

Acceptability of The Flu Vaccine among The General Population in Tabuk, Saudi Arabia, 2021-2022

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ABSTRACT

Background: Vaccine hesitancy and ignoring prevents reaching the desired rates of vaccine coverage.

Objectives: The present study was conducted to identify factors for the acceptability of the seasonal flu vaccination in the 2021-2022 season.

Patients and methods: A cross-sectional study was conducted between December 2021 and February 2022 among the general population of Tabuk, KSA. A structured, self-administered, web-based questionnaire was distributed to a sample of adult residents of Tabuk, Saudi Arabia. The questionnaire included: 1) demographic data; 2) information about contracting COVID-19 and/or getting COVID-19 vaccination; and 3) acceptance or refusal of flu vaccination and reasons for either.

Results: Most respondents (73%) believed that the flu vaccine was important, but only 45% received the vaccine during the years 2021-2022. Independent predictors for believing the vaccine's importance were having good knowledge about the vaccine, thinking that influenza is dangerous, hearing about the vaccine or taking it before, and believing that it reduces susceptibility to the disease. The independent predictors for vaccine acceptability were the male gender, the medical profession, perceiving influenza as a dangerous disease, believing the importance of the vaccine, uptake of the vaccine, and believing that the vaccine could reduce susceptibility.

Conclusion: A considerable proportion of the Tabuk adult population holds misconceptions about influenza and its vaccines. These misconceptions reduce the rate of vaccination coverage. COVID-19 infection or vaccination did not significantly contribute to flu vaccine acceptability. Health education about the flu vaccine's safety and efficacy can increase vaccine acceptability.

Keywords: COVID-19, Immunization, Influenza vaccine, Seasonal influenza, Vaccination uptake, Cross sectional study, King Salman Armed Forces Hospital.

INTRODUCTION

The global annual incidence of influenza approximates one billion cases, out of which 3–5 million cases develop severe disease, and 290,000–650,000 cases end in death. Most deaths occur in children younger than 12-years-old or elderly people aged over 65 years ⁽¹⁾.

Influenza leads to hospital admissions and absence from work, resulting in increased health expenditure and reduced productivity, which in turn account for massive economic costs ⁽²⁾. Vaccination represents the main strategy for reducing the incidence of seasonal influenza. The WHO and the Centers for Disease Control and Prevention in the United States have emphasized the safety and efficacy of the seasonal flu vaccine to protect against the disease and prevent the development of severe complications and hospital admissions ⁽³⁻⁵⁾. The Kingdom of Saudi Arabia (KSA) is particularly susceptible to outbreaks and epidemics of influenza as the Kingdom receives millions of Muslims from around the world to perform Umrah and pilgrimage ⁽⁶⁾. Influenza vaccination is free of charge in Saudi Arabia and is indicated for any individual over 6 months of age in the absence of any contraindication. In

addition, the Saudi Ministry of Health launched a 5-year strategic project in 2014 to increase vaccination coverage among high-risk groups ⁽⁷⁾. During the COVID-19 pandemic, concerns have been raised regarding the co-occurrence of the influenza epidemic and the resultant aggravated respiratory morbidities and mortalities ⁽⁸⁾. The WHO has recommended influenza vaccination for high-risk groups during the COVID-19 pandemic. The Saudi Ministry of Health stated the role of the influenza vaccine in reducing influenza-related mortality and morbidity during the COVID-19 pandemic ⁽⁹⁾.

Understanding the factors that increase the acceptability of influenza vaccination is essential to designing effective strategic projects to increase vaccination coverage and rate with the goal of reducing seasonal influenza-related morbidity and mortality ⁽¹⁰⁾. The present study aimed to assess knowledge, beliefs, and attitudes regarding flu vaccination and to investigate the association between participants' demographic and professional characteristics, COVID-19 exposure and/or vaccination, and the acceptability of seasonal flu vaccination in the 2021-2022 season.

PATIENTS AND METHODS

Study design, setting, and date: A cross-sectional study was conducted between December 2021 and February 2022 among the general population of Tabuk, KSA.

Study participants: All the residents of Tabuk City were invited to participate. We included adults (aged 18 years or more) of both sexes who are residents of Tabuk City, KSA. Participants less than 18 years old and those with incomplete data were excluded from the study.

Sample size calculation: According to the 2020 census, Tabuk City has a population of about 657,000. The sample size was calculated as 663, assuming that the margin of accepted error is 5%, the needed confidence level is 99%, and the response distribution is 50.

Data collection: A structured, self-administered, web-based questionnaire was designed and presented to the participants to collect data. The questionnaire included the following items: (1) demographic information (i.e., age, gender, education, nationality, occupation, marital status, and socioeconomic status); (2) information about contracting COVID-19 and/or getting COVID-19 vaccination; and (3) acceptance or refusal of getting flu vaccination and reasons for either. The questionnaire was validated by a pilot study on 66 participants (10% of the calculated sample size) with the same eligibility criteria as the study sample. The participants of the pilot study were not added to the final sample size of the current study. The needed changes were added after validation. Reliability was checked in terms of inter-and intra-observer equivalence and internal consistency.

