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Willingness of Saudi Adults to Receive a COVID-19 Vaccine Booster Dose

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Abstract: Background: COVID-19 vaccine booster dose hesitancy amongst the Saudi Arabia population is a concern. The objectives of the study were to explore the Saudi public's willingness to receive a COVID-19 vaccine booster dose and identify the factors affecting their willingness. Methods: From December 2021 to March 2022, an online cross-sectional survey using an anonymous, structured, and self-administered questionnaire was conducted among members of the Saudi public aged ≥18 years who did not receive a COVID-19 vaccine booster dose. Results: Of the 2101 respondents, 86.8% expressed a willingness to receive a COVID-19 vaccine booster dose. Multiple logistic regression analysis showed that age (18 to 25 years) (adjusted odds ratio [aOR] = 2.54; 95% confidence interval [95% CI] = 1.14–5.74), being single (aOR = 2.85; 95% Cl = 1.42–5.72), and prior receipt of an influenza vaccine (aOR = 2.45; 95% Cl = 1.80–3.34) were significantly associated with participants' willingness to receive the COVID-19 vaccine booster dose. Having a bachelor's degree or above (aOR = 0.95; 95% CI = 0.81–0.99) and not following COVID-19 news (aOR = 0.70; 95% CI = 0.52–0.89) were associated with a significant likelihood of having no intention to receive the COVID-19 vaccine boosters. Conclusions: Most Saudi people were willing to have the COVID-19 vaccine booster dose, with age and prior influenza vaccination as the predictors; paradoxically, a university-level qualification was a barrier.

Keywords: COVID-19; COVID-19 vaccine; vaccination; COVID-19 vaccine booster; vaccine hesitancy; vaccine uptake; Saudi Arabia

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1. Introduction

In December 2019, Wuhan (China) experienced a sudden surge in an atypical respiratory illness cases. The illness was found to be caused by a novel virus which was formally named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is the causative agent of the current COVID-19 pandemic that has taken a heavy toll worldwide [1]. Almost all countries in the world have been affected by COVID-19, and as of 29 November 2022, more than 638 million cases with more than 6.6 million deaths have been reported. As of writing this report, more than 825,000 cases with 9,459 fatalities have been recorded in Saudi Arabia up to 29 November 2022 [2]. COVID-19 vaccines are now regarded as the most promising preventive measure against the pandemic [3].

Several efficacious COVID-19 vaccines are being used worldwide. By June 2021, 25 candidate vaccines in various phases of development had been approved [4]. The BNT162b2 mRNA vaccine manufactured by Pfizer-BioNTech was the first vaccine to be approved in Saudi Arabia in December 2020 [5]. The ChAdOx1 nCoV-19 (AZD1222) vaccine manufactured by Oxford-AstraZeneca was the second vaccine approved in the Kingdom in February 2021 [6]. Finally, in July 2021, the Moderna mRNA-1273 was the third vaccine approved in the country [7].

Since December 2020, Saudi Arabia has started a mass vaccination program against COVID-19, prioritizing the most vulnerable people, including at-risk elderly people, patients with immunosuppressive conditions, residents of nursing homes, and front-line healthcare workers (HCWs). On 27 March 2021, the program was extended to people with disabilities and all other adult people, and on 17 June 2021, adolescents aged 12–15 years were included [4]. In addition, since 19 December 2021, booster doses have been offered to individuals aged 18 years and older who completed the primary course (with two doses) at least six months previously [8].

In order to ensure enduring immunity against COVID-19, booster doses are recommended for all people who received the recommended primary series [4,5]. A booster vaccination is even believed to be effective against the emerging strains of SARS-CoV-2 [4,9]. Some countries, including Saudi Arabia, have been able to stockpile enough COVID-19 vaccines to cover the primary series and booster doses for their residents [4].

Unfortunately, many people across the world, including Saudi Arabians, have been hesitant to receive or even refuse to receive COVID-19 vaccines despite the intensive campaigns and drives undertaken by the authorities [4,9].

