

# The Influence of COVID-19 Pandemic on Influenza Immunization in Saudi Arabia: Cross-Sectional Study

Faisal Minshawi<sup>1</sup>, Mohammed Samannodi<sup>2</sup>, Hassan Alwafi<sup>3</sup>, Hamza M Assaggaf<sup>1</sup>,  
Mohammed A Almatrafi<sup>4</sup>, Emad Salawati<sup>5</sup>, Radi Alsafi<sup>1</sup>, Ruba A Alharbi<sup>3</sup>, Raghad F Alduais<sup>3</sup>,  
Muruj Alrehaili<sup>3</sup>, Shahad Tariq<sup>3</sup>, Rahaf Alghamdi<sup>3</sup>, Shumok Almatrfi<sup>3</sup>

<sup>1</sup>Department of Laboratory Medicine, Faculty of Applied Medical Sciences, Umm Al-Qura University, Makkah, Saudi Arabia; <sup>2</sup>Department of Medicine, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia; <sup>3</sup>Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia; <sup>4</sup>Department of Pediatrics, Umm Al-Qura University, Makkah, Saudi Arabia; <sup>5</sup>Department of Family Medicine, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

Correspondence: Mohammed Samannodi, Email [mssamannodi@uqu.edu.sa](mailto:mssamannodi@uqu.edu.sa)

**Introduction:** Influenza vaccination is the primary control measure for severe complications caused by influenza viruses. Moreover, in the face of the COVID-19 pandemic, Saudi Arabia recommends vaccinating people at risk against influenza to minimise co-infection risk with SARS-CoV2. Therefore, this study aims to assess the Saudi population's knowledge, attitude, and practice toward influenza vaccination during the COVID-19 pandemic. Moreover, we evaluate the impact of the COVID-19 pandemic on seasonal influenza vaccination.

**Methods:** This cross-sectional study was conducted using an online survey in Saudi Arabia between July to August 2021. Participants were invited to complete the questionnaire through a survey link sent to social media platforms.

**Results:** A total of 2410 participants were included in this study. Our data demonstrate a lack of practice, attitude, and knowledge, especially on the influenza virus's symptoms, viral transmission, and vaccine efficacy. Moreover, this study showed that the COVID-19 pandemic significantly impacted seasonal influenza vaccination in the Saudi population by 1.5-times compared to the previous years.

**Conclusion:** COVID-19 pandemic has increased the hesitancy of Saudi participants in influenza vaccination due to the lack of knowledge. As the pandemic of COVID-19 is fading, awareness campaigns are needed to encourage the public about the importance of receiving the influenza vaccine, especially for those at high risk each year.

**Keywords:** COVID-19 pandemic, influenza vaccine, vaccine hesitancy

## Introduction

Seasonal influenza is a highly contagious respiratory disease caused by viruses.<sup>1</sup> It frequently causes an abrupt onset of fever, headache, dry cough, sore throats, runny nose, and body aches.<sup>2</sup> It is tremendously challenging to differentiate influenza illness from infections caused by other respiratory viruses based on their clinical presentation.<sup>3</sup> Even though seasonal influenza epidemics are most prevalent in the winter months in temperate zones, they can occur any time of year in tropical regions.<sup>2,4</sup> The annual epidemic is predicted to affect up to 5 million cases of severe illness, with 650,000 deaths worldwide.<sup>5</sup> Patients with underlying chronic conditions (such as cardiovascular disease, diabetes mellitus, or asthma), extreme age, pregnant females, and children less than five years old.<sup>6</sup> Furthermore, they risk developing severe illnesses such as bacterial pneumonia, ear infections, and sinus infections, aggravating pre-existing medical conditions.<sup>3</sup>

The vaccine helps prevent influenza-related illnesses and serious complications resulting in hospital admission or fatality. It is recommended for high-risk populations, including pregnant females, children under five, seniors 65 years of age and older, individuals with chronic health problems, and healthcare professionals.<sup>7</sup> In addition, the Ministry of Health in Saudi Arabia provides influenza vaccines annually, free for anyone older than six months.<sup>8</sup>

Moreover, routine precautions such as washing hands, avoiding exposure to people at risk, and covering the mouth and nose when coughing or sneezing are recommended. Generally, vaccination against influenza is low among the general

population and the high-risk population among pregnant women and healthcare professionals.<sup>9,10</sup> For instance, a report shows unsatisfactory compliance with the annual influenza vaccination for healthcare professionals in Saudi Arabia.<sup>11</sup>