Ethical considerations

The study obtained ethical approval from the Research Ethics Committee of King Salman Armed

Forces Hospital, Tabuk, KSA. Participants were informed about the study objectives, methodology, risks, and benefits. Agreement to complete the questionnaire implies agreement to participate in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

An Excel spreadsheet was established for the entry of data. The analyses were carried out using the Statistical Package for Social Sciences (IBM SPSS Statistics), version 26 for Windows (IBM Corp., Armonk, N.Y., USA). Descriptive statistics were carried out to calculate frequencies (N) and percentages (%) for categorical variables and mean with standard deviation (SD) for continuous variables. Statistical tests including Pearson’s Chi-square, Fisher’s exact, and Fisher-Freeman-Halton exact were performed to assess the association between categorical variables. The independent samples T-test was performed to compare normally distributed continuous variables between the two groups. Regression analysis, Stepwise method, of the correlated variate was performed to determine the significant predictors. Statistical significance was set at a P-value ≤ 0.05 .

RESULTS

General characteristics of the respondents:

A total of 623 participants completed the questionnaire, giving a response rate of approximately 94%. The general characteristics of the respondents are presented in **Table 1**. Most respondents (N=453, 73%) believed that the flu vaccine is important, and the number and rate of vaccination is presented in **Figure 1**.

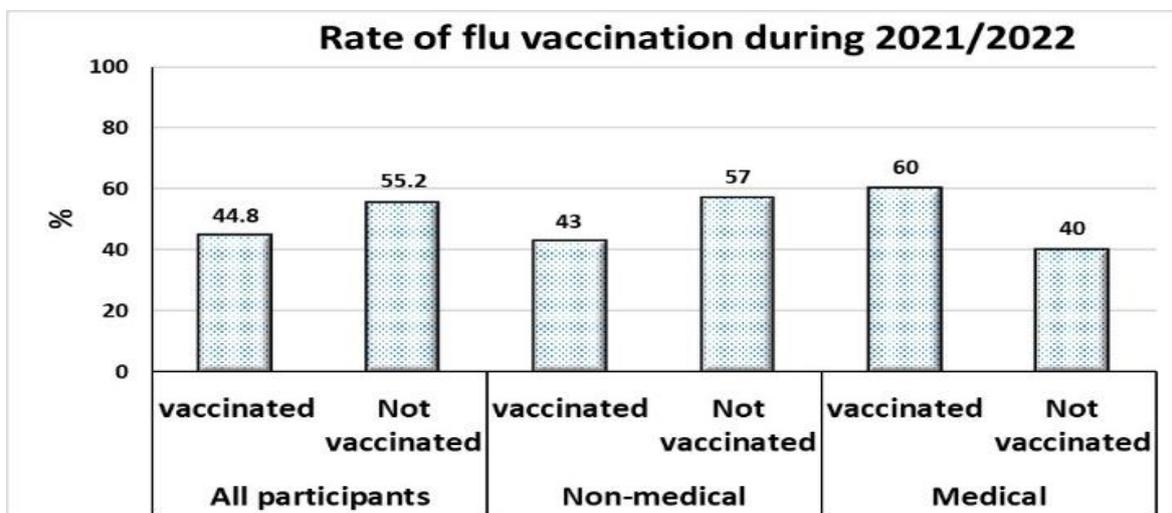


Figure 1. The rate of participants taking the flu vaccine during the year 2021/2022.

Figure 2 reveals the reasons for not taking the flu vaccine. However, most (73%) unvaccinated participants gave no specific reason.

