Seasonal influenza vaccine coverage, intention, motivators and barriers among Algerian healthcare workers

Mohamed Lounis[1,2], Djihad Bencherit[2,3], Adda Oudjedi[4]

ABSTRACT

INTRODUCTION The purpose of this study was to evaluate Algerian healthcare professionals' uptake and intentions regarding seasonal flu vaccination and to describe the factors of willingness or rejection.

METHODS Between 28 December 2022 and 29 May 2023, a cross-sectional survey was conducted online using various social networking channels with a particular focus on Algerian healthcare personnel.

RESULTS Overall, the participants demonstrated a high level of correct knowledge about influenza (85.89%), and the nature and benefits of the influenza vaccine (72.7%). However, despite the interesting level of vaccine acceptance (58%), the rate of uptake remains lower than the targeted coverage level. Motivators of vaccine acceptance include the prevention of family (98.5%) or patients (95.5%), while barriers are multiple mainly including the fear of side effects, the effectiveness of the diseases and other beliefs related to the severity of the disease, and the economic benefits of laboratories. Medical staff (OR=2.34; 95% CI: 1.02–5.35) and those who had the COVID-19 vaccine (OR=2.90; 95% CI: 1.29–6.54) were more likely to accept the flu vaccine.

CONCLUSIONS The current study provides data on influenza vaccination intention, uptake, and predictors in Algeria. The results indicated a low level of vaccine uptake while vaccine acceptance was reported by about two-thirds of participants. Within our sample, factors associated with vaccine acceptance mainly included the medical profession and COVID-19 vaccine uptake.

AFFILIATION

1 Department of Agro-Veterinary Sciences, Faculty of Natural and Life Sciences, University of Djelfa, Djelfa, Algeria
2 Laboratoire d'Exploration et Valorisation des Écosystèmes Steppiques, Faculty of Natural and Life Sciences, University of Djelfa, Djelfa, Algeria
3 Department of Biology, Faculty of Natural and Life Sciences, University of Djelfa, Djelfa, Algeria
4 Institute of Science and Techniques of Physical and Sport Activities, University of Oum El Bouaghi, Algeria

CORRESPONDENCE TO

Mohamed Lounis. Department of Agro-Veterinary Sciences, Faculty of Natural and Life Sciences, University of Djelfa, P.O. Box 3117, Djelfa 17000, Algeria.
Email: m.lounis@univ-djelfa.dz

KEYWORDS

influenza, knowledge, attitude, vaccines, Algeria

Received: 21 February 2025
Revised: 3 March 2025
Accepted: 22 March 2025

INTRODUCTION

From mild to severe symptoms and from sporadic cases to a pandemic, seasonal influenza (seasonal flu) affects 5–15% of the worldwide population leading to about 3 to 5 million severe cases requiring hospitalization and about 290000 to 650000 respiratory-related deaths[1-3]. This viral disease caused by influenza viruses occurs mainly during the cold season in the northern and southern hemispheres while it can be recorded at any time of year in tropical regions[2].

Symptoms of flu that begin after an incubation of 1–4 days include typical signs of upper respiratory tract infection (such as cough, a runny nose, and sore throat), and other manifestations like sudden fever, chills, muscle and joint pain, fatigue, and headache that usually last around a week[2-4]. These signs could, however, be life-threatening among high-risk individuals (children, pregnant women, the elderly, persons with chronic diseases, etc.) where pneumonia, sepsis and secondary bacterial infections could be observed in severe cases[2,3]. Viral shedding begins about 24–48 hours prior to the onset of the symptoms and the transmission occurs mainly after sneezing and coughing through direct or indirect contact with infectious droplets in crowded places which contribute significantly to the spreading of the virus[2].

The influenza vaccine, which has been used since 1945 is seen as the safest and the most cost-effective tool to prevent influenza infections and complications[1,5,6]. This vaccine is recommended annually by the World Health Organization (WHO) for high-risk categories including pregnant women, children aged 6 months to 5 years, persons aged >65 years, people with underlying medical disorders, and healthcare professionals[3]. Healthcare workers (HCWs) can also be included in these categories. In fact, in addition to the increased risk of getting influenza at work from both patients and infected colleagues[7], HCWs are also at risk of exposure from the broader community (public transportation, home interactions, etc.)[8]. For these reasons, HCWs are 3.4 times more at risk of developing seasonal flu than the adult population[9] and some estimates show that one in four HCWs could contract the disease in a mild influenza season[10]. Consequently, they constitute a source of infection for patients, coworkers, and family members[11,12]. Thus, by getting vaccinated, HCWs will protect not only themselves from the

Pneumon 2025;38(1):5
https://doi.org/10.18332/pne/203943

infection but also their colleagues, relatives and patients[9]. It has been shown that immunizing HCWs lowers influenza disease by 29%, healthcare visits by 52%, and fatalities from all causes among aged individuals by 55%[1]. In addition, vaccination will indirectly reduce the rate of absenteeism and consequently limit the ensuing disruption of medical services[1,13]. However, despite the above-mentioned benefits of the vaccines and the recommendations of the WHO and the national health authorities, vaccine coverage remains low among HCWs in most countries, especially in low-and-middle income ones[1,5,6,14-23].