Additionally, SARS-CoV-2 circulated concurrently with seasonal influenza, which began in October and ended in March, and the clinical symptoms are similar, complicating differentiation. Co-infections of influenza viruses with SARS-CoV-2 at this time of the year were a big concern for public health. A report that examined the clinical outcomes of co-infection of influenza viruses with SARS-CoV-2 in the UK showed that SARS-CoV-2 co-infections with influenza viruses were significantly associated with an increased need for invasive mechanical ventilation and in-hospital mortality.<sup>12</sup> Therefore, there was emerging public awareness worldwide to vaccinate against influenza viruses. However, due to the global spread of the COVID-19 pandemic, it is believed the COVID-19 pandemic may positively or negatively affect the decision-making for influenza vaccination. Therefore, this study aims to assess the Saudi population's knowledge, attitude, and behaviour toward the influenza vaccine during the COVID-19 pandemic and to evaluate the impact of the COVID-19 pandemic on seasonal influenza vaccination.

## Methods

### Study Design and Sampling Strategy

This was a retrospective cross-sectional study using a web-based survey questionnaire in Saudi Arabia between July 15 and August 2, 2021. The questionnaire was adapted from a previously validated Arabic questionnaire.<sup>11</sup> The participants who met the inclusion criteria were used to recruit the study sample. The inclusion criteria to participate in this study were all adults (males and females) aged 18 years or above and living in Saudi Arabia (Saudis or non-Saudis). The exclusion criteria are participants younger than 18 years old. This study used a random sampling strategy to recruit possible eligible participants in the study. In addition, participants were invited to complete the questionnaire through a survey link sent to social media platforms. Since all participants volunteered to participate in the study, they were not required to provide written informed consent. However, we clearly explained the study's aim at the opening of the invitation letter. Finally, participants accessed the survey and completed it if they decided to participate. We also categorised patients with chronic respiratory diseases such as lung cancer, chronic obstructive pulmonary disorder (COPD), cystic fibrosis, and Asthma

### Sample Size Estimation

The sample size estimates how many patients are needed in this study. Accordingly, the sample size was calculated using the Raosoft sample size calculation; the estimated number of participants is 385.<sup>13</sup>

### Statistical Analysis

Baseline demographic characteristics were calculated and presented as frequencies and percentages. Frequencies of the correct answers were described with different options for knowledge, practice, and attitude questions. We used the One-way ANOVA test to compare demographic variables with knowledge and practice scores. The number of participants, knowledge, practice scores  $\pm$  standard deviation (SD), and p-value were reported. Univariate and multivariate logistic regression was performed to identify COVID-19 impact on influenza vaccination with knowledge, practice, and attitude scores. Odds Ratios (ORs) and confidence intervals (CIs) were also reported. Data analysis was conducted using SPSS version 25. The statistical significance level was set at ( $P < 0.05$ ) (two-sided).

### Ethical Statement

Ethical approval was obtained by the biomedical ethical committee at Umm Al-Qura University (UQU) (Ref.HAPO-02-K-012-2021-08-707). The consent was given on the first page of the questionnaire, and all information was provided. This study complies with the Declaration of Helsinki.

## Result

### Baseline Characteristics of Participants

A total of 2410 participants were included in our study (Table 1). About half of the participants (46.5%) were 18–28. Most participants were females (67.3%). Most participants were Saudis and residents (41.7%) of the western area of Saudi Arabia. Around half of our study participants were married, and more than half had a bachelor's degree (66.8%). About 24% of our study participants declared a history of chronic illness. Diabetes mellitus was our study population's most common chronic illness (7.8%).

