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Impact of COVID-19 pandemic on influenza vaccination rate among health care workers

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ABSTRACT

Vaccinations against influenza are critical in mitigating the severity of the disease, preventing its transmission, and restricting its dissemination. Concerns about vaccination hesitancy among healthcare workers (HCWs) have been duly recognized during and following the COVID-19 pandemic. To examine the extent to which the COVID-19 pandemic has influenced the adoption of vaccinations among HCWs. A cross-sectional online survey was conducted four years after the COVID-19 pandemic among HCWs in Saudi Arabia. We performed a logistic regression analysis using influenza vaccination uptake as the dependent variable and perceived COVID-19 pandemic's impact, age, gender, marital status, employment status, education level, monthly income, respondent's overall health, doctor visits, tobacco use, number of adults in the household, and number of children in the household as independent variables. The study included 574 participants, an 86% response rate. Of the sample, 47% reported they had the influenza vaccination. HCWs who reported a greater negative impact due to the COVID-19 pandemic were 40% more likely to acquire the influenza vaccine (OR = 1.4, 95% CI [1.24, 1.58]). Compared to HCWs without children, HCWs with a child had a 44% lower likelihood of taking the influenza vaccination (OR = 0.34, 95% CI [0.16, 0.69]). The odds of HCWs obtaining the influenza vaccine were 4.5 times higher for those who reported one yearly medical visit, 2.6 times higher for two, and 1.4 times higher for three or more. HCWs who experienced more severe COVID-19 outcomes were more likely to get vaccinated against the virus. However, long-term monitoring of this inclination is necessary.

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Introduction

Lower respiratory tract infections are classified as one of the leading causes of death worldwide, as reported by the World Health Organization.[1] Seasonal influenza, although often not highly severe, can lead to significant complications or even mortality in some instances. Globally, approximately 389 thousand people lose their lives annually due to influenza-related mortality; 65 and older adults comprise two-thirds of these fatalities.[2] Seasonal influenza significantly increases the mortality rate of other diseases, such as ischemic heart disease or sudden heart failure, in susceptible populations.[3,4]

Vaccinations against influenza are of critical importance in mitigating the severity of the disease, preventing its transmission, and restricting its dissemination.[5] Moreover, implementing widespread vaccination on a worldwide scale is one of the most effective strategies to mitigate the impact of influenza on healthcare systems, society, and the economy.[6] A recent study indicates that obtaining an influenza vaccination can reduce the length of hospital admissions, visits to critical care units, mortality, and the burden on healthcare systems.[7] The decrease in the incidence of influenza vaccination among the general population has been projected to have significant implications for society as a whole.[8] Several governments have prioritized influenza immunization as a key healthcare goal due to the vaccine's cost-effectiveness in preventing influenza-related illnesses.[9–12] Vaccination against influenza is strongly recommended for all individuals aged six months and older in several countries.[13] Notwithstanding all of these recommendations, the rates of influenza vaccination persistently fail to meet the intended goals.[14] In the United States, the target of achieving a 70% coverage rate for seasonal influenza vaccines has not been achieved.[15] Global research revealed that disparities in influenza immunization rates are associated with factors such as gender, age, the incidence of chronic illness, family income, household size, and educational achievement.[16]

Over the past several decades, there has been a rise in opposition to vaccines and the appearance of concerns around vaccination hesitancy.[17] The development of resistance to vaccination has been identified as one of the top 10 hazards to global health.[18] Recent studies have demonstrated varying levels of vaccine hesitancy. For example, out of the 700 individuals surveyed, 49% expressed an overall hesitation toward being vaccinated, 17% stated that they had not received the COVID-19 vaccine, and 36% reported never having received the influenza vaccine.[19] In particular, the adverse consequences and severity of COVID-19 could potentially impact individuals' attitudes toward alternative immunizations and reduce their willingness to receive the yearly influenza vaccination.[20,21]

