

Influenza vaccine acceptance by healthcare workers in Saudi Arabia: A questionnaire-based analysis

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SUMMARY

The aim of this study was to gauge the reasons for accepting or declining influenza vaccine in healthcare staff in Saudi Arabia. A questionnaire was administered to healthcare workers in Saudi Arabia. In all, 633 respondents who provided gender, nationality and profession were included. Reasons for vaccine uptake or refusal were assessed according to profession and educational level. Uptake of vaccine was lower in the period from 2010 to 2014 (3-13.3%) compared to pre-2010 figures (20.7%), rising to 44.1% in 2015. Comparing data for 'never having been vaccinated' to 'being vaccinated in 2015', there was no significant difference in distribution between nurses (9.27% v 38.8%), physicians (13.9% v 56.0%)

and laboratory technicians (15.9% v 33.5%) ($p=0.08$). The top reason for vaccination was protection of self and family, while the top reason for refusal was not considering the vaccine to be necessary. Education level had no significant effect on the likelihood of being vaccinated. Improvement of healthcare worker vaccination levels in Saudi Arabia might be achieved by addressing staff concerns on vaccine safety and efficacy, emphasizing the potential dangers of influenza and capitalizing on the staff's focus on protecting themselves and their families.

Keywords: healthcare workers; influenza; Saudi Arabia; flu; vaccine.

INTRODUCTION

Influenza continues to represent a major societal burden that affects hundreds of millions of people, causing extensive morbidity and mor-

tality. Seasonal influenza is an acute, contagious respiratory infection caused by one of three types A, B, and C of seasonal influenza viruses, circulating in all parts of the world [1]. Both A and B types cause outbreaks and epidemics; circulating strains of both are incorporated in seasonal influenza vaccines [1]. Influenza type A viruses are the most common among humans and are the only type known to have caused pandemics. Most recent World Health Organization

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(WHO) data (25 November 2019 to 08 December 2019) show that both influenza A (74.9%) and B (25.1%) viruses are currently circulating [2]. For influenza A 30.2% of subtyped viruses were H1N1 pdm09 and 69.8% were H3N2. For B viruses, 5.2% were B-Yamagata lineage and 94.8% were B-Victoria lineage [2].

Vaccination programs are effective in reducing occurrence of influenza-associated illnesses and deaths, and reducing physician and hospital attendances [3,4]. However, influenza vaccination programs typically suffer from poor adoption rates among at-risk groups [5-10]. One barometer of the effectiveness of influenza vaccination programs is whether hospital staff itself choose to receive vaccinations. Healthcare workers (HCWs) are at significantly higher risk of influenza than adults working in non-healthcare settings. The take-up of influenza vaccination programs amongst hospital staff is below expectations in many countries, including the Kingdom of Saudi Arabia (KSA) [8-13]. A survey of awareness and attitudes of unvaccinated physicians and nurses in Spain, where influenza vaccination is recommended for HCWs, highlighted substantial misconceptions that impeded the successful coverage of the national vaccination program [10]. Reasons for low uptake include uncertainties surrounding the importance, perceived efficacy and safety of the influenza vaccinations, low perceived risk of infection and lack of convenient vaccine access [6,7-13]. Hospital workers represent an important group since unvaccinated health professionals can spread the virus to their patients and on to their families [14,15]. The CDC, WHO and public health directors in many countries recommend that HCWs receive annual influenza vaccine [1-4,11,13].

Where influenza vaccination programs have been considered unsuccessful, various strategies have been instigated. Public Health England (PHE) ran a successful awareness program that increased influenza vaccination by HCWs from 45% to 69% [17]. However, one report showed that vaccination rates in UK HCWs had declined [18]. Another potential approach to increase HCW vaccination rates is mandatory vaccination, with the alternative of mandatory mask wearing [19,20]. KSA Ministry of Health (MOH) guidelines state that annual influenza vaccination is mandatory for HCWs, yet rates of vaccination remain low

[12,21,22]. The quality and message of studies describing the adoption of influenza vaccination programs by HCWs worldwide are variable [23]. We report herein on the attitudes that influenced uptake of influenza vaccination in a range of HCWs in KSA, together with an analysis of their opinions of who should receive this vaccination. Our study is underpinned by focused original research in a large group of HCWs.