**Table 1** Descriptive Tables of Demographic Variables, N= Number of Participants, (n=2410)

Variable	Category	n (%)
<b>Age</b>	18–28	1120 (46.5)
	29–39	403 (16.7)
	40–50	559 (23.2)
	65–51	328 (13.6)
<b>Gender</b>	Female	1622 (67.3)
	Male	788 (32.7)
<b>Marital Status</b>	Single	1098 (45.6)
	Married	1176 (48.8)
	Widow	60 (2.5)
	Divorced	76 (3.2)
<b>Nationality</b>	Saudi	2287 (94.9)
	Non-Saudi	123 (5.1)
<b>Education Level</b>	High School	552 (22.9)
	Intermediate School	30 (1.2)
	Bachelor	1610 (66.8)
	Higher Education (Master's/PhD)	218 (9.0)
<b>Chronic Diseases</b>	Diabetes Mellitus	189 (7.8)
	Thyroid Disease	123 (5.1)
	Cardiac Disease	41 (1.7)
	Hypertension	164 (6.8)
	CRD	68 (2.8)
	No chronic diseases	1825 (75.8)
<b>Region</b>	West	1006 (41.7)
	East	278 (11.5)
	North	91 (3.8)
	South	28 (1.2)
	Central	411 (17.0)

## Knowledge, Practice, and Attitude Towards Influenza Vaccine

As shown in Table 2, 12 questions were utilised to assess the knowledge of the influenza vaccine. Most of our study participants heard about the influenza vaccine, but only 73.4% of participants were knowledgeable about the timing of influenza vaccination. Most participants know influenza signs, symptoms, and transmission mode (~90%). Around half of the participants realised that influenza could be more severe than a common cold. In contrast, about two-thirds of participants lack knowledge of influenza transmission during the asymptomatic period.

Interestingly, around one-third of participants (~36%) were familiar with influenza complications. Finally, most of our participants (~70%) were competent that the COVID-19 vaccine does affect the prevention of influenza. The total knowledge score (mean±SD) was 6.27±1.91.

**Table 2** Questions to Assess Knowledge, Practice, and Attitude Towards Influenza Vaccine During the COVID-19 Pandemic (Correct Answer Percentage)

Knowledge (K)	n (%)
K1. Have you heard about the flu vaccine	2305 (95.6)
K2. how often do you think the flu vaccine should be administered	1769 (73.4)
K3. Influenza is transmitted primarily by coughing and sneezing	2094 (86.9)
K4. Influenza is more severe than a "common cold."	1284 (53.3)
K5. The signs and symptoms of influenza include fever, headache, sore throat, cough, nasal congestion, and aches and pains	2140 (88.8)
K6. People with influenza can transmit the infection only after their symptoms appear	830 (34.4)
K7. Influenza is transmitted primarily by contact with blood and body fluids	1077 (44.7)
K8. Influenza vaccination may not work if the vaccine contains the wrong mix of viruses	827 (34.3)
K9. Influenza vaccination does not work in some persons, even if the vaccine has the right mix of viruses	489 (20.3)
K10. Symptoms typically appear 8 to 10 days after a person is exposed to influenza	744 (30.9)
K11. The sign and symptoms of severe influenza include meningitis, pericarditis, pneumonia, otitis media	872 (36.2)
K12. Do you believe the COVID –19 vaccine will decrease the symptom of seasonal influenza?	686 (28.5)
<b>Total Knowledge score, (mean±SD) (out of 12)</b>	<b>6.27±1.91</b>
Practice (P)	n (%)
P1. Did you take the COVID-19 vaccine	2154 (89.4)
P2. Did you receive the influenza vaccine before COVID-19 started	947 (39.3)
P3. If you answered yes, how frequently did you take the flu vaccine?	481 (20)
<b>Total Practice score, (mean±SD) (out of 3)</b>	<b>1.48±0.86</b>
Attitude (A)	n (%)
A1. Do you believe the COVID-19 vaccine raises awareness of seasonal influenza	1353 (56.1)
A2. Do you feel the COVID-19 vaccine encourages you to take the influenza vaccine	650 (27)
A3. Do you believe the precaution measures for COVID-19 helped decrease the number of flu cases? (Face mask, wash hands frequently with soap and water, maintain distance)	2118 (87.9)
<b>Total Attitude score, (mean±SD) (out of 3)</b>	<b>1.17±0.89</b>

**Abbreviations:** K, Knowledge; P, Practice; A, Attitude; SD, Standard Deviation.

Three questions were used to evaluate the practice of our participants. First, about 90% of our study participants received the COVID-19 vaccine. Our data showed that around 40% of participants received the influenza vaccine before the COVID-19 pandemic. Only 20% of participants adhered to most international guidelines and received the influenza vaccine yearly. The total practice score (mean±SD) was 1.48±0.86.

