48%) were the most significant factors that affected participants' vaccination decision. Regarding the 2018–19 season, self-protection (84%) and protecting patients (74%) were the most common motivators for vaccination, whereas not being in a high-risk group (32%) and inconvenience (25%) were the most common reasons for not having been vaccinated (Table 3).

In multivariate analysis; working in Turkey (OR: 0.41, 95% CI: 0.22–0.77,  $p = 0.006$ ) and being an IC nurse (OR: 0.43, 95% CI: 0.24–0.80,  $p = 0.007$ ) were significantly associated with not having been vaccinated, whereas vaccination of head of ICT (OR: 16.04, 95% CI: 8.4–30.8,  $p < 0.001$ ) and having free vaccine (OR: 7.56, 95% CI: 2.1–27.4,  $p = 0.02$ ) were the strongest predictors of having been vaccinated for influenza during 2018–19 (Table 4). The sensitivity analysis for multivariate analysis was done by calculation of area under receiver operating curve (ROC), and it was 85%. The  $p$  value for the model by chi square was  $< 0.001$ , and  $R^2$  was 0.37.

### 4. Discussion

Increasing the influenza vaccination rate became more significant at the time of pandemic, and enhancing the awareness of the ICT members is a critical step. Influenza vaccination rate among HCPs in European region countries varies and in many countries may be even <50% [8]. One of the tasks of hospital ICT is to motivate and ensure high vaccination rates of HCPs for influenza. Our survey targeted the group that is primarily responsible for HCP vaccination and therefore aimed to examine the

**Table 3**

Leading reasons for vaccination or not in 2018–19 season.

Leading reasons for vaccination n = 675 (%)	Leading reasons for not being vaccinated n = 213 (%)
To protect myself	Don't belong in a risk group
564 (84)	68 (32)
To protect patients	Do not believe efficacy of vaccine
502 (74)	53 (25)
I believe efficacy of vaccine	To have influenza is better than vaccination
465 (69)	34 (16)
To protect my family and friends	I had influenza like illness despite vaccination
454 (67)	33 (16)
To be a role model	Different views by press and/or scientific areas
420 (62)	21 (10)
The vaccine is free of charge	Vaccine has serious adverse events
83 (12)	20 (10)
Positive comments of press and scientific authorities	I experienced vaccine related adverse events
38 (6)	20 (10)
Because of chronic disease	I had influenza despite vaccination
23 (3)	16 (8)
Other reasons	Influenza is not fatal
34 (5)	13 (6)
	Being pregnant
	8 (4)
	Being an anti-vaxxer
	4 (2)
	Other reasons
	63 (30)

**Table 4**  
Predictors of influenza vaccination.

	Univariate analysis			Multivariate analysis		
	Odds ratio	95% CI	P	Odds ratio	95% CI	p
Female gender	2.36	1.62–3.42	<0.001	0.61	0.32–1.19	0.147
Age > 50 years	2.56	1.76–3.74	<0.001	1.56	0.83–2.93	0.171
Turkey	0.11	0.08–0.16	<0.001	0.41	0.22 to 0.77	0.006
Infection control nurse	0.2	0.15–0.30	<0.001	0.43	0.24 to 0.80	0.007
Working in state hospital	0.5	0.37–0.7	<0.001	0.76	0.43 to 1.36	0.359
Having chronic disease	0.65	0.38–1.1	0.1	0.91	0.35 to 2.39	0.852
Vaccination of head of ICT	32.6	18.4–57.9	<0.001	16.04	8.36 to 30.78	<0.001
Having free influenza vaccine	3.01	1.8–4.9	<0.001	7.56	2.09 to 27.36	0.02

ICT: Infection control team.

beliefs and practices of ICT about influenza vaccine, as well as related factors across different countries. In this multinational study that was performed in the 2018–2019 season, we detected that the main drivers of influenza vaccination among ICT members was vaccination of the leaders and free of charge availability of the vaccine (Table 4).

The highest level of influenza vaccination (100%) among ICT was detected in Finland, Portugal, Norway, Israel, while lowest rates were detected in Italy (68%) and Turkey (39%) (Table 1). The influenza vaccination rates of HCPs in these countries also differ from one season to another with an annual reported rate of 20% to 30% [8]. In a systematic review from Italy, influenza vaccination rate was 13.5% in nurses, which was lower than other European countries. Influenza vaccination rate was between 15% and 29% in Germany and France [9].

The most significant factors that affected the decision of the ICT members in terms of influenza vaccination were personal influenza vaccine experience, scientific authorities and being member of ICT. The leading motivators of influenza vaccination in the 2018–19 season were self-protection, to protect the patients and family members to believe in the efficacy of vaccine and to be a role model, while not being in a risk group and not to believe in the efficacy of the vaccine, were the major reasons for not being vaccinated. Among the patients who were not vaccinated, 10% reported that they avoided the vaccine because of vaccine-related adverse events, and 2% declared themselves as anti-vaxxer (Table 3). In a study by Bish et al, being a nurse was correlated with a negative intent to influenza vaccination. To protect other people, opinion about vaccine efficacy and safety, and previous influenza vaccinations were predictors of adherence to influenza vaccinations. Older age, male gender, and being a doctor were associated with higher intentions for vaccination [10]. In another study, self-protection in addition to protection of family members were the most common motivators of influenza vaccination among HCPs [9]. Suspicions about vaccine efficacy, possibility of adverse events, being anti-vaxxer were the most common beliefs against vaccination [9]. In another survey, the reported reasons for future vaccinations were self-protection and protection of family. Encouragement by supervisors and vaccination campaigns were the factors that positively influenced vaccination [11]. In our survey, vaccination of role model and free influenza vaccine coverage were motivators of vaccination while, being IC nurse and being in Turkey were the factors that presented negative intention towards influenza vaccination (Table 4).

Our study, the first to assess the perceptions and practices of ICT members regarding influenza vaccination, was multinational and multilingual, yielding a notable sample size. Our major limitation is the possibility of response bias due to use of a self-reporting survey to obtain information about influenza vaccination. Nevertheless, self-reporting is one of the preferred ways to get information retrospectively.

In conclusion, COVID-19 pandemic increased the importance of protection against respiratory viruses including influenza. Vaccination strategies should have a special emphasis on IC nurses, who have a relatively lower vaccination rate, should enhance the vaccination of the ICT leaders, and put effort to provide free availability of the influenza vaccine.

### Author contributions

Study conception: SK, OE. Study design: all authors. Data analysis: SK, OE. Data interpretation: all authors. First draft of manuscript: SK, OE. Critical revision of manuscript and approval of final manuscript: all authors.

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### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2020.11.003>.

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