■ PATIENTS AND METHODS

Subjects and questionnaires

A specially designed questionnaire was employed to ascertain the views and behavior of staff at Saudi medical facilities regarding previous and current patterns of use of influenza vaccination. The questionnaire was conducted via SurveyMonkey and distributed via email, Facebook, and other social media. The survey took place over a continuous 9 week-period, concluding on 29/01/2016. Responses were anonymous; institutions and names of the respondents were not identified.

Statistics

Collated data was analyzed statistically using SPSS version 10. Chi-square analysis was used in comparisons of distributions of vaccination uptake according to education status, post-vaccination infection according to age and/or gender, and vaccination uptake according to occurrence or not of adverse events. Differences were considered statistically significant at $p \leq 0.05$.

■ RESULTS

Participants' overview

Of the 689 people who responded, information on gender, nationality (Saudi or non-Saudi) and profession was provided by 633 individuals who formed the basis of the study. Profession, nationality (Saudi/non-Saudi) and gender profiles of these 633 participants are shown in Table 1. Figure 1 shows the trend in percentage uptake of influenza vaccine from pre-2010 to 2015 overall across these 633 participants. For years 2010 to 2014, overall uptake of the influenza vaccine (3-13.3%) was lower than pre-2010 figures (20.7%), increasing to 44.1% in 2015. Comparing distribution of "never having been vaccinated" to "be-

Table 1 - Participant characteristics.

Profession	Male		Female	
	Saudi	Non-Saudi	Saudi	Non-Saudi
Physician (n=266)	108	38	106	14
Nurse (n=152)	46	10	82	14
Laboratory staff (n=164)	75	11	67	11
Other* (n=51)	27	4	19	1
Total (n=633)	256	63	274	40

*Group comprised 21 X-ray technicians, 11 physical therapists, 19 medical administrators.

ing vaccinated in 2015", there was no significant difference in distribution between nurses (9.27% v 38.8%), physicians (13.9% v 56.0%) and laboratory technicians (15.9% v 33.5%) [Chi-square statistic = 5.16; $p=0.08$].

Frequently cited reasons for vaccination across professions

Participants who opted to be vaccinated were asked why made this choice. HCWs who received influenza vaccination at any time and who gave reasons were included. Possible influence of nationality and/or gender was considered. The profession, gender and nationality of the participants included in this part of the study are summarized in Table 2, along with the reasons cited for choosing to be vaccinated. For physicians, nurses and laboratory technicians, the most frequently cited reason was "Protection of the participant and

their family" followed by "Following hospital rules & regulations" (Table 2). No significant influence of age, nationality or gender was detected on the reasons given.

Influence of education level on decisions on influenza vaccinations

Education level of participants (high school, graduate or post-graduate) is summarized in Table 3 for those who provided their education level. There was no significant difference in likelihood of having never been vaccinated as opposed to being vaccinated in 2014/2015 with respect to education level (Chi-square statistic=0.36, $p=0.83$). There was no significant difference in vaccination uptake among graduates or postgraduates with respect to profession (Chi-square statistic=4.04, $p=0.26$; Chi-square statistic=3.58, $p=0.17$ respectively).

Figure 1 - Influenza vaccination uptake percentages among healthcare professionals.