Algeria, where about 2 to 7 million persons are affected annually resulting in about 2000 deaths, and where 10% of medical consultations are related to flu-like syndromes (caused mainly by subtypes A(H1N1) and A(H3N2), and B/Victoria lineage influenza viruses), the vaccine [intended to provide protection against four distinct flu viruses, including two influenza A (H1N1 and H3N2) and two influenza B viruses (Victoria and Yamagata)], is provided free of charge to high-risk categories including HCWs[24]. However, no data are available regarding vaccination coverage. Thus, this study was conducted to describe the level of knowledge, attitude, and uptake of seasonal flu vaccine among Algerian HCWs.

METHODS

To assess the knowledge of healthcare workers about seasonal influenza and their uptake and intention towards vaccines, a web-based cross-sectional survey was conducted in Algeria, using a self-administered questionnaire. The survey took place from 28 December 2022 to 29 May 2023, by sharing a Google Forms link on social media platforms targeted at the relevant population that includes mainly Facebook groups and pages dedicated for healthcare workers. All healthcare workers aged ≥18 years, living and working in Algeria were eligible while healthcare students were not allowed to participate in this survey.

The minimum sample size was calculated using the equation:

$$n=Z^2pq/e^2$$

where Z^2=1.96 for α=0.05 (95% CI), p=0.5 (we assume that 50% of the population accepted the flu vaccine), q=1-p, and e is the accepted margin of error chosen to be 10% (e=0.10), giving n=97.

Participation in the study was voluntary, and no financial incentives or compensations were provided. Before any data were collected, each participant gave informed consent online. According to the Declaration of Helsinki Ethical Principles, participants could discontinue the survey at any moment, and those who refused consent were not permitted to continue with the study. Participants' identities were kept anonymous, while the Scientific Committee of the Faculty of Natural and Life Sciences, University of Djelfa signed the approved protocol.

The self-administered questionnaire (see Supplementary file for English version) was prepared in both Arabic and French after reviewing previous literature related to seasonal influenza attitudes and knowledge in different countries[7,9-11,15,17,25]. It included 23 multiple-choice items divided into three sections: sociodemographic, professional, and health characteristics (e.g. sex, age, experience, chronic diseases), knowledge level about seasonal influenza (with 10 yes/no knowledge items), and its vaccine (7 yes/no/ I don't know items), and attitudes towards seasonal influenza vaccines.

Table 1. Sociodemographic and health characteristics of the study population

Characteristics	Categories	n	%
Age (years)	18–30	45	40.18
	31–40	38	33.93
	>40	29	25.89
Sex	Female	70	62.50
	Male	42	37.50
Marital status	Married	58	51.79
	Single	54	48.21
Profession	Medical (physicians, dentists, etc.)	63	56.25
	Paramedics (nurses, etc.)	49	43.75
Experience (years)	<5	60	53.57
	6–10	15	13.39
	11–20	15	13.39
	>20	22	19.64
Sector	Private	13	11.61
	Public	99	88.39
Place of work	Commune	26	23.21
	Daïra	38	33.93
	Department	48	42.86
Allergy	Yes	49	43.75
Smokers	Yes	11	9.82
COVID-19 infection	Yes	95	84.82
COVID-19 vaccination	Yes	59	52.68
Chronic diseases	Yes	26	23.21
Types	Hypertension	10	8.93
	Diabetes	7	6.25
	COPD	5	4.46
	Other	11	9.82

Statistical analysis

Data were extracted from the Excel sheet and analyzed using SPSS version 22.0 (SPSS Inc. Chicago, IL, USA, 2011). They were first presented as frequencies (n) and percentages (%). Chi-squared (χ^2) and Fisher tests were used to assess the association between dependent and independent variables to assess the relation between seasonal influenza vaccine acceptance and the sociodemographic characteristics. Factors with a $p \leq 0.10$ in the univariate analysis were included in the logistic regression model to confirm their association with seasonal influenza vaccine acceptance. All statistical analyses were performed with a 95% confidence level (CI) and a level of significance of $p<0.05$.