Three questions were used to assess the attitude of our participants toward the influenza vaccine, as shown in [Table 2](#). First, about half of the participants (56%) believed that the COVID-19 vaccine increased the awareness of seasonal influenza. Moreover, 88% of our study population believe that primary preventive measures such as wearing masks and avoiding close contact in the COVID-19 period help decrease the number of influenza infections.

To sum up, our data demonstrate a lack of knowledge (6.27±1.91), especially on the symptoms, viral transmission, and vaccine efficacy. Moreover, this would reflect the practice (1.48±0.86) and participants' attitudes toward influenza vaccination (1.17±0.89).

## Demographics and the Level of Knowledge, Practice, and Attitude Toward the Influenza Vaccine During the COVID-19 Pandemic

In [Table 3](#), we found the important factors affecting the knowledge, practice, and attitude score, such as age, gender, educational level, and region of residence in Saudi Arabia. Our data demonstrate that the knowledge score declined in the elderly age group (51- to 65-year-old) compared to the other groups. However, these age groups have good practice toward influenza vaccine [Table 3](#). The highest attitude score was noticed among 29–39-year-old. Overall, there is a significant association between age group and the level of knowledge, practice, and attitude toward the influenza vaccine.

On the other hand, males have significantly more practice and attitude toward the influenza vaccine than females. Regarding the level of education our data demonstrate that high degrees such as Master's/PhD have higher knowledge than other levels of education. Therefore, it is worth noting that the knowledge score was increased with a high level of education.

On the other hand, this data showed a significant difference in the knowledge, practice, and attitude concerning the geographical location of Saudi Arabia. The highest knowledge score was noticed in participants who live in the eastern province of Saudi Arabia.

To sum up, this data showed that age, level of education, and region are essential demographic factors affecting the level of knowledge, practice, and attitude toward the influenza vaccine.

## The Impact of the COVID-19 Pandemic on Seasonal Influenza Vaccination

Then, we addressed the impact of the COVID-19 pandemic on seasonal influenza vaccination. First, we questioned the participants if they had received influenza vaccination during the COVID-19 pandemic. Our data showed that the number of individuals who received the influenza vaccine during the COVID-19 pandemic was 25.7% (620). Then, we compare the trend in practice for the influenza vaccine before and during the COVID-19 period ([Figure 1](#)). Our data analysis demonstrated that the COVID-19 pandemic impacted the seasonal influenza vaccination by 1.5-times compared to before the COVID-19 pandemic ([Figure 1](#)). Our study also showed the reason for not acquiring an influenza vaccine after the COVID-19 pandemic, as presented in [Supplementary Figure 1](#). In addition, our study showed that 25% and 23% of the participants acquired information about the influenza vaccine from media and social media, respectively ([Supplementary Figure 2](#)).

## Discussion

During the COVID-19 pandemic, different views and attitudes toward influenza vaccination emerged. This is the first study assessing seasonal influenza awareness and the importance of vaccination among the general population in Saudi Arabia during the COVID-19 pandemic.

Regarding demographic factors associated with the high knowledge of the influenza vaccine, the knowledge score declined in the elderly age group in this study. This finding supports the results of a previous study from Jordan conducted on the elderly (65+)

**Table 3** Association of Demographic Characteristics of Participants and Knowledge, Practice, and Attitude Score (n=2410)