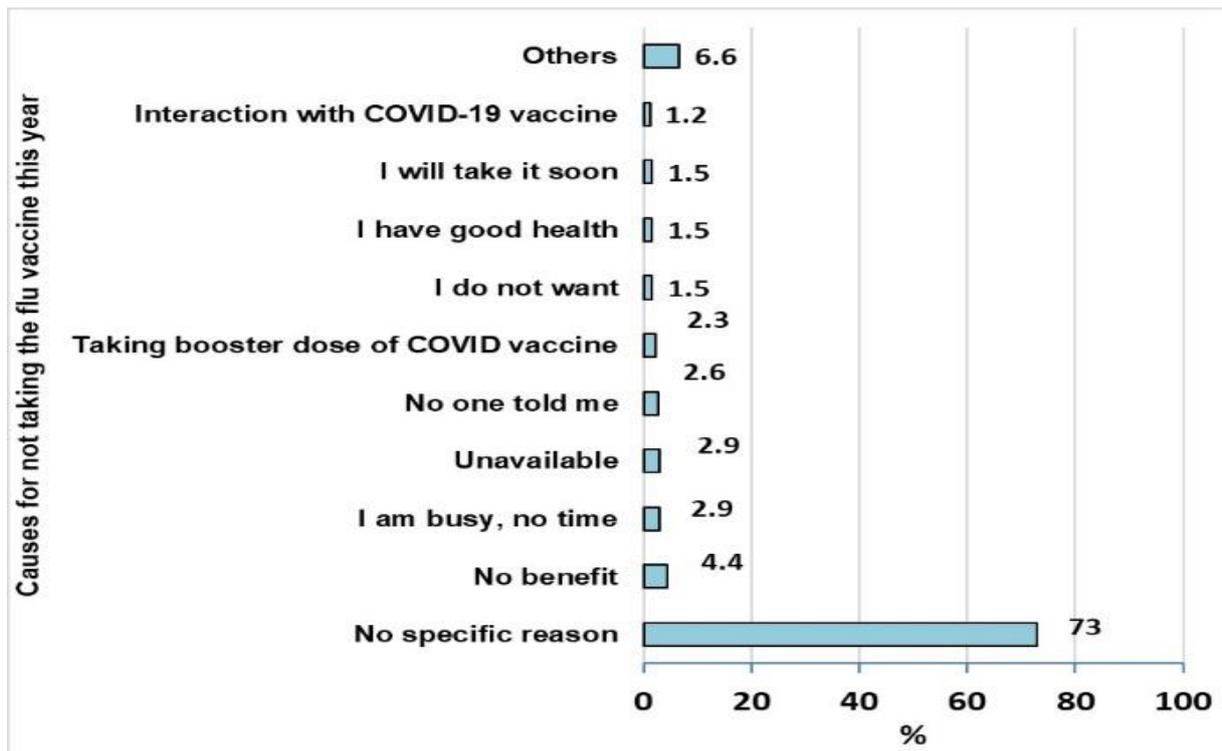


Figure 2. Reasons for not taking the flu vaccine.

Among those who were previously vaccinated, 147 (39.7%) respondents did not get the flu vaccine this year. The causes of non-vaccination in this group deserve analysis, as previous vaccination ought to be a predictor for future vaccination. Most of this group gave no specific reason (N= 93/147), while the other causes included having no time (N= 10/147), unavailability of the vaccine (N= 6/147), postponing to have the booster dose of COVID-19 vaccine (N= 5/147), perceiving no benefit (N= 5/147), fearing interaction with COVID-19 vaccination (N= 4/147), not knowing that the new vaccine is available, fearing the side effects (N= 3/147), having good health (N= 3/147), pregnancy (N= 2/147), not wanting the vaccine (N= 2/147), forgetting (N= 2/147), thinking previous vaccination is enough (N= 1/147), and thinking the vaccine causes flu (N= 1/147). Five out of the 147 respondents said they intend to take the vaccine.

Most respondents thought they had good knowledge of influenza (80.4%) and believed they were susceptible to acquiring the disease (77%). More than half the respondents (55.7%) perceived that influenza is not a dangerous disease. Most respondents had heard about the vaccine (84.9%) and believed in its importance (72.7%). Only 63.9% have taken the flu vaccine before, with two-thirds of them taking the vaccine more than once. Slightly more than half of the respondents (53.5%) believed the vaccine would not reduce their susceptibility to influenza. Only 20.5% reported experiencing adverse effects (Table 2).

Approximately one-third of respondents heard that the vaccine was not effective. The most frequent

source of this information was the internet (34.7%), followed by the media (26.1%), and medical staff (22.6%). About 29% heard that the vaccine had unacceptable side effects, with the most common sources of information being the internet, media, and medical staff (31.7, 26.1, and 26.1%; Table 3).

Believing the importance of the flu vaccine: Believing the importance of the flu vaccine was significantly associated with having postgraduate studies (P <0.001), having a medical profession (P= 0.016), earning a monthly income above 15,000 SAR (P= 0.016), and taking the COVID-19 vaccine (P <0.001; Table 1). Moreover, the belief in the flu vaccine's importance was significantly associated with having good knowledge about influenza (P <0.001), thinking that influenza is dangerous (P <0.001) and that oneself is susceptible to the disease (P <0.001), hearing about the flu vaccine before (P <0.001), taking the vaccine this year (P <0.001), taking the flu vaccine before (P <0.001), and believing that the vaccine would reduce one's susceptibility to influenza (P <0.001; Table 2). On the other hand, no significant association was found with hearing that the vaccine is ineffective or has unacceptable side effects (P >0.05; Table 3). A multivariate binomial logistic regression analysis was conducted to assess factors that significantly contributed to the belief in the importance of the vaccine. Independent predictors were having a good knowledge about the vaccine (P <0.001), thinking that influenza is dangerous (P= 0.001), hearing about the vaccine before (P= 0.001), taking the vaccine before

(P= 0.003), and believing that it reduces susceptibility to the disease (P <0.001, **Table 7**).

Taking the vaccine during the year 2021-2022:

Acceptability of the flu vaccine was significantly associated with male gender (P= 0.009), having postgraduate studies (P= 0.008), having a medical profession (P <0.001), earning an income above 15,000 SAR (P= 0.001), having taken COVID-19 vaccine before (P <0.001). No significant associations were detected with age (P= 0.518), nationality (P= 0.920), marital status (P= 0.424), contracting COVID-19 (P= 0.221), or having chronic diseases (P= 0.458, **Table 4**).

In addition, acceptability of the vaccine was significantly associated with having good knowledge (P <0.001), perceiving influenza as dangerous (P <0.001), believing in one’s susceptibility to acquiring the disease (P <0.001), hearing about the flu vaccine before (P

<0.001), believing the importance of the vaccine (P <0.001), taking the vaccine before (P <0.001), believing that the vaccine can reduce the susceptibility to have the disease (P <0.001, **Table 5**).

However, no significant association was detected with hearing about the vaccine’s non-efficacy or adverse effects (P >0.05, **Table 6**).