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The findings of studies investigating the impact of the COVID-19 pandemic on individuals who received the influenza vaccination have been inconclusive. Several studies have shown that the pandemic positively impacted the rate at which people received influenza vaccinations. A global meta-analysis of studies has found that the COVID-19 pandemic has increased people's inclination to receive influenza vaccinations.[22] Based on a nationwide survey of American adults, it was found that 25% of those who declined to get the influenza shot in the previous year expressed their intention to be vaccinated in the upcoming season.[23,24] Research conducted in Spain[24] and Italy[17] revealed that adults were more likely to be vaccinated against influenza as a result of the COVID-19 pandemic.[25] Conversely, researchers noted that individuals impacted by the COVID-19 pandemic who were hesitant to receive the vaccination also had negative attitudes about getting vaccinated for influenza.[26] A study revealed that individuals who had not had a COVID-19 booster shot were less inclined to receive a yearly influenza immunization.[27] Another study found that misleading information about COVID-19 immunization and policy increased adverse sentiments about influenza vaccinations after the pandemic.[28] This result was consistent with another study's finding that influenza vaccination rates had decreased after the COVID-19 pandemic.[29]

Considering the significance of adherence to influenza vaccination, it is particularly crucial for Healthcare Workers (HCWs), a population that receives considerable focus concerning influenza immunization. In addition to keeping HCWs from getting sick, vaccinations are crucial for preventing infections from spreading to patients and the general public. The immunization rate among healthcare professionals in various European nations is as low as 30% and is decreasing.[30] Conversely, estimates indicate that the immunization rate among US workers stands at around 78%. The higher coverage rate in the USA may be attributed to mandatory vaccination requirements in some healthcare institutions.[31]

Given the necessity for adequate global vaccine coverage and the dearth of empirical evidence regarding the factors influencing influenza vaccine adoption, it is imperative to investigate the impact of the COVID-19 pandemic on influenza vaccination. The objective of this study is to examine the extent to which the COVID-19 pandemic has influenced the adoption of vaccinations among HCWs four years after the COVID-19 pandemic. Vaccination rates were compared among members of the same population, and the factors contributing to the discrepancy were investigated. Furthermore, we investigated the correlation between the number of adult members of the household, the number of children in the household, age, gender, marital status, employment status, education level, monthly income, respondent's overall health, doctor visits, and tobacco use, and the uptake of the influenza vaccination among HCWs.

Methods

Study design and data collection

The present study employed a cross-sectional design and utilized an online anonymous questionnaire. To recruit participants, the researchers employed a convenient sampling approach. Although convenience sampling has limited generalizability, it may circumvent administrative constraints to get a sample list, while still being simple and efficient. Email invitations were sent out, between 1 and 25 November 2023, to HCWs who were undergraduate and graduate students at a Saudi public university. The invitation included an abundant amount of information on the objectives, procedures, and background of the study, as well as the deadline for completing the survey, the researcher's contact information, pledges of confidentiality and privacy, and an explicit reminder about the choice of declining participation. An estimated sample size of 550 was calculated after taking into consideration a margin of error of 5%, a confidence level of 95%, a response rate of 50%, and a prior estimated rate of influenza vaccine uptake of 70%.[32] Individuals were required to give their informed permission on the introduction webpage. An overall response rate of 86% was achieved, with a total of 574 responses being received from the 600 questionnaires that were in distribution.

Measures

All constructs and questions consisted of indicators measured by survey questions. Indicators were constructed from the pertinent existing literature for the current study's vaccination setting by expert convergence spanning the fields of behavior, psychology, and public health.[33–35] The questionnaire consisted of three separate sections in different portions (See Table 1). The first part of the survey examined demographic factors, including the age, gender, marital status, work status, education level, and monthly income of the respondents. The second part evaluated the participant's overall health, visits to the doctor, use of tobacco, number of adults residing in the home, and number of children residing in the family. The last part examined the respondent's perceived impact of the COVID-19 pandemic which was measured by asking the participants three questions. Participants were instructed to select from the following options for each question: Large negative, impact, Fair negative impact, Low negative impact, or No Negative Impact. Table 2 presents Cronbach's α coefficients, factor loadings, Average Variance Extracted (AVE), and Composite reliability (CR) with their corresponding measuring items for the COVID-19 pandemic impact construct. The final version of the questionnaire was established after a comprehensive evaluation of its content and face validity by two experts in the field of public health. The primary outcome variable was designed to evaluate the rate at which individuals obtained the influenza vaccination. This was determined by asking respondents if they had received the influenza vaccine following the COVID-19 pandemic. The item offers a binary choice, with only two possibilities available: Yes or No.