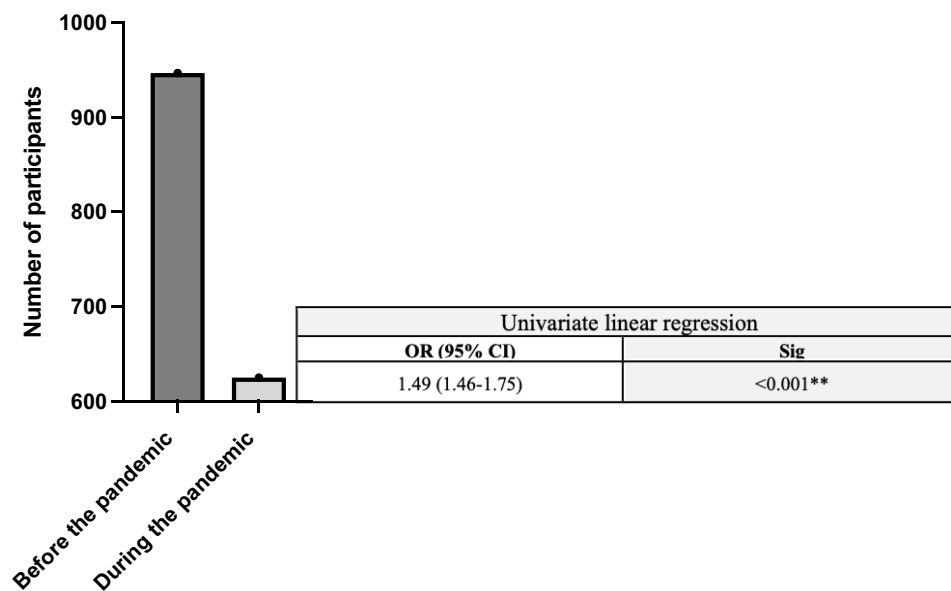
Variable	Category	Knowledge Score (Mean±SD)	Sig	Practice Score (Mean±SD)	Sig	Attitude Score (Mean±SD)	Sig
<b>Age</b>	18–28	6.45±1.87	<0.001**	1.44±0.85	<0.001**	1.66±0.86	<0.001**
	29–39	6.20±1.92		1.43±0.83		1.83±0.86	
	40–50	6.11±1.93		1.51±0.88		1.74±0.93	
	65–51	5.99±1.96		1.66±0.90		1.69±0.94	
<b>Gender</b>	Female	7.27±1.90	0.62	1.41±0.85	<0.001**	1.64±0.88	<0.001**
	Male	6.25±1.95		1.65±0.87		1.85±0.89	
<b>Marital Status</b>	Widow	5.18±1.82	0.68	1.62±0.96	0.51	1.98±1.07	0.78
	Single	6.45±1.90		1.46±0.86		1.66±0.86	
	Married	6.18±1.88		1.50±0.87		1.75±0.90	
	Divorced	5.90±2.17		1.50±0.77		1.62±0.83	
<b>Nationality</b>	Saudi	6.27±1.90	0.13	1.49±0.86	0.05*	1.71±0.89	0.31
	Non-Saudi	6.11±2.08		1.34±0.90		1.63±0.82	
<b>Education Level</b>	Intermediate School	6.00±1.55	<0.001**	1.33±0.96	0.14	1.93±0.87	0.22
	High School	6.13±1.97		1.46±0.88		1.67±0.89	
	Bachelor	6.28±1.89		1.49±0.85		1.74±0.88	
	Higher Education (Master's/PhD)	6.55±1.96		1.58±0.90		1.59±0.96	
<b>Chronic Diseases</b>	Diabetes Mellitus	5.87±1.01	0.82	1.85±0.89	0.19	1.95±0.99	0.92
	Thyroid Disease	6.33±2.15		1.46±0.90		1.56±1.00	
	Cardiac Disease	5.65±1.78		1.86±0.89		2.14±1.00	
	Hypertension	5.11±2.01		1.46±0.87		1.73±0.93	
	CRD	5.98±2.02		1.71±0.89		1.59±0.82	
<b>Region</b>	West	6.10±1.91	0.04*	1.50±0.86	0.04*	1.81±0.90	<0.001**
	East	6.81±1.72		1.48±0.82		1.58±0.81	
	North	5.80±1.87		1.09±0.82		1.48±0.93	
	South	6.39±2.06		1.21±0.74		1.57±0.92	
	Central	6.38±1.88		1.43±0.89		1.56±0.83	

Notes: \*P-value≤0.05, \*\*P-value≤0.001.

Abbreviation: SD, Standard Deviation.

that reported meagre influenza vaccination rates for the elderly, and the level of knowledge and attitude towards influenza vaccination was low.<sup>14</sup> However, the Saudi Arabian Ministry of Health recommends annual seasonal influenza immunisation for everyone over 50 years old.<sup>8,15</sup>

These findings reinforce the notion that the most significant barrier to a lifetime immunisation practice is the lack of knowledge noticed in the elderly. Furthermore, patients underestimate the severity and impact of influenza, making them reluctant to seek a vaccine.<sup>16</sup> In our research, the educational level significantly impacted knowledge



