Original Article

Seasonal Influenza Vaccination Prevalence and Factors Associated with Vaccination Behaviors among Saudi Adults after the COVID-19 Pandemic

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Receiving Date: Feb 12,2024 Accept Date: Sep 05,2024, dx.doi.org/10.5455/mjhs.2024.04.012

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Abstract

Background and Aims: The seasonal influenza vaccinations play a crucial role in preventing the spread of influenza virus and reducing the risk of severe illness. Understanding the prevalence of seasonal influenza vaccinations and the factors associated with it is essential for public health interventions and vaccine promotion. In this study, we examine the prevalence and factors associated with vaccination behavior among Saudi adults after the COVID-19 pandemic.

Methods: A cross-sectional study was conducted. The data was collected through structured self-reported questionnaires administered online. The study involved 848 participants ranging in age from 18 to 50 years old.

Results: The prevalence of seasonal influenza vaccinations was 42.3%. Sex was significantly associated with seasonal influenza vaccinations with males being more likely to take the seasonal influenza vaccinations. There was also a decrease in reporting seasonal influenza vaccinations in families with six members or more. COVID-19 doses were associated with seasonal influenza vaccinations.

Conclusion: A considerable proportion of the Riyadh population did not prioritize the flu vaccine. Females and members of large families need to be the focus of healthcare education programs to raise awareness of seasonal influenza vaccinations. Health professionals, policymakers, and public health organizations could use this information to promote healthy behaviors and increase influenza vaccination rates.

Keywords:

Seasonal influenza vaccinations; Prevalence; COVID-19 pandemic; Public health interventions; Vaccine promotion

Introduction

Seasonal influenza, also known as the flu, is a viral infection that affects millions of people worldwide each year h It is caused by the influenza virus and is characterized by symptoms such as fever, cough, sore throat, body aches, and congestion. The flu season typically lasts from fall to early spring, with peak activity during the winter months [1,2].

Although seasonal influenza is generally considered a mild illness, it can cause serious complications in some individuals. Pneumonia, sinusitis, respiratory syncytial virus, and viral bronchitis are all possible complications [1,2]. Globally, seasonal influenza is estimated to cause 3-5 million severe illnesses and 250-500 thousand deaths annually[1]. It has been proven that vaccination is the most effective method of protecting against influenza, as individuals not only protect themselves, but also help reduce the spread of the virus among the community as a whole. Influenza vaccines work by stimulating the immune system to produce antibodies that attack and neutralize influenza viruses. The flu vaccination provides protection against the disease, protects vulnerable populations, reduces the spread of the disease, and saves valuable time, money, and resources [1,3]. In preventing influenza-related morbidity, vaccination is both cost-effective and efficient[4,5]. Vaccination against the flu should be given to all individuals 6 months of age and older, including healthy individuals, those with chronic medical conditions, pregnant women, and those over 65. Individuals with certain medical conditions, young children, and elderly people are at higher risk of developing serious flu complications [6]. It is recommended to get vaccinated by the end of October or beginning of November, before the start of the flu season. This allows the body to develop immunity before the virus becomes more widespread [7]. Several countries have made influenza vaccination a priority healthcare objective [8]. However, influenza vaccination rates remain low[5]

In Saudi Arabia, the seasonal influenza vaccine is offered free of charge in public hospitals and private clinics [9]. Yet vaccination rates remain low (ranging from 20,1% to 44.5%)[10–15]. The low vaccination rate can be attributed to various reasons: a lack of awareness about the importance of SIV in protecting oneself and others from influenza, a lack of understanding of the risks associated with influenza and the potential complications that can arise, especially among vulnerable populations such as the elderly, children, and people with certain medical conditions [10–12].

As a result of the CO VID-19 pandemic, various aspects, including public health, have been profoundly affected. Many researchers have been focused on understanding how the COVID-19 pandemic has affected the demand for and effectiveness of the flu vaccine [13,14,16-18] .

In order to maintain public health, monitor vaccination effectiveness, identify barriers to vaccination, inform policy decisions, and promote public education, it is vital to study the prevalence of flu vaccinations and the factors associated with them. It is possible to improve community health and well-being by investing in ongoing surveillance and research, thereby optimizing flu vaccination programs.

As far as we know, no research has been conducted in Saudi Arabia to study SIV prevalence after the end of the global state of emergency for COVID-19 pandemic and to explore the effects of the pandemic on vaccine willingness. Therefore, this research aims to:l) Estimate the prevalence of seasonal influenza vaccinations SIV (vaccinated or plans to) in 2023 among adults living in Riyadh, Saudi Arabia; 2) Identify the factors associated with seasonal influenza vaccinations, and 3) Analyze the impact of the COVID-19 pandemic on individuals' behaviors towards receiving the influenza vaccine.