RESULTS

Sociodemographics

A total of 122 healthcare workers completed the questionnaire, after excluding those who did not meet the inclusion criteria, 112 individuals made up the final sample with a distribution of 56.3% and 43.7% of medical and paramedical staff, respectively. The sample was predominately female (62.5%) with a slightly higher percentage of married individuals (51.8%). Most participants were aged 18–30 years, followed by those in the 31–40 years age group. More than half of the participants had <5 years of experience (53.6%), the majority worked in the public sector (88.4%), and were evenly distributed across different work locations, with the Department being the most common place of work (42.9%).

In terms of health status, nearly a quarter of participants (23.2%) had chronic diseases with hypertension and diabetes being the most common diseases. In addition, a significant portion of participants (43.8%) reported having allergies, while 9.8% were smokers.

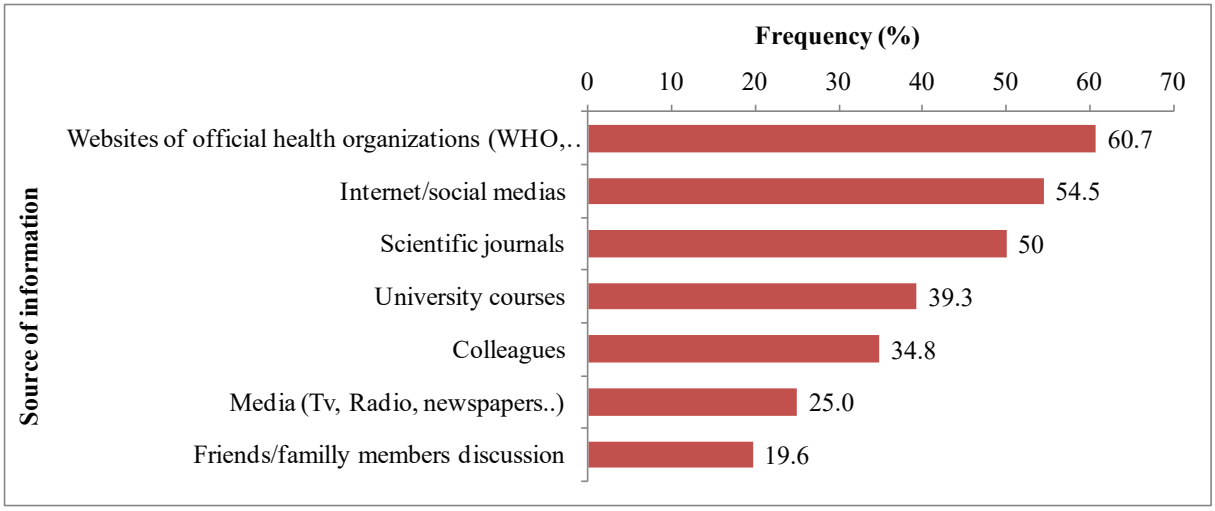
Regarding COVID-19 status, the majority of participants (84.8%) reported being infected, while slightly over half of

Table 2. Knowledge of the study population about seasonal influenza (SI) and its vaccine

Item	Correct	%	Incorrect	%
Seasonal influenza knowledge				
Influenza causes mild symptoms only; therefore, it cannot be considered a serious disease	67	59.82	45	40.18
Influenza can cause severe illness or death	88	78.57	24	21.43
Influenza can be transmitted through droplets and aerosols from coughing or sneezing	106	94.64	6	5.36
Influenza can be transmitted via blood and body fluids	92	82.14	20	17.86
People may spread influenza even without symptoms	87	77.68	25	22.32
Influenza may be spread by touching one's mouth or nose with contaminated hands	100	89.29	12	10.71
People may contract influenza even if they have previously contracted influenza	108	96.43	4	3.57
Mask wearing can limit the spread of influenza	104	92.86	8	7.14
HCWs can transmit seasonal influenza to their patients	105	93.75	7	6.25
HCWs are at high risk of contracting seasonal flu	105	93.75	7	6.25
Mean		85.89		14.11
Knowledge about SI vaccine				
The influenza vaccine is effective at preventing influenza	72	64.29	40	35.71
The influenza vaccine is composed of inactivated viruses	85	75.89	27	24.11
The influenza vaccine reduces the risk of hospitalization and death	96	85.71	16	14.29
The vaccine may decrease the days of illness from influenza	81	72.32	31	27.68
The influenza vaccine causes flu-like symptoms	74	66.07	38	33.93
Influenza vaccination reduces absenteeism from work	82	73.21	30	26.79
Vaccinating healthcare workers against influenza helps to protect patients from severe illness or death	80	71.43	32	28.57
Mean		72.70		27.30

HCWs: healthcare workers.