**Figure 1** Impacts of COVID-19 pandemic on the influenza vaccination in Saudi Arabia. **\*\***P-value $\leq$ 0.001.

**Abbreviations:** OR, Odds Ratio; CI, Confidence interval; Sig, Significance.

scores. As a result, participants with a higher educational level have seen a substantial rise in their knowledge scores. Similarly, Lu et al found that higher education was associated with correct knowledge about the influenza vaccination.<sup>17</sup> These findings support intervention programs to raise awareness among those groups. Finally, efforts to better educate those with lower levels of education about the importance of influenza vaccination may improve vaccination rates.<sup>18</sup>

Regarding the effects of the COVID-19 pandemic on the seasonal influenza vaccine, our study reports that most participants believe that encouraging people to acquire the COVID-19 vaccine would not directly enhance their awareness. That would explain the hesitancy in receiving the influenza vaccine during the COVID-19 pandemic. Therefore, our data analysis showed that the COVID-19 pandemic significantly impacted the influenza vaccine during the COVID-19 pandemic by 1.5-times compared to the previous years. Conversely, a prior study by La Vecchia et al indicates that attitudes about influenza vaccination have proven to be more favourable in the 2020 season.<sup>19</sup> Another study in Canada showed that influenza vaccination uptake and intention to take the vaccine among Canadians aged 50 and over increased during the 2020/2021 season compared to the prior year.<sup>20</sup> A possible explanation for a decrease in the number of people receiving the influenza vaccine might be that people tend to misunderstand the safety of receiving both COVID-19 and influenza within a short period. Moreover, a strong relationship between applying preventive measures guidelines and reducing influenza infection cases has been reported in the literature.<sup>21</sup> Around 88% of our study population believe that primary preventive measures such as wearing masks and avoiding close contact in the COVID-19 period help reduce the number of influenza infections. In addition, a study done in Korea revealed that Alongside the reduction in diagnosed cases of COVID-19, they found a substantial decrease in influenza activity.

Our study has several limitations. First, the representation of the population is a major limitation of convenience sampling; however, given the objectives of this study and the current COVID-19 pandemic situation, in which a large proportion of people are working from home due to lockdowns and other governmental restrictions, we believe the study's findings can be generalised to the Saudi population. Second, the questionnaire was prepared specifically for Arabic readers, challenging those who do not speak the language. Third, the data collected through a self-reported survey may have recall bias.

## Conclusion

This study revealed that the COVID-19 pandemic had influenced the general population's intention to vaccinate against seasonal influenza. However, the possible factor associated with a decreased willingness to receive the influenza vaccine is a lack of knowledge of the importance of influenza vaccination. The trend of vaccine hesitancy is often related to new information or newly defined vaccine risk, especially with COVID-19 time, which increases the risk for re-emerging infectious diseases. Therefore, equipping healthcare providers with the knowledge circulating in the community to correct any misinformation at the community level. Moreover, an extensive awareness campaign is needed to emphasize the importance of receiving the influenza vaccination and other recommended vaccine on social media. Thus, education, improving public awareness and regulating social media content will enhance the hesitancy to receive the influenza vaccine.

## Disclosure

The authors report no conflicts of interest in this work.