Materials and methods

Study design and settings

In this study, an analytical cross-sectional survey design was employed. An online survey link was distributed to the participants via KSU Questionnaire Center (using KSU e-mail) and social communication platforms commonly used in KSA such as WhatsApp. One response was accepted from each participant. Participation was voluntary, and no incentives were provided. The survey distribution and data collection were between September and November 2023.

Participants

In this study, people living in Riyadh, Saudi Arabia, aged (18 years old), of both sexes, were included. Responses from persons under 18 years of age and those not living in Riyadh were excluded. Participants were selected using the convenience sampling method.

Sample size

The desired minimum target number of re- 95% confidence level and a 5% margin of error.

Instrument

the survey consisting of closed ended questions in Arabic language. The questionnaire was organized into three sections: Section (I) which includes socio-demographic questions (age, sex, marital status, educational level, employment status, and number of family members), and questions about the presence of chronic health problems. Section (II) , collects data about the intention towards the seasonal influenza vaccinations before and after (COVID-19) pandemic, causes of receiving the vaccine, source of information they had about the vaccines, side effects they experienced if any, why and why not they received. Finally, section (III) investigated the opinion of the participants about the SIV.

Content Validity analysis

The face and content validity of the questionnaire was evaluated by five experts (three in basic medical sciences and two in laboratory investigations and general medicine) and 15 adults. All of their comments were addressed. A content validity index (CVI) was used to measure content validity. The item-CVI and the Scale-CVI/Average and Scale-CVI/UA were 1. The modified kappa (K*) was calculated to adjust the chance of agreement using this formula, K* = (I-CVI—Pc)/(1—Pc), where Pc =[N/A (N—A)] x 0.5N, N = number of raters; A = number of agreements. The K* of each statement was 1. the results showed a good validity 19, 20. Before the questionnaire was distributed, 15 adults tested its usability and

technical functionality.

Research ethics review

The study protocol was reviewed and approved by the Scientific Research Ethics Review board of KSU (Approval number: KSU-HE-23-644). The study survey and methodology comply with the ethical guidelines and regulation of the studies involving humans as per the Helsinki Declaration.

An informed consent process was completed before they started to complete the survey. The consent included clarification of the study aims and objective, the data use and confidentiality. It was made clear that agreement to answer the Questionnaire means acceptance to share in the study.

Statistical analysis plan

The received data was automatically transferred into an Excel spreadsheet and then imported into the statistical analysis program. Data analysis was performed using the IBM SPSS Statistics software program for Windows, Version 29 (IBM Corp., Armonk, NY, USA). Descriptive statistics in terms of frequency and percentage were used to detect the prevalence of seasonal influenza vaccinations (SIV) and to describe the participants' characteristics (age group, gender, marital status, educational level, number of family members) and COVID-19 pandemic related factors (number of doses of COVID-19 vaccine taken, the important reasons for taking COVID-19 vaccine, previous diagnoses with COVID-19 infection). The degree of association was measured with Phi coefficient (cp) or Cramer's V (cpc). The association coefficient (r) was interpreted as follows: zero-0.04 is weak or no; 0.05- 0.09 is moderate; 0.10- 0.24 is strong; and equal or more than 0.25 is very strong [21].

The independent variables showing significant correlation were included in the binary logistic regression analysis to explore the predicted variables for the dichotomous SIV (1= yes, 0= No). The target group was defined as taking the seasonal influenza vaccine (If the answer is yes), compared with not taking the vaccine (If the answer is No). Odds ratios (OR) were calculated with a 95% confidence interval (CI). The Likelihood Ratio Test was used to exclude variables which were not statistically significant ($p > .05$) from the model. Correlation matrix (> .7) was used to identify potential multicollinearity for predictor variables. A model fit was evaluated using X2 and p values of Omnibus test of model coefficients. A weak relationship exists between the predictors and the outcome when the value of Nagelkerke's R Square is less than 0.2, and moderate relationship exists between 0.2 and 0.4, and a strong relationship exists above 0.4 [22].

Results:

A total of 848 responses were received; none of the responses were excluded. Eight hundred forty-four participants took part in this study (569; 67.1% were female and 279; 32.9% were male), (64.3% were aged between 18 and 40 years and 18.3% aged from 41 to 50 years, the remaining 17.4% were 51 years old or above).