The multivariate binomial logistic regression analysis revealed that the following factors were independent predictors for vaccine acceptability: male gender (P= 0.018), medical profession (P= 0.044), perceiving influenza as a dangerous disease (P= 0.001), believing the importance of the flu vaccine (P= 0.035), up taking the vaccine before (P <0.001), believing the vaccine could reduce susceptibility (P <0.001). Experiencing side effects was also significantly associated with vaccine acceptability (**Table 7**).

Table 1. Sociodemographic factors of the respondents and COVID-19 status (Total n= 623).

Variable		Do you believe that the flu vaccine is important?				P-value
		All participants (n=623)	Yes (n=453)	No (n=170)	Unadjusted OR (95% CI)	
Age (years)	Mean ± SD (Min–Max)	34.3 ± 9.8 (18.0-75.0)	34.2 ± 9.5 (18.0-70.0)	34.5 ± 10.6 (18.0-75.0)	0.997 (0.979–1.015)	0.748
Gender	Male	410 (65.8%)	291 (64.2%)	119 (70.0%)	0.770 (0.526–1.126)	0.177
	Female	213 (34.2%)	162 (35.8%)	51 (30.0%)	Reference	
Nationality	Saudi	517 (83.0%)	370 (81.7%)	147 (86.5%)	Reference	0.156
	Non-Saudi	106 (17.0%)	83 (18.3%)	23 (13.5%)	1.434 (0.870–2.363)	
Education	High school or less	145 (23.3%)	91 (20.1%) \$-	54 (31.8%) \$+	Reference	<0.001*
	University graduate	407 (65.3%)	299 (66.0%)	108 (63.5%)	1.643 (1.099–2.456)	
	Postgraduate studies	71 (11.4%)	63 (13.9%) \$+	8 (4.7%) \$-	4.673 (2.081–10.494)	
Occupation	Medical	165 (26.5%)	134 (29.6%)\$+	31 (18.2%) \$-	1.991 (1.163–3.410)	0.016*
	Non-medical	328 (52.6%)	230 (50.8%)	98 (57.6%)	1.081 (0.697–1.677)	
	Unemployed	130 (20.9%)	89 (19.6%)	41 (24.1%)	Reference	
Marital status	Single	204 (32.7%)	143 (31.6%)	61 (35.9%)	Reference	0.572
	Married	398 (63.9%)	295 (65.1%)	103 (60.6%)	1.222 (0.840–1.777)	
	Divorced	21 (3.4%)	15 (3.3%)	6 (3.5%)	1.066 (0.395–2.879)	
Monthly income in SAR	Less than 5,000	199 (31.9%)	139 (30.7%)	60 (35.3%)	Reference	0.016*
	5000–15000	345 (55.4%)	246 (54.3%)	99 (58.2%)	1.073 (0.732–1.572)	
	More than 15,000	79 (12.7%)	68 (15.0%) \$+	11 (6.5%) \$-	2.668 (1.318–5.402)	
Had COVID-19 before	Yes	233 (37.4%)	168 (37.1%)	65 (38.2%)	0.952 53 (0.662–1.369)	0.792
	No	390 (62.6%)	285 (62.9%)	105 (61.8%)	Reference	
Took COVID-19 vaccine before?	Yes	561 (90.0%)	430 (94.9%)\$+	131 (77.1%) \$-	5.566 (3.208–9.658)	<0.001*
	No	62 (10.0%)	23 (5.1%) \$-	39 (22.9%) \$+	Reference	
Do you have any chronic diseases?	Yes	141 (22.6%)	97 (21.4%)	44 (25.9%)	0.780 (0.518–1.176)	0.235
	No	482 (77.4%)	356 (78.6%)	126 (74.1%)	Reference	

CI: confidence interval; Max: maximum; Min: minimum; OR: odds ratio; SAR: Saudi riyal; SD: standard deviation; * significant at P≤0.05; \$+ significantly higher frequency than expected by chance; \$-significantly lower frequency than expected by chance.

Table 2. Respondents' knowledge about influenza and its vaccine (Total n= 623).

Variable		Do you believe that the flu vaccine is important?				P-value
		All participants (n=623)	Yes (n=453)	No (n=170)	Unadjusted OR (95%CI)	
What about your knowledge about influenza?	Good	501 (80.4%)	405 (89.4%)	96 (56.5%)	6.504 (4.248–9.958)	<0.001*
	Not good	122 (19.6%)	48 (10.6%)	74 (43.5%)	Reference	
Is influenza a dangerous disease?	Yes	276 (44.3%)	233 (51.4%)	43 (25.3%)	3.128 (2.114–4.628)	<0.001*
	No	347 (55.7%)	220 (48.6%)	127 (74.7%)	Reference	
Are you susceptible to acquiring influenza?	Yes	480 (77.0%)	388 (85.7%)	92 (54.1%)	5.061 (3.392–7.550)	<0.001*
	No	143 (23.0%)	65 (14.3%)	78 (45.9%)	Reference	
Have you heard about the flu vaccine before?	Yes	529 (84.9%)	427 (94.3%)	102 (60%)	10.949 (6.635–18.068)	<0.001*
	No	94 (15.1%)	26 (5.7%)	68 (40%)	Reference	
Did you up take the vaccine this year?	Yes	453 (72.7%)	241 (53.2%)	38 (22.4%)	3.949 (2.633–5.922)	<0.001*
	No	170 (27.3%)	212 (46.8%)	132 (77.6%)	Reference	
Have you ever uptake the flu vaccine?	Yes	398 (63.9%)	338 (74.6%)	60 (35.3%)	5.388 (3.688–7.872)	<0.001*
	No	225 (36.1%)	115 (25.4%)	110 (64.7%)	Reference	
If yes how many times?	Once	137 (34.4%)	113 (33.4%)	24 (40%)	Reference	0.397
	2-3	201 (50.5%)	171 (50.6%)	30 (50%)	1.211 (0.673–2.177)	
	4 and more	60 (15.1%)	54 (16%)	6 (10%)	1.912 (0.738–4.950)	
Did you believe that it reduces your susceptibility to influenza?	Yes	290 (46.5%)	252 (55.6%)	38 (22.4%)	4.355 (2.903–6.534)	<0.001*
	No	333 (53.5%)	201 (44.4%)	132 (77.6%)	Reference	
Did you experience unacceptable side effects?	Yes	128 (20.5%)	93 (20.5%)	35 (20.6%)	0.996 (0.644–1.541)	0.987
	No	495 (79.5%)	360 (79.5%)	135 (79.4%)	Reference	