The vaccine hesitancy notion, which is a health belief model that involves a set or a combination of attitudes, behaviors, beliefs, and perceptions shared by a portion of a population, has grown significantly, resulting in a growing proportion of the population unwilling to take a vaccine. In order to understand vaccine hesitancy, various factors should be taken into consideration, including health belief models, psychological perspectives, and sociological viewpoints [10].

In addition, the WHO EURO has proposed a "3 Cs" model that includes complacency (when people deem vaccines unnecessary), convenience (vaccines readily available), and confidence (primarily because of safety concerns) [11]. Subsequently, the "5 Cs" model, a framework that was developed from research conducted in high-income countries which included confidence, complacency, constraints/convenience, risk calculation, and responsibility, noted these as key factors of COVID-19 vaccine hesitancy [12]. The application of the 3 Cs and 5 Cs models can help formulate an achievable plan to address vaccine nonacceptance and hesitancy, particularly in resource-poor settings.

Despite the availability of these workable models, there has been limited research to explore public hesitancy toward COVID-19 booster vaccination. A study from Japan found public hesitancy toward booster vaccination to be 2.1%, stemming from an uncertain level of vaccine efficacy at the cost of adverse events [13]. In Ethiopia, the COVID-19 hesitance prevalence ranged from 14.1% to 68.7%. This Ethiopian study showed that hesitance was multifactorial. The most identified factor included young age, female sex, residing in rural locations, inadequate knowledge, poor adherence to COVID-19 prevention efforts, and a bad attitude toward the COVID-19 vaccine. The negative effects of the vaccine and skepticism regarding its efficacy were frequent vaccine-specific predictors of COVID-19 vaccine reluctance [14]. In Nigeria, vaccine hesitance was 68.5%. Ethnicity, Christianity, being a nurse or pharmacist, and skepticism about foreign vaccines were the factors [15].

A study conducted in Europe found that, despite hesitance ranging from 6.4% in Spain to 61.8% in Bulgaria, messages communicating the benefits of vaccination significantly increase the willingness to take the COVID-19 vaccine. However, poor health information and fear of vaccine side effects contributed to the hesitance in studied European countries [16].

In Middle Eastern countries, the studies are still limited, highlighting a need for more research on vaccination acceptance and uptake. Few of the studies available indicated

that misinformation and religious factors play a vital role in determining vaccine acceptance. However, it was revealed that the belief of a plot against Arab and Muslims by Western powers drove hesitance among Middle Eastern people. In addition, concern about Halal-certified vaccines contributed to vaccine uptake refusal, which is similar to other previous vaccines introduced in the region [17]. In Saudi Arabia, there are limited studies exploring the public's willingness to receive a COVID-19 vaccine booster dose. The limited data suggest that about 20% of people are hesitant to take the COVID-19 booster vaccine, especially educated people. In addition, educated parents were more likely to be hesitant to get their children vaccinated [17]. In Saudi Arabia, the limited data available suggest that about 20% of people are hesitant to take the COVID-19 booster vaccine, especially in people with higher education. In addition, educated parents were also more likely to be hesitant to get their children vaccinated [17,18]. However, to our knowledge, there are no further studies available to explore the reasons behind such hesitancy. Therefore, our study explored the COVID-19 vaccine booster dose acceptance rate in relation to sociodemographic characteristics of the Saudi population, as well as examining the public perception of and willingness to accept COVID-19 booster vaccination in order to understand the factors behind their reluctance and negative attitudes to better employ vaccination programs across the country.

2. Materials and Methods

2.1. Setting and Participants

Our study is a cross-sectional online survey. Participants were recruited through e-mails or WhatsApp messages sent as a link to a web-based survey platform (Google form) containing the online questionnaire. We used an anonymous and self-administered questionnaire with a random sampling strategy to ensure representativeness by sociodemographics and geographical distribution.

The study included Saudi Arabian adults aged 18 years and older who were vaccinated against COVID-19 but did not receive the booster dose. Those who received the booster dose were considered ineligible and excluded. The survey was conducted from December 2021 to March 2022. We used a systematic random sampling method to select 2500 eligible participants from the records of the Ministry of Health (MOH) immunization centers.