## References

- Moghadami M, Narrative A. Review of influenza: a seasonal and pandemic disease. *Iran J Med Sci.* 2017;42(1):2–13.
- Krammer F, Smith GJD, Ram FK, et al. Influenza. *Nat Rev Dis Primers.* 2018;4(1):3. doi:10.1038/s41572-018-0002-y
- Demicheli V, Jefferson T, Rivetti D, Deeks J. Prevention and early treatment of influenza in healthy adults. *Vaccine.* 2000;18(11–12):957–1030. doi:10.1016/S0264-410X(99)00332-1
- Tamerius JD, Shaman J, Alonso WJ, et al. Environmental predictors of seasonal influenza epidemics across temperate and tropical climates. *PLoS Pathog.* 2013;9(3):e1003194. doi:10.1371/journal.ppat.1003194
- Paget J, Spreuwwenber P, Charu V, et al. Global mortality associated with seasonal influenza epidemics: new burden estimates and predictors from the GLaMOR Project. *J Glob Health.* 2019;9(2):020421. doi:10.7189/jogh.09.020421
- Walker TA, Waite B, Thompson MG, et al. Risk of severe influenza among adults with chronic medical conditions. *J Infect Dis.* 2020;221(2):183–190. doi:10.1093/infdis/jiz570
- Nowak GJ, Sheedy K, Bursley K, et al. Promoting influenza vaccination: insights from a qualitative meta-analysis of 14 years of influenza-related communications research by U.S. Centers for Disease Control and Prevention (CDC). *Vaccine.* 2015;33(24):2741–2756. doi:10.1016/j.vaccine.2015.04.064
- Saudi Arabia Ministry of Health. Seasonal influenza vaccination; 2022 [cited August 19, 2022]. Available from: <https://www.moh.gov.sa/en/Flu/Pages/QA.aspx>. Accessed August 26, 2022.
- Erazo CE, Erazo CV, Grijalva MJ, et al. Knowledge, attitudes and practices on influenza vaccination during pregnancy in Quito, Ecuador. *BMC Public Health.* 2021;21(1):72. doi:10.1186/s12889-020-10061-4
- Costantino C, Vitale F. Influenza vaccination in high-risk groups: a revision of existing guidelines and rationale for an evidence-based preventive strategy. *J Prev Med Hyg.* 2016;57(1):E13–8.
- Alshammari TM, Yusuff KB, Aziz MM, et al. 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. doi:10.1186/s12913-019-4054-9
- Swets MC, Russell CD, Harrison EM, et al. SARS-CoV-2 co-infection with influenza viruses, respiratory syncytial virus, or adenoviruses. *Lancet.* 2022;399(10334):1463–1464. doi:10.1016/S0140-6736(22)00383-X
- Naing NN. Determination of sample size. *Malays J Med Sci.* 2003;10(2):84–86.
- Ababneh M, Jaber M, Rababa'h A, et al. Seasonal influenza vaccination among older adults in Jordan: prevalence, knowledge, and attitudes. *Hum Vaccin Immunother.* 2020;16(9):2252–2256. doi:10.1080/21645515.2020.1718438
- Al Hassan YT, Fabella EL, Estrella ED, et al. Association of vaccine awareness and confidence on the influenza vaccination status of Al Ahsa, Saudi Arabia residents. *Hum Vaccin Immunother.* 2021;17(7):2190–2196. doi:10.1080/21645515.2020.1855954
- Wang R, Liu M, Liu J. The association between influenza vaccination and COVID-19 and its outcomes: a systematic review and meta-analysis of observational studies. *Vaccines.* 2021;9(5):529. doi:10.3390/vaccines9050529
- Lu PJ, Srivastav A, Santibanez TA, et al. Knowledge of influenza vaccination recommendation and early vaccination uptake during the 2015–16 season among adults aged  $\geq 18$  years - United States. *Vaccine.* 2017;35(34):4346–4354. doi:10.1016/j.vaccine.2017.06.074
- Salawati E, Alwafi H, Samannodi M, et al. Parents' willingness to vaccinate their children against seasonal influenza after the COVID-19 pandemic in Saudi Arabia: a retrospective cross-sectional survey. *Patient Prefer Adherence.* 2021;15:2821–2835. doi:10.2147/PPA.S342135
- La Vecchia C, Negri E, Alicandro G, et al. Attitudes towards influenza vaccine and a potential COVID-19 vaccine in Italy and differences across occupational groups, September 2020. *Med Lav.* 2020;111(6):445–448. doi:10.23749/mdl.v111i6.10813
- Sulis G, Basta NE, Wolfson C, et al. Influenza vaccination uptake among Canadian adults before and during the COVID-19 pandemic: an analysis of the Canadian Longitudinal study on Aging (CLSA). *Vaccine.* 2022;40(3):503–511. doi:10.1016/j.vaccine.2021.11.088
- Lee H, Lee H, Song K-H, et al. Impact of public health interventions on seasonal influenza activity during the COVID-19 outbreak in Korea. *Clin Infect Dis.* 2021;73(1):e132–e140. doi:10.1093/cid/ciaa672



Journal of Multidisciplinary Healthcare

Dovepress

### Publish your work in this journal

The Journal of Multidisciplinary Healthcare is an international, peer-reviewed open-access journal that aims to represent and publish research in healthcare areas delivered by practitioners of different disciplines. This includes studies and reviews conducted by multidisciplinary teams as well as research which evaluates the results or conduct of such teams or healthcare processes in general. The journal covers a very wide range of areas and welcomes submissions from practitioners at all levels, from all over the world. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/journal-of-inflammation-research-journal>