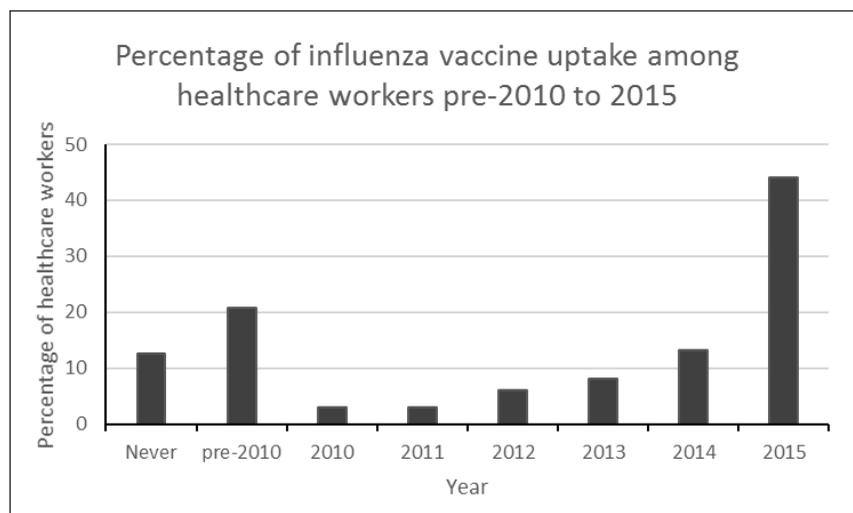


Table 2 - Reasons for acceptance of flu vaccination.

Profession	Reason	Male		Female	
		Saudi	Non-Saudi	Saudi	Non-Saudi
Physician (n=224) p=0.35; Chi square =5.58 (male v female) p=0.98; Chi square =0.82 (Saudi vs non-Saudi)	Following hospital rules & regulations	40 (43.9%)	15 (46.9%)	30 (33.7%)	4 (33.3%)
	Fear of influenza outbreak	26 (28.6%)	7 (21.9%)	25 (28.1%)	6 (50.0%)
	To protect patients	24 (26.4%)	6 (18.8%)	25 (28.1%)	5 (41.7%)
	To protect myself and my family	56 (61.5%)	22 (68.8%)	65 (73.0%)	10 (83.3%)
	Convenient availability in clinic & hospital	23 (25.3%)	5 (15.6%)	16 (18.0%)	4 (33.3%)
	To eliminate and stop any outbreak	25 (27.5%)	9 (28.1%)	15 (16.9%)	4 (33.3%)
Nurse (n=134) p=0.48; Chi square =4.52 (male v female) p=0.52; Chi square =4.24 (Saudi vs non-Saudi)	Following hospital rules & regulations	12 (28.6%)	2 (28.6%)	28 (38.4%)	6 (50.0%)
	Fear of influenza outbreak	9 (21.4%)	1 (14.3%)	13 (17.8%)	2 (16.7%)
	To protect patients	3 (7.1%)	0	11 (15.1%)	7 (58.3%)
	To protect myself and my family	18 (42.9%)	5 (71.4%)	42 (57.5%)	12 (100%)
	Convenient availability in clinic & hospital	3 (7.1%)	1 (14.3%)	8 (11.0%)	3 (25.0%)
	To eliminate and stop any outbreak	6 (14.2%)	0	17 (23.3%)	5 (41.7%)
Laboratory technician (n=132) p=0.70; Chi square =3.02 (male vs female) p=0.55; Chi square =3.98 (Saudi vs non-Saudi)	Following hospital rules & regulations	22 (34.4%)	3 (42.9%)	17 (34.0%)	5 (45.5%)
	Fear of influenza outbreak	14 (21.9%)	4 (57.1%)	12 (24.0%)	0
	To protect patients	8 (12.5%)	2 (28.6%)	1 (2.0%)	2 (18.2%)
	To protect myself and my family	32 (50.0%)	5 (71.4%)	25 (50.0%)	7 (63.6%)
	Convenient availability in clinic & hospital	9 (14.1%)	0	5 (10.0%)	1 (9.1%)
	To eliminate and stop any outbreak	15 (23.4%)	2 (28.6%)	10 (20.0%)	1 (9.1%)

Table 3 - Vaccination uptake according to education level.