The prevalence of SIV in 2023 was 42.3% (359 people reported taking the vaccine or planning to take it). On the other hand, a majority of respondents (489; 57.7%) indicated they did not want to receive the annual

influenza vaccination; there were 439 respondents (51.8%) did not believe the vaccine was effective or important. Moreover 38 (4.5%) reported bad previous experience about the SIV, and 3 (0.4%) reported that the vaccine was not available. Only 282 (33.3%) reported receiving SIV before COVID-19.

In a Chi-squared test, SIV was associated with sex (X2 = 7.80, df= 1, P = .01) with a strong effect (<p = .10). Males were more likely to take/plan to take SIV than females, while females were more likely to not take/plan to take SIV. There was an association of SIV with number of family members, (X2 =10.25, df=2, P = .01) with a strong effect (<p c = .11). There is a high proportion of SIV (52.4%) in families of 1-3 members. This decreases to 42.7% in families of 4-5 members and to 37.8% in families having 6 members or more. Vice versa, there is increased in reporting of not taken/planned to take the SIV in families with more members. Age, marital status, employment status, education level, or chronic diseases were not associated with SIV (p >.05). Table 1 summarizes the characteristics of the participants and the association with SIV.

Table 1: participants' characteristics and the association with SIV

	Total N=848		SIV N (%)	Non-SIV N (%)	X2	df	P
Age							
18-40	545	64.3%	238 (43.7%)	307(56.3%)	1.57	2	.46
41-50	155	18.3%	59(38.1%)	96 (61.9%)			
51 and above	148	17.5%	62 (41.9%)	86 (58.1%)			
Sex							
Male	279	32.9%	137(49.1%)	142 (50.9%)	7.80	1	.01*
Female	569	67.1%	222 (39.0%)	347 (61.0%)			

Marital status	Total N=848		S1V N (%)	Non-SIV N (%)	X2	df	p
Single	407	48%	182 (44.7%)	225 (55.3%)	1.82	1	.18
Married	441	52%	177 (40.1%)	264 (59.9%)			
Educational level							
High school or lower	130	15.3%	55 (42.3%)	75 (57.7%)	.03	2	.98
Bachelor	510	60.1%	217 (42.5%)	293 (57.5%)			
Postgraduate	208	25.5%	87 (41.8%)	121 (58.2%)			
Employment Status							
Student	281	33.1 %	188 (43.6%)	243 (56.4%)	1.61	2	.45
Employed	431	50.8%	120 (42.7%)	161 (57.3%)			
Not Employed	136	16%	51 (37.5%)	85 (62.5%)			
Number of family members							
1-3	168	19.8 %	88 (52.4%)	80 (47.6%)	10.25	2	.01*
4-5	286	33.7%	122 (42.7%)	164 (57.3%)			
6 or more	394	46.5%	149 (37.8%)	245 (62.2%)			
Chronic diseases							
No	608	71.7%	255 (41.9%)	353 (58.1%)	.14	1	.71
Yes	240	28.3 %	136 (56.7%)	104 (43.3%)			

SIV= Seasonal Influenza Vaccinations; N = number of participants; %= percentage; X^2 = Pearson's chi-squared; df = degrees of freedom. ***P*=** Level of significance, *a < .05.

Predictor factors of SIV

The model fitting showed that there was a significant relation between SIV and independent variables sex and number of family member (X2 = 17.35, df=3; p c.OOl). Nagelkerke's R2 (.03) indicated a week model fit.

The probability of male taken the SIV (OR=1.49) higher than female. Families of 1-3 member were more likely to take the SIV (OR=1.78). and families of 4-5 member were more likely to take the SIV (OR=1.22) although there were no significant differences between them (P=.21) as shown in the table 2.

Table 2: Binary logistic regression analysis

	B	SE	Wald	df	P	OR	95% CI
Sex							
Male	.39	.15	7.16	1	.01	1.49	1.11-1.99
Female	Reference category						
Number of family members							
1-3	.56	.19	9.52	1	<.01	1.78	1.23-2.57
4-5	.20	.16	1.60	1	.21	1.22	0.89-1.67
6 or more	Reference category						

SIV= Seasonal Influenza Vaccinations; B= beta coefficients; SE- standard of error; df = degrees of freedom. OR= Odd ratio; CI= confidence interval. ***P*****=** Level of significance, *a < .05.

The COVID-19 pandemic impact on individuals' behaviors towards receiving the influenza vaccine.