CI: confidence interval; OR: odds ratio; * Significant at $P \leq 0.05$; \$+ significantly higher frequency than expected by chance; \$-significantly lower frequency than expected by chance

Table 3. Respondents' knowledge about the efficacy and side effects of the vaccine and the sources of knowledge (Total n= 623)

Variable		Do you believe that the flu vaccine is important?				P-value
		All participants (n=623)	Yes (n=453)	No (n=170)	Unadjusted OR (95%CI)	
Did you hear that the vaccine is not effective?	Yes	199 (31.9%)	153 (33.8%)	46 (27.1%)	1.375 (0.930–2.031)	0.109
	No	424 (68.1%)	300 (66.2%)	124 (72.9%)	Reference	
If yes, from where did you hear about that?	Media	52 (26.1%)	40 (26.1%)	12 (26.1%)	Reference	0.947
	Internet	69 (34.7%)	55 (35.9%)	14 (30.4%)	1.179 (0.493–2.819)	
	Health campaigns	13 (6.5%)	10 (6.5%)	3 (6.5%)	1.000 (0.236–4.231)	
	Colleagues	20 (10.1%)	15 (9.8%)	5 (10.9%)	0.900 (0.271–2.989)	
	Medical staff	45 (22.6%)	33 (21.6%)	12 (26.1%)	0.825 (0.328–2.077)	
Did you hear that the vaccine has an unacceptable side effect?	Yes	180 (28.9%)	121 (26.7%)	59 (34.7%)	0.686 (0.470–1.001)	0.059
	No	443 (71.1%)	332 (73.3%)	111 (65.3%)	Reference	
If yes, from where did you hear about that?	Media	47 (26.1%)	33 (27.3%)	14 (23.7%)	Reference	0.694
	Internet	57 (31.7%)	40 (33.1%)	17 (28.8%)	0.998 (0.429–2.322)	
	Health campaigns	13 (7.2%)	8 (6.6%)	5 (8.5%)	0.679 (0.189–2.442)	
	Colleagues	16 (8.9%)	12 (9.9%)	4 (6.8%)	1.273 (0.349–4.636)	
	Medical staff	47 (26.1%)	28 (23.1%)	19 (32.2%)	0.625 (0.266–1.469)	

CI: confidence interval; OR: odds ratio.

Table 4. Sociodemographic factors of the respondents and COVID-19 status (Total n= 623)

Variable		Did you up take the vaccine this year?			p-value
		Yes (n=279)	No (n=344)	Unadjusted OR (95%CI)	
Age (years)	Mean ± SD (Min–Max)	34.6 ± 9.8 (20.0-70.0)	34.1 ± 9.9 (18.0-75.0)	1.005 (0.989-1.022)	0.518
Gender	Male	199 (71.3%)	211 (61.3%)	1.568 (1.118–2.199)	0.009*
	Female	80 (28.7%)	133 (38.7%)	Reference	
Nationality	Saudi	232 (83.2%)	285 (82.8%)	Reference	0.920
	Non-Saudi	47 (16.8%)	59 (17.2%)	0.979 (0.643-1.49)	
Education	High school or less	60 (21.5%)	85 (24.7%)	Reference	0.008*
	University graduate	175 (62.7%)	232 (67.4%)	1.069 (0.728-1.569)	
	Postgraduate studies	44 (15.8%) \$+	27 (7.8%) \$-	2.309 (1.29-4.132)	
Occupation	Medical	99 (35.5%) \$+	66 (19.2%) \$-	3.500 (2.149–5.699)	<0.001*
	Non-medical	141 (50.5%)	187 (54.4%)	1.759 (1.140–2.716)	
	Unemployed	39 (14%) \$-	91 (26.5%) +	Reference	
Marital status	Single	84 (30.1%)	120 (34.9%)	Reference	0.424
	Married	186 (66.7%)	212 (61.6%)	1.253 (0.891-1.763)	
	Divorced	9 (3.2%)	12 (3.5%)	1.071 (0.432-2.657)	
Monthly income in SAR	Less than 5,000	71 (25.4%) \$-	128 (37.2%) \$+	Reference	0.001*
	5000–15000	160 (57.3%)	185 (53.8%)	1.559 (1.089-2.233)	
	More than 15,000	48 (17.2%) \$+	31 (9%) \$-	2.791 (1.632-4.774)	
Had COVID-19 before	Yes	97 (34.8%)	136 (39.5%)	0.815 (0.587–1.131)	0.221
	No	182 (65.2%)	208 (60.5%)	Reference	
Took COVID-19 vaccine before?	Yes	265 (95%)	296 (86%)	3.069 (1.655–5.694)	<0.001*
	No	14 (5%)	48 (14%)	Reference	
Do you have any chronic diseases?	Yes	67 (24%)	74 (21.5%)	1.153 (0.791–1.680)	0.458
	No	212 (76%)	270 (78.5%)	Reference	