Education level*	Profession	Never vaccinated	Vaccinated 2014/2015
High school (n=20)		2 (10.0%)	13 (65.0%)
Graduate (n=341) (p=0.26)**	Physician (94)	18 (19.1%)	54 (57.4%)
	Nurse (105)	8 (7.6%)	60 (57.1%)
	Laboratory (109)	15 (13.8%)	59 (54.1%)
	Other (34)	3 (8.8%)	12 (35.3%)
Postgraduate (n=228) (p=0.17)***	Physician (172)	19 (11.0%)	116 (67.4%)
	Nurse (29)	4 (13.7%)	10 (34.5%)
	Laboratory (47)	8 (17.0%)	24 (51.1%)
	Other (10)	3 (33.3%)	4 (40.0%)

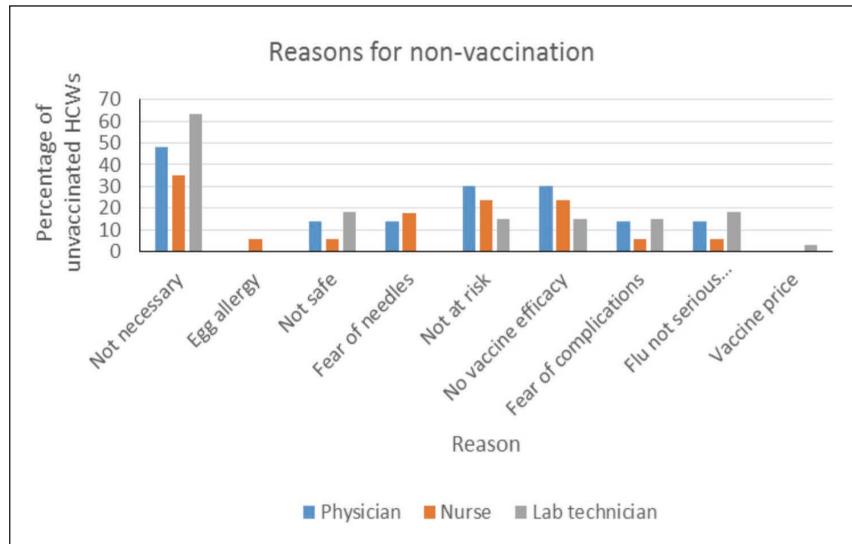
*No significant difference in vaccination uptake with respect to education level (Chi-square statistic =0.36, p=0.83; no significant difference in vaccination uptake among graduates** or postgraduates*** with respect to profession (Chi-square statistic =4.04, p=0.26; Chi-square statistic =3.58, p=0.17 respectively).

Reasons for declining vaccination

199 participants stated they were not convinced influenza vaccinations were necessary. Of these, 48 (24.1%) stated they “never took it”. However, 53 (26.6%) chose to be vaccinated in 2015, and 68 (34.2%) were either vaccinated in 2014 and/or 2015. Of the 69 healthcare workers who stated that influenza vaccines are “not safe”, surpris-

ingly only thirteen (18.8%) reported never taking the vaccine. Sixteen (23.2%) received the vaccine in 2015, and 24/69 (34.8%) either in 2014 or 2015. Of these 24, twelve (50.0%) took it in order “To protect themselves and their families”. 66 participants expressed “fear of complications” related to receiving influenza vaccinations. Thirteen of these 66 (19.7%) had never been vaccinated, while

Figure 2 - Reasons for non-vaccination among healthcare professionals.



a further twenty (30.3%) had not been vaccinated since before 2010. 76 participants did not feel that influenza is a serious problem. Of these, fourteen (18.4%) had never been vaccinated, while another 23 (30.3%) had not been vaccinated since before 2010.

Sub-analysis of participants who had chosen not to be vaccinated

Responses of physicians (n=43), nurses (n=17) and laboratory technicians (n=33) who either stated that they had never been given an influenza vaccination or did not cite any year when they had received a vaccination were further considered (Figure 2). The top reason chosen by all three groups was that they did not consider the vaccine to be necessary. The second highest reason for both physicians and nurses was that they did not consider the vaccine to be efficacious, while for laboratory technicians the second highest reason was that they did not consider that they were at risk (Figure 2).