The majority of participant (822; 96.9%) reported receiving the CO VID-19 vaccine. More than half of them (458; 54%) received it as a mandatory requirement to enter work places, airports, shopping malls, or other public facilities and not by voluntarily. Seven (0.8%) received one dose, 145 (17.1%) received two doses, 643 (75.8%) received three doses, and 27 (3.2%) received the four doses. Among the participants 432 (50.9%) were previously diagnosed with positive COVID-19 infection.

Among the participants, 306 (37.2%) believed that COVID-19 pandemic had no effect on their attitudes towards taking SIV, while 272 (33.1%) believed it had a positive effect, and 244 (29.7%) believed it had a negative effect.

There were 603 respondents (71.1%) who believed that COVID-19 pandemic had raised awareness about respiratory diseases prevention methods. There are 390 people (46%) who disagree that COVID-19 vaccines can substitute SIV and protect from COVID1-9 as well as from influenza infection, 80 (9.4%) who agree, and 378 (44.6%) who are unsure.

The SIV uptake was associated with the number of COVID-19 doses taken (X2 =15.56, df=3, P < .001) with a strong effect (<p c = .18). The percentage of SIV intake was associated with the increase of the number of doses of COVID-19 vaccine. The percentage of having SIV of individuals taking one, two, three and four doses of COVID-19 vaccination were 0 %, 33.8%, 44.9% and 63.0% respectively. There was also an association between the reasons of taking the COVID-19 vaccine and the SIV (X2 =69.48, df=l, P < .001), with a strong effect (<p c = .29). In both of them the internet websites and the social media communications are the most encouraging reason for taking the vaccination. When people took the COVID-19 vaccine by choice, they were more likely to take the SIV as well. Previous diagnoses with positive COVID-19 virus infection showed no association with SIV (p >.05.

Participants who do not take the vaccine or are not planning to take it, reported that they are not convinced about the importance of it. Regarding the source of information about the seasonal influenza vaccination; 70% of the vaccinated precipitants reported that social communication media and the internet websites provided them with the needed data about the importance of the vaccine, advantages and side effects and the vaccination places and booking details. However, 66.3% of the vaccinated participant did.

Discussion

The study investigated the prevalence and factors affecting SIV during the first season (2023) following the end of the global state of emergency for COVID-19 pandemic as well as the impact of the pandemic on vaccination behavior.

In the current study, the rate of SIV exceeds the reported vaccination rate in the nearby counties including (38.9%) among health care professionals in United Arab of Emirates[23] and 32.8% among high-risk disease patients with renal failure and diabetes mellitus in eastern Iran[24]. The prevalence was similar to the prevalence reported in

previous studies in Riyadh; a study conducted in early 2020 reported a 43.7% prevalence of SIV[10], and in another study published in early 2020, 41.8% of individuals plan to take the SIV[11]. A study conducted in 2019 reviled that the prevalence of SIV was 44.3% .

Moreover a study published in 2017 indicated that 44.5% of Saudi population received SIV [12]. In contrast, the prevalence of this study was higher than previously reported for season 2022 in Saudi Arabia's central region, including Riyadh (20,1%), and other regions (between 22.6% and 38.9%) [13]. Also the prevenance was higher than what have been reported in other region of Saudi Arabia, such as Al-Jouf region (27.4%) in 2020/2021[15] and similar than what have been reported in Tabuk, Saudi Arabia, 2021-2022 (43%)[25].

More than half of the respondents either did not receive the vaccine or did not intend to take it, according to this study. They resisted the vaccine for three reasons: personal beliefs regarding its ineffectiveness and lack of importance, negative experiences with previous vaccines, or a lack of availability. According to the results of the current study, the reasons for participants' unwillingness to take the vaccine matched well those reported previously. According to the Centers for Disease Control and Prevention, about 50% of Americans did not receive the seasonal influenza vaccine.[26].

To our knowledge this is the first study conducted after end of the global state of emergency for COVID-19 pandemic. We observe that the prevalence of the current study was similar to the study conducted before or in the early of 2020[10,12], and higher than study conducting during the pandemic in Riyadh[13]. This may be as a result of widespread media coverage and emphasis on Covid-19, other infectious diseases, including seasonal influenza, were overshadowed resulting in fewer people seeking vaccine. A colder climate in Tabuk could explain the higher prevalence of the SIV during the pandemic.

In contrast to other studies, there was no association of SIV with age [25], marital status [27], educational level [16], employment status [15], and chronic disease. On the other hand, some previous study found that the rate of SIV increase with age [16], being unmarried (single) is associated with lower vaccination rates as compared to being married [11,28]

Vaccination rates are higher among those with a higher education level [14-25-29].