The questionnaire was devised by reviewing the examples of several previously published studies that dealt with the COVID-19 vaccine booster dose hesitancy [9,19–26]; then, it was accustomed to suit the Saudi population and pilot-tested among 30 volunteers to ensure its validity. In addition, a language expert ensured the accuracy of the questions and translations into Arabic. The questionnaire consisted of 32 questions assessing: (1) participants' sociodemographic characteristics, such as gender, age, region of residence, employment status, marital status, income, education, comorbidities, vaccination against influenza, and general health status before and after receiving each dose of the COVID-19 vaccination; (2) participant willingness to take up COVID-19 vaccine boosters and (3) their attitude toward COVID-19 vaccine boosters; (4) any association between willingness to take COVID-19 vaccine boosters and an agreement to adhere to various public health prevention measures, and finally (5) the participants trusted sources of COVID-19 information and their relationship with vaccine booster acceptancy.

2.2. Sample Size

Since this study aimed to examine the acceptability of the COVID-19 vaccines among the adult resident population of Saudi Arabia, and there was no previously published report in the literature that examined the associated factors, we assumed that 50% of the general people had the factor of interest. By assuming a 20% percent response rate, a 5% precision or margin of error, and 50% of the population having the factor of interest with a 95% confidence interval, a sample size of 2000 would yield sufficient power for this study.

2.3. Data Analysis

We used R software (version 4.1.2, R Core Team (2022)) to analyze the data collected [19]. We did descriptive statistics and presented variables (e.g., sociodemographic factors) such as frequency and percentages. By using contingency tables and chi-squared (X2) testing, we compared the intention to take COVID-19 vaccine boosters with the variables and groups. Multiple logistic regression analysis was carried out to determine the factors associated with the intention to have COVID-19 vaccine boosters (1 = definitely willing; 0 = definitely unwilling). For each independent variable, the adjusted odds ratio (aOR) with a 95% confidence interval (CI) was calculated. All *p*-values of <0.05 were considered statistically significant.

3. Results

3.1. Participant Characteristics

Out of the total 2500 participants approached, 2101 (84%; 2101/2500) responded and completed the survey questionnaires. Table 1 shows the sociodemographic characteristics of the participants, where just over half were female (50.9%; 1069/2101) and in the age bracket of 18 to 25 years (51.8%; 1086/2101). Over three-fifths were unmarried (61.7%; 1297/2101) and unemployed (61.1%; 1283/2101). Most participants had a bachelor's degree (71.4%; 1500/2101), worked in a nonhealthcare job (86.7%; 1822/2101), and earned more than SAR 5000 (59.8%; 1257/2101) per month. At least one comorbidity was reported by 23.3% of the participants, with obesity (11.6%; 243/2101) and respiratory conditions (7%; 156/2101) being the two most dominant comorbidities. The majority of participants reported receiving the first and second doses of COVID-19 vaccine from Pfizer (74.9%; 1574/2101 and 76%; 1597/2101, respectively) followed by Oxford AstraZeneca (23.3%; 490/2101 and 22.3%; 482/2101, respectively). Regarding the occurrence of adverse events following the first and second doses of the COVID-19 vaccine, mild symptoms were reported by (39.9%; 838/2101) and (32.5%; 682/2101), respectively, followed by moderate symptoms by (22.2%; 467/2101) and (28.5%; 598/2101), and severe and critical symptoms by (14.2%; 298/2101) and (17.2%; 361/2101), respectively.

Table 1. Sociodemographic characteristics and COVID-19 vaccine booster dose acceptance (n = 2101).