■ DISCUSSION

In the context of current understanding of ways to increase annual influenza vaccination acceptance rates amongst HCWs, our study was designed to consider factors that influence HCW decisions on whether to receive influenza vaccination. We found that “Protection of the participant and their

family” was the single most highly cited reason why HCWs chose to be vaccinated, while the main reason for declining was that they did not consider the vaccine to be necessary.

Uptake was low in the years following 2010. The 2009 H1N1 influenza pandemic is likely to have encouraged uptake in 2010, declining after the pandemic ended and awareness declined. A trend towards increased overall uptake of 44.1% by 2015 was broadly consistent with observations of increased uptake in other recent Saudi Arabia studies. For example, uptake of 67.6% was reported in eight major hospitals in the 2016 season, while 55% was reported among nurses and physicians in Arar City in the 2018 season [24,25]. However, the uptake fell far short of the reported 88.3% of participants in King Abdullah Medical City in Makkah during the 2014/2015 season [26].

Take-up of influenza vaccination programs amongst hospital staff can be poor when adequate measures to encourage vaccination are not implemented. On balance there is evidence to suggest that patient safety can be enhanced by HCW vaccination [27]. It has been conservatively estimated that staff vaccination would prevent approximately 2.5 influenza cases per 100 HCWs and save approximately four working days per vaccinated HCW [18]. Vaccination of staff also directly influences the number of patients who also choose to be vaccinated [28]. Consistent with

our observations, previous studies suggest that HCWs tend to be more motivated by protection of self and family than by other considerations such as patient safety, and that they may decline vaccination for a variety of reasons, including adverse reactions, being unconcerned about influenza, not perceiving that they are at risk, inconvenient provision arrangements and not being convinced about vaccine efficacy [11].

The results of the questionnaire in the current study are in the KSA national context, where the MOH Infection Prevention and Control Guidelines dictate that it is mandatory for HCWs to have annual influenza vaccinations in line with ACIP recommendations and HCWs are defined as a high-risk group [22,29-31]. The topic of the relative benefits of mandatory versus non-mandatory programs for HCWs remains a subject of worldwide debate [32]. Several mandatory immunization programs have been established and achieved increased HCW vaccine uptake to 90%, as well as improved cost effectiveness and reduced illness-related staff absenteeism [18,19,23,33,34]. However, these programs required a multidisciplinary approach, and were challenging to implement.

Despite the requirement for mandatory vaccination, the choice of voluntary vaccination in our study was 50%-60% for physicians, lower than uptake levels in some centers not using mandatory policies in other countries, such as 83% and 77% recently reported in Korea and the USA respectively [35,36]. Thus, while mandatory systems are often effective, there are apparently issues with the enforcement and uptake of the mandatory requirements in KSA and potentially effective alternatives should not be disregarded [37,38]. Consistent with findings from Canada and Europe, as well as HCWs in other studies in Saudi Arabia, we found that "protection of the participant and their family" was the dominant reason why physicians, nurses and laboratory technicians chose to have their influenza vaccination [26,39,40]. "Following hospital rules and regulations" was the second most highly cited reason. This suggests that, if the mandatory vaccination requirement was more robustly and consistently emphasized in hospital regulations, it might improve uptake levels.

In some studies, low influenza vaccination uptake levels were influenced by uncertainty about the importance of the vaccine, perceived vaccine efficacy and safety, fear of side-effects, low perceived

risk of infection and lack of convenient vaccine access [6,7-13,41]. In our study, the top-cited reason for declining vaccination was a misguided view that it is not necessary. Information campaigns convincing HCWs on the necessity of the vaccine may therefore have some impact. 76 participants stated that influenza is not a serious problem. This view that influenza is an unimportant and benign disease and false perceptions of severity of influenza symptoms is consistent with studies of HCWs in other countries and in Saudi Arabia, in which a negative impact on update of vaccination has also been observed [24,42,43]. Emphasis on the potentially serious consequences of influenza, particularly on vulnerable groups, may help to remind HCWs of the importance of protection against influenza.