It was reported that employment status (employed) had a positive influence on SIV [13],[15,25] and patients with chronic health problems have 85% increased odds ratio of vaccination compared to the participants with no chronic health problems [13].

This could be due to the fact that vaccines are now seen as an essential part of preventive care, and people with different characteristics are more aware of their importance, thus eliminating the differences between people who have different characteristics when it comes to SIV.

The researchers discovered that 49.1% of the male participants had received the flu shot whereas only 39.0 % of the females had not. Comparable to our result, Mohamed M et al 2023, founds increased SIV rate between the

male gender in TABUK city in KSA[25]. Similarly Al sharani et al 2023 in the Southern region of KSA [13]. Opposite the findings of our study, the rate of vaccination was higher in Females than male participants in other studies in KSA [n'14]. We suggest that cultural factors or a validity and the degree of believe in the vaccine importance may be behind the decreased vaccination rate in female, also presence of pregnancy and lactation may interfere with the vaccination of the females in the reproductive age group. The latter may be related to insufficient information about the safety of vaccination in these particular conditions of the females' participants. In addition females may experience more worries and fear of the injections in general and flu vaccine side effects in particular [30].

A family's size was inversely correlated with the intake of SIV. The highest rates of SIV were found in small families of 1-3 members, while rates decreased in larger families. Despite the limited number of studies on family size, one study found that living with another individual predicted vaccination uptake [31]. Probably with a larger family size, scheduling appointments and coordinating with family members' schedules can be demanding.

Among the participants in this study, SIV prevalence was significantly higher after the pandemic than it was before the pandemic. Perhaps this is due to the fact that most of them reported that the CO VID-19 pandemic raised awareness of respiratory diseases prevention methods as reported by other studies [16_18].

The relatively high SIV rate observed in 2023 in the current study in comparison to the rate before could be attributed to the overall vaccination program against COVID-19 infection that necessitates the intake of 1-3 doses in certain individuals and the extensive non- medical measures to prevent the spreading of the respiratory tract infections such as social distancing, lockdown and wearing face makes. This atmosphere increases the overall public awareness about the prevention attitude against the infectious respiratory diseases and the importance of receiving the vaccination [17].

Additionally, the experiences of the COVID-19 pandemic increase the people awareness by the behavioral measures against respiratory infections as reported by 71% of the current study participants. According to this study, the percentage of SIV intake correlated with the increase in doses of COVID-19 vaccine, which is in accordance with previous reports, during the pandemic, of a very high rate of co-administration of the third COVID-19 dose and SIV among healthcare personnel in a recent single-center study by Stefanizzi et al [32]. The general public's attitude toward COVID-19 may have affected their readiness to receive an influenza vaccine [33].This demonstrated an increased willingness to get vaccinated was higher among persons who believed that vaccinations generally had benefits and that the COVID-19 virus posed a threat to their community. This could be attributed to the rich supply of information and awareness programs and campaigns about the respiratory viral infections in particular and how

they are transmitted, and how the vaccine is prepared and its mechanism of action.

A significant association was found between the reasons for taking the CO VID-19 vaccine and SIV. Participants who took the COVID-19 vaccine voluntarily were more likely to take the SIV, which reflects their positive attitude towards vaccination. Conversely, those who received the COVID-19 vaccine against their will were more likely to not receive the SIV vaccine. This observed correlation can be explained by the attitudes, beliefs, and motivations of individuals regarding vaccinations. The findings of this study align with previous research that emphasizes the role of attitudes, beliefs, and motivations in shaping individuals' vaccination decisions[10-12]. Previous studies have shown that individuals who hold positive attitudes and beliefs towards vaccination are more likely to get vaccinated, while those with negative attitudes or skepticism towards vaccines may be reluctant to vaccinate.

Limitation

The study was subject to some limitations. Although we used a convenience sample of Saudi adults located in Riyadh city. However, the questionnaire was designed in Arabic language only, this limited the participation of those who read and speak Arabic. This made it difficult for a reasonable sector of the international workers living in Riyadh to participate in the study. It was useful to reach them also if an English translation of the questionnaire was considered. Additionally, the distribution of the questionnaire was through E-mail and social media platforms. This limited the responders to those using smart phones and are familiar with the internet applications.

Conclusion

The acceptance and compliance with SIV among adults in Riyadh City of KSA is still below the goals of the vaccination coverage program of the local health authorities. Health education programs to increase the public awareness about the disease severity and the safety and efficiency of the vaccine are highly needed. This would increase the vaccination uptake, particularly among females and the subjects living in large sized families.

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