CI: confidence interval; Max: maximum; Min: minimum; OR: odds ratio; SAR: Saudi riyal; SD: standard deviation; * Significant at P≤0.05; \$+ significantly higher frequency than expected by chance; \$-significantly lower frequency than expected by chance.

Table 5. Respondents' knowledge about influenza and its vaccine (Total n= 623).

Variable		Did you uptake the vaccine this year?			P-value
		Yes (n=279)	No (n=344)	Unadjusted OR (95%CI)	
What about your knowledge about influenza?	Good	244 (87.5%)	257 (74.7%)	2.360 (1.536–3.627)	<0.001*
	Not good	35 (12.5%)	87 (25.3%)	Reference	
Is influenza a dangerous disease?	Yes	156 (55.9%)	120 (34.9%)	2.367 (1.712–3.274)	<0.001*
	No	123 (44.1%)	224 (65.1%)	Reference	
Are you susceptible to acquiring influenza?	Yes	235 (84.2%)	245 (71.2%)	2.158 (1.450–3.212)	<0.001*
	No	44 (15.8%)	99 (28.8%)	Reference	
Have you heard about the flu vaccine before?	Yes	264 (94.6%)	265 (77%)	5.247 (2.944–9.350)	<0.001*
	No	15 (5.4%)	79 (23%)	Reference	
Do you believe that the flu vaccine is important?	Yes	241 (86.4%)	212 (61.6%)	3.949 (2.633–5.922)	<0.001*
	No	38 (13.6%)	132 (38.4%)	Reference	
Have you ever uptake the flu vaccine?	Yes	230 (82.4%)	168 (48.8%)	4.717 (3.383–7.147)	<0.001*
	No	49 (17.6%)	176 (51.2%)	Reference	
If yes how many times?	Once	57 (24.8%) \$-	80 (47.6%) \$+	Reference	<0.001*
	2-3	127 (55.2%)	74 (44%)	2.409 (1.544-3.757)	
	4 and more	46 (20%) \$+	14 (8.3%) \$-	4.612 (2.318-9.175)	
Did you believe that it reduces your susceptibility to influenza?	Yes	177 (63.4%)	113 (32.8%)	3.547 (2.546–4.942)	<0.001*
	No	102 (36.6%)	231 (67.2%)	Reference	
Did you experience unacceptable side effects?	Yes	76 (27.2%)	52 (15.1%)	2.102 (1.415–3.123)	<0.001*
	No	203 (72.8%)	292 (84.9%)	Reference	

CI: confidence interval; OR: odds ratio; * Significant at $P \leq 0.05$; \$+ significantly higher frequency than expected by chance; \$- significantly lower frequency than expected by chance.

Table 6. Respondents' knowledge about the efficacy and side effects of the vaccine and the sources of knowledge (Total n= 623).

Variable		Did you uptake the vaccine this year?			P-value
		Yes (n=279)	No (n=344)	Unadjusted OR (95%CI)	
Did you hear that the vaccine is not effective?	Yes	82 (29.4%)	117 (34%)	0.808 (0.574–1.135)	0.219
	No	197 (70.6%)	227 (66%)	Reference	
If yes, from where did you about that?	Media	16 (19.5%)	36 (30.8%)	Reference	0.207
	Internet	27 (32.9%)	42 (35.9%)	1.446 (0.675-3.099)	
	Health campaigns	8 (9.8%)	5 (4.3%)	3.6 (1.018-12.73)	
	Colleagues	9 (11%)	11 (9.4%)	1.841 (0.638-5.312)	
	Medical staff	22 (26.8%)	23 (19.7%)	2.152 (0.939-4.934)	
Did you hear that the vaccine has an unacceptable side effect?	Yes	79 (28.3%)	101 (29.4%)	0.950 (0.670–1.347)	0.775
	No	200 (71.7%)	243 (70.6%)	Reference	
If yes, from where did you hear about that?	Media	20 (25.3%)	27 (26.7%)	Reference	0.229
	Internet	24 (30.4%)	33 (32.7%)	0.982 (0.449-2.145)	
	Health campaigns	9 (11.4%)	4 (4%)	3.037 (0.818-11.281)	
	Colleagues	9 (11.4%)	7 (6.9%)	1.736 (0.553-5.452)	
	Medical staff	17 (21.5%)	30 (29.7%)	0.765 (0.334-1.754)	

CI: confidence interval; OR: odds ratio.

Table 7. Multivariate binary logistic regression analysis for factors associated with the acceptability of the flu vaccine.