Various possible steps could be considered to improve staff compliance. A quality improvement program aimed at addressing staff concerns surrounding influenza vaccinations has been successfully implemented in a non-mandatory environment in Melbourne [44]. Meanwhile, a multi-pronged web-based multimedia approach has also been successfully implemented in Italy [45]. Addressing vaccine-related knowledge gaps and implementing pro-vaccination workplace policies would also have relevance in the context of our study results [43]. Some UK hospitals have specifically implemented vaccination by peers, educational DVDs, Twitter and Facebook, with tangible success [46].

The current study adds to the understanding of the reasons underpinning why healthcare professionals choose whether to comply with influenza vaccination programs. The study had limitations. The mode of questionnaire administration dictated that we had no information as to the number of institutions the respondents were gathered from. Participants also chose to respond and may therefore be more than averagely motivated individuals and not completely representative of the HCW population as a whole, thus introducing a possible response bias. Nevertheless, our findings should assist in the design and targeting of more effective future vaccination programs in a Saudi Arabia context, for example addressing staff concerns on vaccine safety and efficacy, emphasizing the potential dangers of influenza infection and capitalizing on the staff focus on protection of themselves and their families.

■ REFERENCES

- [1] World Health Organization (WHO). Influenza (Seasonal). Fact sheet November 2018. Available at [https://www.who.int/en/news-room/fact-sheets/detail/influenza-\(seasonal\)](https://www.who.int/en/news-room/fact-sheets/detail/influenza-(seasonal)); 2018 [accessed 06 January 2020]
- [2] World Health Organization (WHO). Influenza Update No. 357. Available at https://www.who.int/influenza/surveillance_monitoring/updates/latest_update_GIP_surveillance/en/; 2019 [accessed 06 January 2020]
- [3] Center for Disease Control and Prevention (CDC). Estimated influenza illnesses and hospitalizations averted by influenza vaccination - United States, 2012-13 influenza season. *MMWR Morb Mortal Wkly Rep.* 2013; 62(49), 997-1000.
- [4] Foppa IM, Cheng P, Reynolds SB, et al. Deaths averted by influenza vaccination in the U.S. during the seasons 2005/06 through 2013/14. *Vaccine.* 2015; 33(26), 3003-9.
- [5] Mayet AY, Al-Shaikh G, Al-Mandeeel H, Alsaleh NA, Hamad AF Knowledge, attitudes, beliefs, and barriers associated with the uptake of influenza vaccine among pregnant women. *Saudi Pharm J.* 2017; 25(1), 76-82.
- [6] Canning HS, Phillips J, Allsup S Health care worker beliefs about influenza vaccine and reasons for non-vaccination--a cross-sectional survey. *J Clin Nurs.* 2005; 14(8), 922-5.
- [7] Kaufman J, Davis J, Krause V Influenza immunisation of doctors at an Australian tertiary hospital: immunisation rate and factors contributing to uptake. *Commun Dis Intell Q Rep.* 2008; 32(4), 443-8.
- [8] Parry HM, Damery S, Fergusson A, et al. Pandemic influenza A (H1N1) 2009 in a critical care and theatre setting: beliefs and attitudes towards staff vaccination. *J Hosp Infect.* 2011; 78(4), 302-7.
- [9] Isaacs A, Chryssanthakis A, Abraham S A cross-sectional audit of the uptake of the seasonal influenza vaccination by medical staff at a London hospital. *Clin Med.* 2013; 13(6), 633