Figure 1. Source of information regarding seasonal influenza vaccine of the study population



the participants reported having received the COVID-19 vaccine (52.7%) (Table 1).

Knowledge about seasonal influenza and seasonal influenza vaccine

Overall, participants demonstrated a high level of correct knowledge about influenza, with an average of 85.89% correct responses across all items. Specifically, knowledge levels were >89% in 6 out of 10 items, and >77% in 9 out of 10 items. The lowest correct response rate was 59.82% for the item: 'Influenza causes mild symptoms only; therefore, it cannot be considered a serious disease'.

Regarding the vaccine, participants showed a good understanding of the nature and benefits of the influenza vaccine, with an average of 72.7% agreeing with the statements. Correct response rates varied from 64.3% for the item 'The influenza vaccine is effective at preventing influenza' to 85.7% for the item 'The influenza vaccine reduces the risk of hospitalization and death' (Table 2).

The most trusted sources (60.7%) of vaccine information were official health organization websites (WHO, MOH), followed by the internet and social media (54.5%), and scientific journals (50%). Traditional media (25%) and personal discussions (19.6%) were less relied upon (Figure 1).

Attitude toward seasonal influenza vaccine

Results revealed that 26.8% of the participants had the seasonal influenza vaccine before the COVID-19 pandemic, 17% had it during the pandemic, and 24.1% in 2022–2023. Nearly half of participants (48.2%) stated that COVID-19 had not changed their attitude toward the influenza vaccine, while 39.3% and 12.5% said their attitude had changed in favor or against the vaccine, respectively.

Regarding their attitude, 58.9% of participants were in

Table 3. Attitude of the study population toward seasonal influenza vaccine

Item	Response	n	%
Have you had the vaccine before the COVID-19 pandemic?	Yes	30	26.8
	No	82	73.2
Have you had the vaccine during the COVID-19 pandemic?	Yes	19	17.0
	No	93	83.0
Have you had the vaccine during this year?	Yes	27	24.1
	No	85	75.9
Has your attitude toward the vaccine changed due to the COVID-19?	Yes (for vaccination)	44	39.3
	Yes (against vaccination)	14	12.5
	No	54	48.2
Are you for or against seasonal flu vaccination?	For vaccination	66	58.9
	Against vaccination	9	8.0
	Neutral	37	33.0
Reasons for acceptance			
To protect my family		65	98.5
Because seasonal flu could be a serious disease		63	95.5
To protect my patients		63	95.5
To protect my self		58	87.9
Because the vaccine is recommended by Health authorities/WHO		56	84.8
Because the vaccine is effective		55	83.3
Because the vaccine is safe		53	80.3

Continued

Table 3. Continued

Item	Response	n	%
Because the vaccine is free of cost		35	53.0
Reasons for rejection			
I am concerned about possible adverse events from the vaccine		9	100
The vaccine is not effective in preventing the flu		8	88.9
Flu is not a serious illness		8	88.9
Vaccines are primarily an economic business of pharmaceutical companies		8	88.9
By following healthy lifestyles, I can avoid diseases without needing to get vaccinated		8	88.9
I have little chance of contracting the disease		7	77.8
I have a healthy body		6	66.7
The vaccine is more dangerous than the virus itself		6	66.7
If I contract the disease, the consequences will not worry me		5	55.6
Recommendations			
We need more information on the composition of the vaccine and its side effects		33	29.5
Vaccination of people at risk against influenza should be compulsory in Algeria		25	22.3
Vaccination of health personnel against influenza should be compulsory in Algeria		6	5.4
Programming awareness campaigns about the influenza vaccine		42	37.5
You recommend the vaccine for your family members/friends		6	5.4

favor of vaccination, 33% were hesitant and 9% were against the vaccine (Table 3). The main reasons for acceptance were: to protect family (98.5%) or patients (95.5%), and because the disease could be severe (95.5%), while the reason for rejection were related to fear of side effects (100%), and effectiveness of the vaccine (88.9%), and other beliefs related to the severity of the disease (88.9%) and the profit motive of pharmaceutical laboratories (88.9%) (Figure 2).

When asked about their recommendations regarding the seasonal influenza vaccine, respondents mostly mentioned the need for intensified awareness campaigns (37.5%) and providing information about the vaccine content (29.5%). Additionally, 22.3% believed that vaccination of people at risk against influenza should be mandatory while only 5.4% agreed that vaccination of HCWs against influenza should be compulsory in Algeria.