Table 1. Characteristics of study participants ($n = 574$).

Variable	%
Sex	
Male	55
Female	45
Age group (years)	
18-30	88
31- 90	8
≥40	4.0
Marital status	
Married	14
Single	86
Education level	
Ungraduated level	97
Graduate level	3
Monthly Income (SAR- Saudi Riyals)	
<5,000	90
5,001 -10,000	9
>10,000	1
Perceived Health Status	
Poor	5
Fair	28.0
Good	67
Tobacco use	
Yes	24
No	76
Number of adults in the household	
None	3
1 adult	7
2 or more adults	90
Number of children in the household	
None	37
1 child	12
2 children	20
3 children	31
Visits to the doctor	
None	30
1 time	9
2 times	27
More than 3 times	34
Receiving flu vaccine	
Yes	47
No	53

Data analysis

In order to assess the characteristics of the HCWs who took part in the study, descriptive statistics including means, standard deviations, and frequencies were utilized. We performed a logistic regression analysis using influenza vaccination uptake as the dependent variable and perceived COVID-19 pandemic's impact, age, gender, marital status, employment status, education level, monthly income, respondent's overall health, doctor visits, tobacco use, number of adults in the household, and number of children in the household as independent variables. The researchers calculated standardized beta coefficients and the corresponding 95% confidence intervals to evaluate the associations. All of the statistical tests were two-tailed, and a p-value of less than 0.05 was considered to be statistically significant. The Statistical Package for the Social Sciences (SPSS) was applied to conduct an analysis of the quantitative data that was collected from the data collection questionnaire. After recruiting participants, the research objectives were clarified to them and informed written consent was secured before any audio recording commenced. All participants were made aware of the confidentiality of their data and their right to join or withdraw from the study at any time. The study protocol has been authorized by the Saudi Electronic University ethics committee with the identification number SEUREC-21100.

Results

The demographics and other characteristics of the participants are illustrated in Table 1, which provides a brief description of each respondent. A total of 574 people, representing an 86% response rate, took part in the study. More than half of the respondents were male, the majority of them falling between the age range of 18 to 30 years, 86% of them being unmarried with a modest monthly income, 66% of them describing their health as excellent, 24% of them reported using tobacco, and 97% of them holding a bachelor's degree. Approximately, 47% of those surveyed indicated that they had received the influenza vaccine.

Logistic regression analysis was employed to determine whether there exists a significant association between the response variable (influenza vaccine uptake) and the following factors among HCWs: age, gender, marital status, employment status, education level, monthly income, respondent's overall health, number of doctor visits, tobacco use, number of adults in the household, and number of children in the household. The findings of the logistic regression model for influenza vaccination uptake are presented in Table 3, which indicates the significant results. The influence of the COVID-19 pandemic on HCWs has had a considerable impact on the uptake of the influenza vaccination. In other words, HCWs who reported having a higher influence as a result of the COVID-19 pandemic were forty percent more likely to get the influenza vaccination, according to the research. (OR = 1.4, 95% CI [1.24, 1.58], $p < .001$). Additionally, we found, holding all variables constant, that the odds of obtaining the influenza vaccine decreased by 79% (OR = 0.21, 95% CI [0.07, 0.60], $p < .001$) among HCWs with monthly income between 5,001 and 10,000 SAR (Saudi Riyals) compared to HCWs with lower than 5000 SAR. Similarly, HCWs with more than 10,000 SAR have an 82% (OR = 0.18, 95% CI [0.06, 0.58], $p < .001$) decrease in their odds compared to HCWs with less than 5000 SAR. In analyzing the impact of the number of children in the family, compared with HCWS with no children in the household, HCWs with one child in the household had a 44% (OR = 0.34, 95% CI [0.16, 0.69], $p < .001$) decrease in the odds of receiving the influenza vaccine. The correlation between the frequency of

Table 2. Items for study measures with descriptive statistics.

Construct	Measurement Item	λ	α	CR	AVE	Range	Mean	SD
Perceived COVID-19 pandemic's impact	Pandemic impact on daily life	0.81	0.78	0.75	0.60	3–9	6.1	1.85
	Pandemic impact on income	0.75						
	Pandemic impact on health	0.86						

λ = Standardized factor loading from structural equation model; α = Cronbach's alpha reliability coefficient; CR = Composite reliability; AVE = Average variance extracted from structural equation model.