- [10] Domínguez A, Godoy P, Castilla J, et al. Knowledge of and attitudes to influenza in unvaccinated primary care physicians and nurses. *Hum Vaccin Immunother.* 2014; 10(8), 2378-86.
- [11] Department of Health United Kingdom. Seasonal flu vaccination for healthcare workers? *Drug Ther Bull.* 2010; 48(11), 122.
- [12] Rehmani R, Memon JI Knowledge, attitudes and beliefs regarding influenza vaccination among healthcare workers in a Saudi hospital. *Vaccine.* 2010; 28(26), 4283-7.
- [13] Hollmeyer HG, Hayden F, Poland G, Buchholz U Influenza vaccination of health care workers in hospitals--a review of studies on attitudes and predictors. *Vaccine.* 2009; 27(30), 3935-44.
- [14] Dolan GP, Harris RC, Clarkson M, et al. Vaccination of healthcare workers to protect patients at increased risk of acute respiratory disease: summary of a systematic review. *Influenza Other Respir Viruses.* 2013; 7 Suppl 2, 93-6.
- [15] Nutman A, Yoeli N Influenza vaccination motivators among healthcare personnel in a large acute care hospital in Israel. *Isr. J. Health Policy Res.* 2016; 5, 52.
- [16] Thomas RE, Jefferson TO, Demicheli V, Rivetti D Influenza vaccination for health-care workers who work with elderly people in institutions: a systematic review. *Lancet Infect Dis.* 2006; 6(5), 273-9.
- [17] Aziz A Improving influenza vaccine uptake in frontline staff. *Br J Nurs.* 2013; 22(21), 1214-20.
- [18] Kliner M, Keenan A, Sinclair D, Ghebrehewet S, Garner P Influenza vaccination for healthcare workers in the UK: appraisal of systematic reviews and policy options. *BMJ Open.* 2016; 6(9), 1.
- [19] Van Buynder PG, Konrad S, Kersteins F, et al. Healthcare worker influenza immunization vaccinate or mask policy: strategies for cost effective implementation and subsequent reductions in staff absenteeism due to illness. *Vaccine.* 2015; 33(13), 1625-8.
- [20] Leibur R, Maslow J Effectiveness and acceptance of a health care-based mandatory vaccination program. *J Occup Environ Med.* 2015; 57(1), 58-61.
- [21] Alshammari TM, AlFehaid LS, AlFraih JK, Aljadhey HS Health care professionals' awareness of, knowledge about and attitude to influenza vaccination. *Vaccine.* 2014; 32(45), 5957-61.
- [22] Ministry of Health Kingdom of Saudi Arabia. Infection prevention and control guidelines for seasonal influenza in healthcare setting, November 2015. Available at <http://www.moh.gov.sa/en/CCC/StaffRegulations/Influenza/Pages/default.aspx> [accessed 07 September 2017].
- [23] Renschmidt C, Wichmann O, Harder T Methodological quality of systematic reviews on influenza vaccination. *Vaccine.* 2014; 32(15), 1678-84.
- [24] Alshammari TM, Yusuff KB, Aziz MM, Subaie GM Healthcare professionals' knowledge, attitude and acceptance of influenza vaccination in Saudi Arabia: a multicenter cross-sectional study. *BMC Health Serv Res.* 2019; 19(1), 229.
- [25] Alenazi BR, Hammad SM, Mohamed AE Prevalence of seasonal influenza vaccination among primary healthcare workers in Arar city, Saudi Arabia. *Electron Physician.* 2018;10(8), 7217-23.
- [26] Haridi HK, Salman KA, Basaif EA, Al-Skaibi DK Influenza vaccine uptake, determinants, motivators, and barriers of the vaccine receipt among healthcare workers in a tertiary care hospital in Saudi Arabia. *J Hosp Infect.* 2017; 96(3), 268-75.
- [27] Ahmed F, Lindley MC, Allred N, Weinbaum CM, Grohskopf L Effect of influenza vaccination of healthcare personnel on morbidity and mortality among patients: systematic review and grading of evidence. *Clin Infect Dis.* 2013; 58(1), 50-7.