Regarding factors associated with vaccine acceptance, logistic regression results showed that medical staff were more favorable than paramedics (OR=2.34; 95% CI: 1.02–5.35). Furthermore, respondents who worked in Daïras (sub-prefectures) showed more willingness than those working in the Commune (municipality) (OR=3.12; 95% CI: 1.04–9.42). Lastly, having had the COVID-19 vaccine increases the odds of seasonal influenza vaccine acceptance (OR=2.90; 95% CI: 1.29–6.54) (Table 4).

DISCUSSION

Although not well documented, influenza constitutes a real public health threat in Algeria[26], which has pushed the national health authorities to install a sentinel surveillance network *Groupe Régional d'Observation de la Grippe* (GROG) since 2006 in order to monitor influenza-like illnesses and identify circulating viruses to adapt health measures[26,27].

One of the measures adopted by this network is the establishment of annual vaccination before and during the flu season (mainly between October and March)[26,27]. The vaccine which is provided freely is recommended for high-risk persons including HCWs, with a target vaccination coverage of 35%[26,28]. However, despite social mobilization through

Table 4. Factors associated with seasonal influenza vaccine acceptance of the study population

Variable	Categories	B	SD	Wald	p	OR	95% CI	
							Lower	Upper
Profession (p=0.059)	Medical	0.850	0.422	4.068	**0.044**	2.341	1.024	5.348
	Paramedics							
Place of work (p=0.049)	Daïra	1.139	0.563	4.085	**0.043**	3.122	1.035	9.418
	Department	0.881	0.528	2.784	0.095	2.414	0.857	6.797
	Commune							
COVID-19 vaccine (p=0.005)	Yes	1.065	0.414	6.632	**0.010**	2.899	1.29	6.536
	No							

traditional and social media[28], some barriers such as the lack of communication outside the flu season, and the fear of side effects, have limited the uptake of the vaccine among HCWs[27,29]. The rate of vaccination coverage, the willingness and the barriers of rejection have not been studied to our knowledge. Thus, this study has been conducted to evaluate these issues.

Overall, HCWs in our study who were mainly connected to MOH and WHO recommendations (60%), were well-documented regarding seasonal flu and its vaccination with levels of correct responses of 85.9% and 72.9%, respectively. These rates are higher than those reported among Jordanian HCWs[11]. However, despite these rates of knowledge, the levels of vaccine uptake were low. In fact, 26.8%, 17%, and 24.1% were vaccinated before, during the COVID-19 pandemic and during the 2022–2023 season, respectively. These rates are far lower than the reported rate of uptake in Jordan (62.8%) during the 2021–2022 season[11]. The small decline observed during the COVID-19 period is not surprising due to its drastic consequence on one's behavior and the introduction of COVID-19 vaccination resulted generally in the avoidance of the flu vaccine[10,30]. Other findings show an increase in vaccine uptake during this period[15,17,31-34], where the fear of contracting the two diseases (flu and COVID-19) was the main reason for vaccination[17]. The encouraging finding of our study is, however, the increase of vaccine uptake during the 2022–2023 season, an expected result as COVID-19 served as a motivator for adopting good public health behaviors[10]. In this way, 39.3% of the participants reported that COVID-19 has positively changed their attitude toward the influenza vaccine. Similar observations were also reported among the general population[35] and healthcare workers in Italy[36] and in Ireland[37]. In addition, 70.97% of HCWs and 81.82% of resident doctors in Italy perceived that flu vaccination would be more important during the first vaccination season after the emergence of COVID-19[31].

Another interesting finding is that 58.9% of the participants were in favor of vaccination despite their uptake status. However, this rate remains lower than the rates of willingness reported in Southern Italy (68%)[25], in China (74.89%)[14], and in Saudi Arabia (79%)[30], but slightly higher than the rate reported in Poland (54%)[38].

In agreement with previous studies, vaccination motivators of the participants include protection of themselves, their families, and their patients[6,17,23], while the most cited barriers include the fear of side effects and the effectiveness of the vaccine[6,9,13,19,22,23,37]. Another barrier that was particularly cited in low- and middle-income countries include the cost of the vaccine and its availability[6,11,19,21]. Furthermore, free access to vaccination was the strongest motivator of vaccine acceptance among HCWs in Poland[38]. These findings suggest the need to ensure the availability of the vaccine and recommendation to be supplied free to high-risk categories including HCWs.