Table 3. Logistic regression between attending BMWM training and demographic variables among the participants.

Variables	B	SE	*P*-value	Exp (B)	95% Confidence Interval for B	
					Lower Bound	Upper Bound
Sex (female)	0.41	0.25	.09	1.50	0.928	2.436
Age group (years)						
31 - 40	−1.05	0.61	.08	0.34	0.10	1.16
More than 40	−1.68	0.79	.39	0.42	0.24	2.21
Martial status	−0.04	0.52	.93	0.95	0.34	2.66
Monthly income (SAR)						
Between 5,001 and 10,000	−1.53	0.52	0.0002	0.216	0.077	0.601
>10,000	−1.25	0.48	0.0005	0.18	0.062	0.58
Perceived Health Status						
Fair	0.21	0.56	.70	1.24	0.41	3.75
Good	0.47	0.26	.07	1.60	0.95	2.69
Tobacco use	−0.13	0.28	.63	0.87	0.50	1.52
Number of adults in the household						
2 adults	−0.32	0.22	.91	0.56	0.24	1.07
More than 2 adults	−0.11	0.24	.48	0.71	0.33	1.38
Number of children in the household						
1 child	−1.09	0.37	0.0008	0.34	0.16	0.69
2 children	−0.44	0.31	.16	0.64	0.35	1.19
3 children	−0.18	0.30	.56	0.84	0.46	1.51
Visits to the doctor						
1 time	1.52	0.45	.00	4.58	1.89	11.09
2 times	0.97	0.31	.00	2.65	1.44	4.88
More than 3 times	0.36	0.34	.29	1.43	0.74	2.76
COVID-19 pandemic impact	0.33	0.06	0.0006	1.40	1.24	1.58

doctor visits and the rate of influenza vaccination uptake among HCWs was significant ($p < .001$). The likelihood of HCWs obtaining the influenza vaccination was 4.5 times greater for those who reported one annual medical visit, 2.6 times higher for those who reported two annual visits, and 1.4 times higher for those who reported three or more annual visits, compared to HCWs with no annual visits.

Discussion

General findings

In this study, we investigated the relationship between the rates of influenza vaccination and the severity of the impact that COVID-19 had on HCWs after four years of the beginning of the pandemic. The results suggested that those who considered the COVID-19 pandemic as having more significant consequences were more inclined to receive the influenza vaccine. Therefore, the pandemic may have led to an increase in vaccination compliance. Moreover, the frequency of receiving the influenza vaccine varied substantially among the participants depending on the healthcare worker's monthly income, the number of children in their home, and the number of medical visits they had each year.

Rate of vaccination

Our findings indicated that 47% of the participants had reported receiving the influenza vaccination. Before the COVID-19 pandemic, most research undertaken in Saudi Arabia reported lower influenza vaccination rates among HCWs. During the 2012 influenza season, a study revealed that only 38% of HCWs received the influenza vaccination. In 2016, further research revealed a similar rate of influenza vaccine use, with a slightly smaller proportion (42.5%) of individuals intending to obtain another influenza vaccination in the subsequent season.[36,37] Comparable results were reported in other studies, where the prevalence of the influenza vaccine varied between 34.4% and 41.0%.[38,39] The post-pandemic research revealed a prevailing inclination toward a rise in the uptake of influenza vaccinations among HCWs. According to the findings of one study, roughly 60% of individuals had the intention of being vaccinated against influenza in the year 2021.[40]

Factors influencing the rate of influenza vaccination

Our study comprised a sizable number of young adults as participants, which was a substantial proportion. This may be a contributing factor to the lower rate of influenza vaccination seen in our research compared to previous national studies.[40] Young adults are recognized as a subgroup that may have low compliance with health-related measures.[41] During the COVID-19 pandemic, elderly individuals were more likely to receive influenza vaccinations, according to research.[42] Seniors are predisposed to the influenza virus and have a significantly higher risk of hospitalization and mortality following transmission than younger individuals.[8] These factors likely account for the elevated level of anxiety and increased likelihood of COVID-19 vaccination among this age group.[8] In our research, HCWs with a child in the family exhibited a 44% reduction in the likelihood of obtaining the influenza vaccination compared to HCWs without children in the household. Such a finding might be due to the younger age of our participants as the literature shows that higher levels of vaccine hesitancy were observed to be associated with younger parents' ages.[43,44] We also found that higher income correlates with decreased acceptance of the flu vaccination among healthcare professionals. This contradicts the majority of previous research. A potential explanation is that the majority of the sample (90%) reported to be from the lower income category.