- [28] Godoy P, Castilla J, Mayoral JM, et al. Influenza vaccination of primary healthcare physicians may be associated with vaccination in their patients: a vaccination coverage study. *BMC Fam Pract.* 2015; 16, 44.
- [29] Ministry of Health Kingdom of Saudi Arabia. Influenza-A surveillance 2016, national cumulative report. Data Management Unit, Ministry of Health, Riyadh; 2016.
- [30] Ministry of Health Kingdom of Saudi Arabia. Influenza surveillance in Saudi Arabia, 2017. Available at: <http://www.moh.gov.sa/en/CCC/StaffRegulations/Influenza/Pages/default.aspx> [accessed 23 October 2019]
- [31] Grohskopf LA, Sokolow LZ, Broder KR, et al. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices — United States, 2017–18 Influenza Season. *MMWR Recomm Rep.* 2017; 66(Nos. RR-2), 1-20.
- [32] Haviari S, Bénet T, Saadatian-Elahi M, et al. Vaccination of healthcare workers: a review. *Hum Vaccin Immunother.* 2015; 11(11), 2522-37.
- [33] Karanfil LV, Bahner J, Hovatter J, Thomas WL. Championing patient safety through mandatory influenza vaccination for all healthcare personnel and affiliated physicians. *Infect Control Hosp Epidemiol.* 2011; 32(4), 375-79.
- [34] Perlin JB, Septimus EJ, Cormier SB, et al. Developing a program to increase seasonal influenza vaccination of healthcare workers: lessons from a system of community hospitals. *J Healthc Qual.* 2013; 35(6), 5-15.
- [35] Ko K, Kim S, Kim SH, et al. Knowledge, current status, and barriers toward healthcare worker vaccination among family medicine resident participants in a web-based survey in Korea. *Korean J Fam Med* 2017; 38(1), 21-2.
- [36] Ali Imtiaz M, Budnick LD, Berman AR. Influenza immunization among resident physicians in an urban teaching hospital. *Am J Infect Control.* 2016; 44(4), 491-3.
- [37] Lytras T, Kopsachilis F, Mouratidou E, Papamichail D, Bonovas S. Interventions to increase seasonal influenza vaccine coverage in healthcare workers: a systematic review and meta-regression analysis. *Hum Vaccin Immunother.* 2016; 12(3), 671-81.
- [38] To KW, Lai A, Lee KC, Koh D, Lee SS. Increasing the coverage of influenza vaccination in healthcare workers: review of challenges and solutions. *J Hosp Infect.* 2016; 94(2), 133-42.
- [39] Lehmann BA, Ruitter RA, Wicker S, van Dam D, Kok G. "I don't see an added value for myself": a qualitative study exploring the social cognitive variables associated with influenza vaccination of Belgian, Dutch and German healthcare personnel. *BMC Public Health.* 2014; 14, 407.
- [40] Corace K, Prematunge C, McCarthy A, et al. Predicting influenza vaccination uptake among health care workers: what are the key motivators? *Am J Infect Control.* 2013; 41(8), 679-84.
- [41] Wicker S, Rabenau HF, Doerr HW, Allwinn R. Influenza vaccination compliance among health care workers in a German university hospital. *Infection.* 2009; 37(3), 197-202.
- [42] Lewthwaite P, Champion K, Blackburn B, et al. Healthcare workers' attitude towards influenza vaccination after the 2009 pandemic. *Occup Med.* 2014; 64(5), 348-51.
- [43] Prematunge C, Corace K, McCarthy A, et al. Qualitative motivators and barriers to pandemic vs. seasonal influenza vaccination among healthcare workers: a content analysis. *Vaccine.* 2014; 32(52), 7128-34.
- [44] Heinrich-Morrison K, McLellan S, McGinnes U, et al. An effective strategy for influenza vaccination of healthcare workers in Australia: experience at a large health service without a mandatory policy. *BMC Infect Dis.* 2015; 15, 42.
- [45] Conte A, Quattrin R, Filiputti E, et al. Promotion of flu vaccination among healthcare workers in an Italian academic hospital: an experience with tailored web tools. *Hum Vaccin Immunother.* 2016; 12(10), 2628-33.
- [46] Edelstein M, Pebody R. Can we achieve high uptakes of influenza vaccination of healthcare workers in hospitals? A cross-sectional survey of acute NHS trusts in England. *Epidemiol Infect.* 2014; 142(2), 438-47.