Regarding flu vaccine acceptance predictors, there were two interesting observations: the increased odds of acceptance among medical staff when compared to paramedics and the effect of COVID-19 vaccine uptake on seasonal influenza vaccine acceptance. The same observation was reported in different countries where physicians were more likely to accept the vaccine than nurses[7,10-12,17,25,31,38,39]. The opposite results were seen in Saudi Arabia where nurses were more likely to be vaccinated during the 2020–2021 season (AOR=2.70), and to declare their intention to be vaccinated in the subsequent year (AOR=2.94)[30]. The authors related these results, however, to the low number of physicians in the studied sample. Lastly, the positive effect of vaccine acceptance on seasonal flu vaccine intention has been previously documented by Di Giuseppe et al. in Italy[25].

Limitations

The results of this study are to be considered in light of some limitations related mainly to the sample size and the sampling approach. The low number of respondents in this study may impact the generalizability of the results, while the online sampling strategy and convenience sample may introduce some selection biases by skipping some groups including older individuals and those lacking an internet connection. Another limitation is related to the self-assessment of vaccine uptake and intention, which may result in social desirability bias.

CONCLUSIONS

The current study provides data on influenza vaccination intention, uptake, and predictors in Algeria. The results indicated a low level of vaccine uptake while vaccine acceptance was reported by about two-thirds of participants. Motivators included protecting families and patients while the most significant barriers were related to vaccine safety. Within our sample, factors associated with vaccine acceptance mainly included the medical profession and COVID-19 vaccine uptake.

ACKNOWLEDGMENTS

The authors would thank all participants in this study.

CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for disclosure of Potential Conflicts of Interest and none was reported.

FUNDING

There was no source of funding for this research.

ETHICAL APPROVAL AND INFORMED CONSENT

Ethical approval was obtained from the Scientific Committee of the Faculty of Natural and Life Sciences, University of

Djelfa (Approval number: 265; Date: 10 November 2022). Participants provided informed consent.

DATA AVAILABILITY

The data supporting this research are available from the authors on reasonable request.

AUTHORS' CONTRIBUTIONS

ML: study concept, data analysis, writing of the manuscript. DB: study concept and data curation. AO: data curation. All authors read and approved the final version of the manuscript.

PROVENANCE AND PEER REVIEW

Not commissioned; externally peer reviewed.