Impact of COVID-19 and vaccine uptake

Our research revealed that the influenza vaccination rates of HCWs were significantly influenced by the COVID-19 pandemic. This finding implies that the epidemic may have incentivized individuals to adopt more proactive measures in order to safeguard their health. In other words, HCWs who reported experiencing more severe repercussions as a result of the COVID-19 pandemic exhibited a higher propensity to obtain the influenza vaccination. Research conducted before and during the COVID-19 pandemic has shown a correlation between individuals' willingness to accept a particular vaccination and their overall attitude toward other vaccinations.[45–47] Emerging evidence suggests that the motivation to vaccinate against COVID-19 is influenced by the degree of concern and perception of vulnerability during the pandemic.[40,48] What individuals believe to be a threat to their health is one of the best predictors of their willingness to adopt preventive measures, like getting vaccinated against influenza.[47] Nevertheless, since worry and anxiety levels associated with health concerns are unstable and fluctuate over time, there is no assurance that intentions to engage in preventative behavior will be followed through in practice.[48,49] This implies that future educational initiatives regarding influenza vaccination should prioritize enhancing individual knowledge regarding the vaccine, its efficacy, and its safety, while also fostering a cultural transition toward participatory and conscientious self-health management.[50–52] Our study was a cross-sectional survey that may not adequately reflect the evolving patterns in influenza vaccination since other respiratory infections might have short-term or direct influence on their uptake. However, this finding contributes further knowledge to the literature to enhance the understanding of influenza vaccination patterns.

Limitations

There are a few possible limitations to this study. First, we employed a convenient sampling method, which decreases the probability of generalizing the results to the entire population of HCWs. Second, the representativeness of the study sample is limited because respondents were not selected randomly. Thus, it is advisable to conduct longitudinal studies because healthcare workers' adherence to vaccination may vary over time, especially when new immunization programs are introduced. Second, many of our measures, particularly those evaluating the concept of perceived COVID-19 impact, were subjective and insufficient to objectively quantify the extent of the impact. Consequently, more investigation is necessary to assess the measurements using objective measuring instruments to get more accurate outcomes. Furthermore, due to the observational nature of our data, we were unable to show a direct causal relationship, which is a common limitation in regression analysis studies. Ultimately, we only relied on self-reported data, as did other studies of an equivalent design. The inquiry's sensitive nature might generate concerns among researchers that certain HCWs who were not vaccinated may have falsely claimed to be immunized.

Conclusion

This study, to the best of our knowledge, is the first to investigate how the COVID-19 pandemic has affected influenza vaccination rates of HCWs in Saudi Arabia. The findings indicate that HCWs who experienced more severe outcomes due to the COVID-19 pandemic were more likely to get vaccinated against the virus. Long-term monitoring of this pattern is essential since it may be the consequence of transient worries and respondents' sensitivity. Facilitating flexible access to free vaccinations is essential for addressing time- and access-related obstacles to vaccine adoption. Moreover, an effective HCW vaccination program necessitates culturally attuned education on the risks of influenza and the comprehensive advantages of vaccination, customized to certain professional attributes. At the policy level, mandatory vaccination mandates may serve as an effective strategy to attain elevated overall immunization rates. In clinics where policies are impractical, comprehensive campaigns including on-site vaccinations, vaccination stations, educational initiatives, promotional activities, and incentives should be executed. Governmental and non-governmental health agencies should provide financing for extensive media campaigns and outreach targeting vulnerable healthcare worker populations.

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Notes on contributor

Salah Alshagrawi holds the position of Associate Professor of Public Health at the Saudi Electronic University. Additionally, he has previously held the roles of director of the public health department and Vice Dean of scientific research and graduate studies. He authored and collaborated on over 20 publications, most of which focused on public health and research choices. In addition, he serves on the editorial board of many prominent publications in the field of health.

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