Variable Classification		n (%)	Accepted Booster Dose		*p*-Value
			Yes n (%)	No n (%)	
Whole sample		2101	1822	279	
Gender	Female	1069 (50.9)	939 (87.8)	130 (12.2)	0.14
	Male	1032 (49.1)	883 (85.6)	149 (14.4)	
Age	18–25	1086 (51.7)	971 (89.4)	115 (10.6)	<0.01 *
	26–35	512 (24.4)	421 (82.2)	91 (17.8)	
	36–45	273 (13)	228 (83.5)	45 (16.5)	
	46–54	183 (8.7)	163 (89.1)	20 (10.9)	
	55–64	41 (1.9)	34 (82.9)	7 (17.1)	
	≥65	6 (0.3)	5 (83.3)	1 (16.7)	
Marital Status	Married	804 (38.3)	673 (83.7)	131 (16.3)	<0.01 *
	Single	1297 (61.7)	1149 (88.6)	148 (11.4)	
Region of Residence	Eastern	243 (11.6)	214 (88.1)	29 (11.9)	0.44
	Middle	830 (39.5)	713 (85.9)	117 (14.1)	
	Northern	260 (12.4)	234 (90)	26 (10)	
	Southern	501 (23.8)	433 (86.4)	68 (13.6)	
	Western	267 (12.7)	228 (85.4)	39 (14.6)	
Employment Status	Employed	818 (38.9)	695 (85)	123 (15)	0.06
	Unemployed	1283 (61.1)	1127 (87.8)	156 (12.2)	

Table 1. *Cont.*

Variable Classification		n (%)	Accepted Booster Dose		*p*-Value
Working in Healthcare	No	1822 (86.7)	1579 (86.7)	243 (13.3)	0.91
	Yes	279 (13.3)	243 (87.1)	36 (12.9)	
Monthly Income	>5000 SR	1257 (59.8)	1103 (87.8)	154 (12.2)	0.23
	5000–10,000 SR	390 (18.6)	331 (84.9)	59 (15.1)	
	<10,000 SR	454 (21.6)	388 (85.5)	66 (14.5)	
Education Level	Below secondary	43 (2.05)	35 (81.4)	8 (18.6)	<0.01 *
	Secondary	403 (19.2)	363 (90.1)	40 (9.9)	
	Bachelor's degree	1500 (71.4)	1300 (86.7)	200 (13.3)	
	Postgraduate studies	155 (7.4)	124 (80)	31 (20)	
Self-reported Comorbidity	At least one	486 (23.3)	412 (84.8)	74 (15.2)	0.17
	None	1615 (76.9)	1410 (87.3)	205 (12.7)	
Diabetes	No	2017 (96)	1751 (86.8)	266 (13.2)	0.66
	Yes	84 (4)	71 (84.5)	13 (15.5)	
Hypertension	No	1995 (95)	1744 (87.4)	251 (12.6)	<0.01 *
	Yes	106 (5)	78 (73.6)	28 (26.4)	
Cancer	No	2095 (99.7)	1817 (86.7)	278 (13.3)	1.00
	Yes	6 (0.3)	5 (83.3)	1 (16.7)	
Respiratory diseases [&]	No	1945 (92.6)	1691 (86.9)	254 (13.1)	0.35
	Yes	156 (7.4)	131 (84)	25 (16)	
Obesity	No	1858 (88.4)	1615 (86.9)	243 (13.1)	0.52
	Yes	243 (11.6)	207 (85.2)	36 (14.8)	
Received influenza vaccination in the past	Never	993 (47.3)	823 (82.8)	170 (17.2)	<0.01 *
	Yes, but irregular	909 (43.3)	817 (89.9)	92 (10.1)	
	Yes, annually	199 (9.5)	182 (91.5)	17 (8.5)	
Received 1st dose COVID-19 vaccination	Yes, Pfizer	1574 (74.9)	1364 (86.6)	210 (13.4)	<0.01 *
	Yes, Moderna	22 (1)	15 (68.2)	7 (13.8)	
	Yes, Oxford AstraZeneca	490 (23.3)	441 (90)	49 (10)	
	Yes, Other	15 (0.8)	2 (13.3)	13 (86.7)	
Adverse events following 1st dose of COVID-19 vaccination	No symptoms	498 (23.7)	440 (88.4)	58 (11.6)	<0.01 *
	Mild symptoms	838 (39.9)	759 (90.5)	79 (9.5)	
	Moderate symptoms	467 (22.2)	405 (86.7)	62 (13.3)	
	Strong symptoms	287 (13.7)	216 (75.3)	71 (42.7)	
	Critical symptoms	11 (0.5)	2 (18.2)	9 (81.8)	
Received 2nd dose COVID-19 vaccination	Yes, Pfizer	1597 (76)	1371 (85.8)	226 (14.2)	<0.01 *
	Yes, Moderna	19 (1.0)	13 (68.4)	6 (31.6)	
	Yes, Oxford AstraZeneca	482 (22.9)	436 (90.5)	46 (9.5)	
	Yes, Other	3 (0.1)	2 (66.7)	1 (33.3)	
Adverse events following 2nd dose of COVID-19 vaccination	No symptoms	460 (21.9)	409 (88.9)	51 (11.1)	<0.01 *
	Mild symptoms	682 (32.5)	623 (91.3)	59 (8.7)	
	Moderate symptoms	598 (28.5)	535 (89.5)	63 (10.5)	
	Strong symptoms	339 (16.1)	249 (73.4)	90 (26.6)	
	Critical symptoms	22 (1.0)	6 (27.3)	16 (72.7)	