REFERENCES

1. Gualano MR, Corradi A, Voglino G, et al. Healthcare Workers' (HCWs) attitudes towards mandatory influenza vaccination: A systematic review and meta-analysis. Vaccine. 2021;39(6):901-914. doi:10.1016/j.vaccine.2020.12.061
2. Javanian M, Barary M, Ghebrehewet S, Koppolu V, Vasigala V, Ebrahimpour S. A brief review of influenza virus infection. J Med Virol. 2021;93(8):4638-4646. doi:10.1002/jmv.26990
3. Influenza (seasonal). WHO. February 25, 2025. Accessed November 8, 2024. https://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal)
4. AlOmran HI, Al-Dosary AS, AlGhamdi FM, Alshahrani ZM, Altayar NS. Exploring parents' knowledge and attitudes towards the influenza vaccine in a rural community of Saudi Arabia. J Public Health Afr. 2022;13(1):2207. doi:10.4081/jphia.2022.2207
5. Cherif I, Kharroubi G, Bouabid L, et al. Knowledge, attitudes and uptake related to influenza vaccine among healthcare workers during the 2018-2019 influenza season in Tunisia. BMC Public Health. 2021;21(1):907. doi:10.1186/s12889-021-10970-y
6. Alame M, Kaddoura M, Kharroubi S, et al. Uptake rates, knowledge, attitudes, and practices toward seasonal influenza vaccination among healthcare workers in Lebanon. Hum Vaccin Immunother. 2021;17(11):4623-4631. doi:10.1080/21645515.2021.1948783
7. Della Polla G, Licata F, Angelillo S, Pelullo CP, Bianco A, Angelillo IF. Characteristics of Healthcare Workers Vaccinated against Influenza in the Era of COVID-19. Vaccines (Basel). 2021;9(7):695. doi:10.3390/vaccines9070695
8. Hofmann F, Ferracin C, Marsh G, Dumas R. Influenza vaccination of healthcare workers: a literature review of attitudes and beliefs. Infection. 2006;34(3):142-147. doi:10.1007/s15010-006-5109-5
9. Colaprico C, Ricci E, Bongiovanni A, et al. Flu Vaccination among Healthcare Professionals in Times of COVID-19: Knowledge, Attitudes, and Behavior. Vaccines (Basel). 2022;10(8):1341. doi:10.3390/vaccines10081341
10. Pascucci D, Nurchis MC, Lontano A, et al. Flu and COVID-19 Vaccination: What Happens to the Flu Shot When the Campaigns Overlap? Experience from a Large Italian Research Hospital. Vaccines (Basel). 2022;10(6):976. doi:10.3390/vaccines10060976
11. Sallam M, Ghazy RM, Al-Salahat K, et al. The Role of Psychological Factors and Vaccine Conspiracy Beliefs in Influenza Vaccine Hesitancy and Uptake among Jordanian Healthcare Workers during the COVID-19 Pandemic. Vaccines (Basel). 2022;10(8):1355. doi:10.3390/vaccines10081355
12. Grochowska M, Ratajczak A, Zdunek G, Adamiec A, Waszkiewicz P, Feleszko W. A Comparison of the Level of Acceptance and Hesitancy towards the Influenza Vaccine and the Forthcoming COVID-19 Vaccine in the Medical Community. Vaccines (Basel). 2021;9(5):475. doi:10.3390/vaccines9050475
13. Costantino C, Ledda C, Squeri R, et al. Attitudes and Perception of Healthcare Workers Concerning Influenza Vaccination during the 2019/2020 Season: A Survey of Sicilian University Hospitals. Vaccines (Basel). 2020;8(4):686. doi:10.3390/vaccines8040686
14. Jiang B, Cao Y, Qian J, et al. Healthcare Workers' Attitudes toward Influenza Vaccination: A Behaviour and Social Drivers Survey. Vaccines (Basel). 2023;11(1):143. doi:10.3390/vaccines11010143
15. Klüwer B, Rydland KM, Mamelund SE, Gleditsch RN. Drivers and barriers of seasonal influenza vaccination 2015/16 & 2019/20 to 2022/23 - a survey on why most Norwegians don't get the flu vaccine. BMC Public Health. 2024;24(1):2687. doi:10.1186/s12889-024-20157-w
16. Alhalaseh L, Fayoumi H, Khalil B. The Health Belief Model in predicting healthcare workers' intention for influenza vaccine uptake in Jordan. Vaccine. 2020;38(46):7372-7378. doi:10.1016/j.vaccine.2020.09.002
17. Štěpánek L, Nakládalová M, Vildová H, Boriková A, Janošíková M, Ivanová K. Demand and motivation for influenza vaccination among healthcare workers before and during the COVID-19 era: a cross-sectional survey. Hum Vaccin Immunother. 2021;17(9):3113-3118. doi:10.1080/21645515.2021.1911212
18. Hussein YHH, Ibrahim MH, Badran SG, Eldeeb SM. Hesitancy for influenza vaccine among healthcare workers and mothers of preschool children: A cross-sectional study in Zagazig, Egypt. J Family Community Med. 2022;29(2):108-116. doi:10.4103/jfcm.jfcm_95_22
19. Hakim SA, Amin W, Allam MF, Fathy AM, Mohsen A. Attitudes, beliefs and practice of Egyptian healthcare workers towards seasonal influenza vaccination. Influenza Other Respir Viruses. 2021;15(6):778-788. doi:10.1111/irv.12868
20. Korkmaz N, Nazik S, Gümüştakım RŞ, et al. Influenza vaccination rates, knowledge, attitudes and behaviours of healthcare workers in Turkey: A multicentre study. Int J Clin Pract. 2021;75(1):e13659. doi:10.1111/ijcp.13659
21. Madewell ZJ, Chacón-Fuentes R, Jara J, et al. Knowledge, attitudes, and practices of seasonal influenza vaccination in healthcare workers, Honduras. PLoS One.