Variables	Believing that the flu vaccine is important		Up taking the vaccine this year	
	OR (95%CI)	P-value	OR (95%CI)	P-value
Male gender (reference: female)	-	-	1.716 (1.096-2.688)	0.018*
Education				
University graduate (reference: high school or less)	1.167 (0.692-1.969)	0.562	0.831 (0.523-1.323)	0.436
Postgraduate studies (reference: high school or less)	1.371 (0.518-3.631)	0.525	0.8 (0.376-1.702)	0.563
Occupation				
Medical profession (reference: unemployed)	0.805 (0.406-1.597)	0.535	1.869 (1.016-3.439)	0.044*
Non-medical (reference: unemployed)	0.984 (0.566-1.713)	0.955	1.2 (0.696-2.068)	0.512
Monthly income				
5,000 to 15,000 (reference less than 5,000)	1.002 (0.612-1.641)	0.995	1.287 (0.836-1.981)	0.252
More than 15,000 (reference less than 5,000)	0.976 (0.408-2.332)	0.956	1.442 (0.73-2.851)	0.292
Took COVID-19 vaccine before? (reference: no)	2.098 (0.993-4.433)	0.052	1.941 (0.904-4.169)	0.089
What about your knowledge about influenza? (reference: not good)	3.181 (1.818-5.564)	<0.001*	1.125 (0.639-1.98)	0.684
Is influenza a dangerous disease? (reference: no)	2.212 (1.362-3.591)	0.001*	1.931 (1.299-2.872)	0.001*
Are you susceptible to acquiring influenza? (reference: no)	1.353 (0.775-2.363)	0.288	0.767 (0.451-1.303)	0.327
Have you heard about the flu vaccine before? (reference: no)	3.025 (1.573-5.819)	0.001*	1.706 (0.827-3.52)	0.148
Do you believe that the flu vaccine is important? (reference: no)	-	-	1.743 (1.04-2.924)	0.035*
Did you uptake the vaccine this year? (reference: no)	1.572 (0.953-2.592)	0.076	-	-
Have you ever uptake the flu vaccine? (reference: no)	2.069 (1.274-3.36)	0.003*	2.662 (1.705-4.157)	<0.001*
Did you believe that it reduces your susceptibility to influenza? (reference: no)	2.647 (1.628-4.303)	<0.001*	2.505 (1.706-3.68)	<0.001*
Did you experience unacceptable side effects? (reference: no)	-	-	2.07 (1.301-3.294)	0.002*

CI: confidence interval; OR: odds ratio; * significant at P<0.05.

DISCUSSION

The sociodemographic data of the participants indicated that most participants were highly educated and about one-quarter were healthcare workers. This was reflected in the high percentage of self-reported good knowledge about influenza (80.4%), the belief of being susceptible to the disease (77%), hearing about the vaccine (84.9%), and believing its importance (72.7%). However, nearly half of the respondents thought that influenza was not a dangerous disease (55.7%) and that the vaccine would not reduce their susceptibility to influenza (53.5%). This finding calls for more efforts to increase the public's awareness about the serious consequences of influenza and the vaccine's efficacy, as poor knowledge constitutes a barrier against vaccination ⁽¹¹⁾.

Another key finding of the current study is the relatively low (45%) flu vaccination rate among the participants, and a large group of non-vaccinated participants gave no specific reason (73%). The rates of flu vaccination among the general population in KSA generally ranged from 42.9% to 55% ⁽¹²⁻¹⁵⁾. The rates among healthcare workers in KSA ranged from 41% to 67% ⁽¹⁶⁻²⁰⁾. Meanwhile, a lower rate of 36.7% was

reported by **Sagor and AlAteeq** ⁽²¹⁾. The higher rate of vaccination among healthcare workers was expected as the ministry of health in KSA mandates the intake of flu vaccine every year for all healthcare workers ^(12,17). Several countries adopt the same policy to restrict nosocomial contraction of influenza ⁽²²⁾.

On the other hand, the rate of vaccination coverage in the current study seems low. This deserved more analysis of the causes underlying reluctance to get the vaccine, as our findings and those of previous studies indicate that previous vaccination increases the likelihood of getting the vaccine again, presumably as those individuals possess good knowledge about the vaccine's safety and hold a positive attitude ^(12,14,23,24).

The reported causes in general give an insight into the barriers that contribute to flu vaccination reluctance and hesitancy. An improvement plan for the vaccination campaign should consider these factors. However, the investigation of these causes in depth requires dedicating a separate study with a questionnaire that explores all possible causes, as a large proportion of non-vaccinated participants in the current study replied "no specific reason" or "I do not want".

The respondents' reasons also showed several misconceptions that should be addressed in the health messages that address the public. The most notable of these misconceptions are the inefficacy of the vaccine, thinking that good health obviates the need for vaccination, interaction with the COVID-19 vaccine, belief that pregnant women should not take the vaccine, and that the vaccine causes flu. Similar misconceptions were reported by previous studies in KSA, particularly vaccine inefficacy and non-seriousness of influenza (12, 14, 25).

A notable finding is that the rate of vaccination against COVID-19 among our sample was 90%. The far higher rate of vaccination against COVID-19 compared to flu could be attributed to the public perception of the gravity of the COVID-19 pandemic, besides the messages directed to the public emphasizing the importance of vaccination. Also, strict regulations set by the government mandated uptake of the vaccine, as in the case of individuals travelling to KSA, and for Umrah and pilgrimage.