2021;16(2):e0246379. doi:10.1371/journal.pone.0246379
22. Madewell Z, Chacón-Fuentes R, Badilla-Vargas X, et al. Knowledge, attitudes, and practices for the use of seasonal influenza vaccination, healthcare workers, Costa Rica. J Infect Dev Ctries. 2021;15(7):1004-1013. doi:10.3855/jidc.14381
23. Luo Q, Gan L, Xiong Y, Li Q, Chen T, Tang X. Knowledge, attitudes and practices related to influenza and influenza vaccine among healthcare workers in Chongqing, China-a cross-sectional study. Hum Vaccin Immunother. 2021;17(12):5500-5508. doi:10.1080/21645515.2021.2007013
24. Gharbi ZE. Grippe saisonnière : «De 2 à 7 millions d'Algériens touchés chaque hiver». El Moudjahid. January 13, 2024. Accessed November 8, 2024. https://www.elmoudjahid.dz/fr/actualite/grippe-saisonniere-de-2-a-7-millions-d-algeriens-touches-chaque-hiver-211574
25. Di Giuseppe G, Pelullo CP, Paolantonio A, Della Polla G, Pavia M. Healthcare Workers' Willingness to Receive Influenza Vaccination in the Context of the COVID-19 Pandemic: A Survey in Southern Italy. Vaccines (Basel). 2021;9(7):766. doi:10.3390/vaccines9070766
26. Ait-Aissa A, Derrar F, Hannoun D, Gradi EA, Scaravelli D, Bouslama Z. Surveillance for antiviral resistance among influenza viruses circulating in Algeria during five consecutive influenza seasons (2009-2014). J Med Virol. 2018;90(5):844-853. doi:10.1002/jmv.25029
27. Derrar F, Voirin N, Khanafer N, et al. Influenza surveillance during the 2009-2010, 2010-2011, 2011-2012, and 2012-2013 seasons in Algeria. J Med Virol. 2019;91(8):1394-1399. doi:10.1002/jmv.25469
28. Abusrewil S, Algeer A, Aljifri A, et al. Influenza surveillance in Middle East, North, East and South Africa: Report of the 8th MENA Influenza Stakeholders Network. Influenza Other Respir Viruses. 2019;13(3):298-304. doi:10.1111/irv.12628
29. Al Awaidy S, Althaqafi A, Dbaibo G; Middle East/North Africa Influenza Stakeholder Network (MENA-ISN). A Snapshot of Influenza Surveillance, Vaccine Recommendations, and Vaccine Access, Drivers, and Barriers in Selected Middle Eastern and North African Countries. Oman Med J. 2018;33(4):283-290. doi:10.5001/omj.2018.54
30. Alkathlan M, Khalil R, Alhemaidani MF, et al. Trends, Uptake, and Predictors of Influenza Vaccination Among Healthcare Practitioners During the COVID-19 Pandemic Flu Season (2020) and the Following Season (2021) in Saudi Arabia. J Multidiscip Healthc. 2021;14:2527-2536. doi:10.2147/JMDH.S330029
31. Scardina G, Ceccarelli L, Casigliani V, et al. Evaluation of Flu Vaccination Coverage among Healthcare Workers during a 3 Years' Study Period and Attitude towards Influenza and Potential COVID-19 Vaccination in the Context of the Pandemic. Vaccines (Basel). 2021;9(7):769. doi:10.3390/vaccines9070769
32. Bertoni L, Roncadori A, Gentili N, et al. How has COVID-19 pandemic changed flu vaccination attitudes among an Italian cancer center healthcare workers? Hum Vaccin Immunother. 2022;18(1):1978795. doi:10.1080/21645515.2021.1978795
33. Cuschieri S, Grech E, Cuschieri A. Climate Change, Obesity, and COVID-19—Global Crises with Catastrophic Consequences. Is This the Future? Atmosphere. 2021;12(10):1292. doi:10.3390/atmos12101292
34. Skyles TJ, Stevens HP, Davis SC, et al. Comparison of Predictive Factors of Flu Vaccine Uptake Pre- and Post-COVID-19 Using the NIS-Teen Survey. Vaccines (Basel). 2024;12(10):1164. doi:10.3390/vaccines12101164
35. Domnich A, Cambiaggi M, Vasco A, et al. Attitudes and Beliefs on Influenza Vaccination during the COVID-19 Pandemic: Results from a Representative Italian Survey. Vaccines (Basel). 2020;8(4):711. doi:10.3390/vaccines8040711
36. Sani T, Morelli I, Sarti D, et al. Attitudes of Healthcare Workers toward Influenza Vaccination in the COVID-19 Era. Vaccines (Basel). 2022;10(6):883. doi:10.3390/vaccines10060883
37. Kearns EC, Callanan I, O'Reilly A, et al. Changing attitudes towards annual influenza vaccination amongst staff in a Tertiary Care Irish University Hospital. Ir J Med Sci. 2022;191(2):629-636. doi:10.1007/s11845-021-02636-w
38. Rykowska D, Sobierajski T, Okarska-Napierała M, Wanke-Rytt M, Kuchar E. Influenza vaccination from the perspective of health care workers at university hospitals. PLoS One. 2023;18(7):e0288470. doi:10.1371/journal.pone.0288470
39. Hogan V, Lenehan M, Hogan M, Natin DP. Influenza vaccine uptake and attitudes of healthcare workers in Ireland. Occup Med (Lond). 2019;69(7):494-499. doi:10.1093/occmed/kqz124