The present study also assessed the circulating information about the flu vaccine and its sources. Vaccine inefficacy was one misconception that one-third of the respondents heard about. Another piece of information was the unacceptable side effects of the vaccine, which reached 29% of the respondents, but this information did not significantly impact the perception of the vaccine's importance or the acceptability of vaccination.

Several studies assessed the factors contributing to flu vaccine acceptability, with varying results. As regards our respondents' perceiving the importance of the flu vaccine, logistic regression revealed that the independent predictors included good knowledge of the vaccine, thinking that influenza is dangerous, hearing about or taking the vaccine before, and believing that it reduces susceptibility to the disease. Most of these factors were also attributed to the likelihood of getting the vaccine in 2021 and 2022, where the independent predictors included the male gender, the medical profession, perceiving influenza as dangerous, believing the importance of the flu vaccine, having taken the vaccine before, and believing the vaccine could reduce susceptibility. These findings stress further the interlink between convincing the targeted population of the vaccine's role and the importance of uptaking the vaccine. Interestingly, experiencing side effects was associated with vaccine acceptability, but it is a result of taking the vaccine more than a factor promoting taking the vaccine.

Our results are corroborated by the findings of previous studies, which stated that perceiving the risk of infection and the importance of protection motivates individuals to uptake the flu vaccine (18, 23, 26, 27).

In the current study, the mean age did not differ based on perceiving the vaccine's importance or uptaking it. A systematic review by **Nagata et al.** (28) on determinants of flu vaccination in elderly people

reported that vaccination probability increased with age in 2 studies, while a third study found no effect of age. **Domnich et al.** (24) in Italy found that the mean age of reluctant participants was significantly lower than those who got the vaccine (43.4 vs. 49 years, $P < 0.001$). However, the systematic review specifically included those aged 65 years or above. These controversies could also be attributed to different cultural and other sociodemographic characteristics of the studied populations.

Individuals with a higher level of education are more likely to understand the vaccine's importance and have sound information about immunization (11,29). Our results showed that higher education had a positive impact on perceiving the vaccine's importance and on uptaking the vaccine in univariate analysis. However, no significant contribution was detected when adjusted for other factors in the multivariate analysis. This may be explained by the adjusting effect of the variable "perceiving the vaccine's importance", which appears to encompass education as well as the variables "good knowledge" and "hearing about the flu vaccine before". A non-significant impact of education was also reported by **Domnich et al.** (24) in multivariate analysis. A study in KSA by **Alwazeh et al.** (15) showed that flu vaccination coverage was significantly higher among COVID-19 patients with higher educational levels, but they did not conduct a multivariate analysis.

Participants' gender showed no significant effect on perceiving the vaccine's importance, but the male gender was significantly associated with vaccination on univariate and multivariate analysis. On the contrary, previous studies in KSA found that the vaccination rates were significantly higher among females than males in univariate (13,15) and multivariate analyses (13).

We found a significant association of monthly income with the vaccine's importance and acceptability on univariate analysis. However, this association was not significant when adjusted for other variables. Flu vaccination is available free of cost in KSA, thus personal income would not constitute a barrier against vaccination. The socioeconomic status is probably linked to other determinants, so adjusting for these factors elicits the lack of significant impact by income. A recent survey in Italy found that lower economic status signified a lower likelihood of influenza vaccination after adjusting for confounders (24).

Our findings suggest the COVID-19 pandemic did not affect flu vaccine acceptability, which is in line with the results of **Sokol and Grummon** (30). However, other studies reported that the COVID-19 pandemic positively impacted individuals' willingness to uptake the flu vaccine (24,31). The lack of impact in our study could be attributed to the high coverage of COVID-19 vaccination among our sample, which gave the participants a sense of safety and, thus, they overlooked the uptake of the flu vaccine.

The fear of adverse effects did not seem to negatively impact the acceptability of the flu vaccine,

but this fear may be under-reported by the respondents. An earlier study identified this factor as the main barrier to uptaking the flu vaccine for 40% of its participants (27).

The most common sources of rumors and misconceptions among our participants were the internet (34.7%), followed by the media (26.1%), and then medical staff (22.6%). Similar results were reported by studies assessing knowledge about the flu vaccine among the general Saudi population (21, 26). To overcome vaccine hesitancy, healthcare workers should educate their patients about the flu vaccine, and the ministry of health should issue dedicated health messages that address the misconceptions about the vaccine and alleviate the public's fear of adverse effects.

Although several studies assessed flu vaccine uptake among the Saudi population, our survey is among the few studies that evaluated determinants of vaccination against flu during the COVID-19 pandemic. No similar study was conducted in Tabuk. Our study also assessed the determinants of perceiving the vaccine's importance. Nevertheless, our study was also subject to some limitations. The cross-sectional nature of the survey prevented the recording of any future changes in the participants' attitudes toward the vaccine. Also, the causes underlying the refusal of vaccination await more thorough exploration than was done in the current study's questionnaire.

In conclusion, a considerable proportion of the Tabuk adult population holds misconceptions about influenza and its vaccines. These misconceptions reduce the rate of vaccination coverage. COVID-19 infection or vaccination did not significantly contribute to flu vaccine acceptability. Health education about the flu vaccine's safety and efficacy can increase vaccine acceptability.

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