[&] respiratory diseases including asthma, * statistically significant $p < 0.05$.

Those participants aged 18 to 25 ($p < 0.01$), who were single ($p < 0.01$), with hypertension ($p < 0.01$), with a bachelor's degree ($p < 0.01$), who received the influenza vaccine in the past ($p < 0.01$), and who did not experience moderate to critical adverse events after taking COVID-19 vaccines ($p < 0.01$) were significantly more willing to receive a booster dose.

3.2. Willingness to Receive COVID-19 Vaccine Booster Dose

As indicated in Table 2, the majority (86.8%) of the participants were willing to receive a booster dose, with Pfizer being the preferred vaccine choice (60%).

Table 2. Study participants' preference for COVID-19 vaccine booster dose (n = 2101).

Responses	n (%)
I will not receive the third dose	279 (13.3)
I want the Pfizer vaccine	1260 (60)
I want the Moderna vaccine	52 (2.5)
I want the Oxford-AstraZeneca vaccine	158 (7.5)
I will not receive any COVID-19 vaccine	352 (6.8)

3.3. Attitude toward COVID-19 Vaccine Booster Dose

Table 3 shows the majority of the participants had a good attitude toward COVID-19 vaccine boosters ('strongly agreed' or 'agreed'). Most (53.9%) agreed that they would get booster doses of the COVID-19 vaccine if it were required to achieve an adequate level of immunity, while 24.9% disagreed, and the rest were neutral. The majority agreed that booster doses would protect them from a symptomatic COVID-19 infection (59%) and from severe COVID-19 (60.9%), and that boosters were as safe as previous doses (53.9%), believing that the benefits of a booster dose outweigh their risks (54.9%). However, the minority (41.9%) agreed that booster doses prevented the community transmission of SARS-CoV-2 and its variants. The overall acceptability of a booster dose was 86.7%, with the highest acceptability noted among those participants who agreed that the booster doses would protect them from severe COVID-19 infection (97.5%), prevent the community transmission of SARS-CoV-2 and its variants (97.5%), and protect them from severe COVID-19 infection (97%), while the lowest acceptance rate was found among the participants with good attitudes (96%) for strongly agreeing that a booster dose was as safe as the previous doses of COVID-19 vaccines.

Table 3. Attitude of participants toward COVID-19 vaccine booster dose (n = 2101).

Statements	Answers		Accepted Booster Dose		*p*-Value
		Total n (%)	Yes n (%)	No n (%)	
Whole sample		2101	1822	279	
Booster dose will protect me from symptomatic COVID-19 infection	Strongly Disagree	245 (11.7)	106 (43.3)	139 (55.7)	<0.01 *
	Disagree	257 (12.2)	180 (70.1)	77 (29.9)	
	Neutral	364 (17.3)	331(90.9)	33 (9.1)	
	Agree	610 (29.1)	597 (97.8)	13 (2.2)	
	Strongly Agree	625 (29.7)	608 (97.3)	17 (2.7)	
Booster dose protects me from severe COVID-19 infection	Strongly Disagree	251 (12)	116 (46.6)	135 (53.4)	<0.01 *
	Disagree	253 (12)	168 (66)	85 (34)	
	Neutral	317 (15)	294 (92.7)	23 (7.3)	
	Agree	615 (29.4)	599 (97.4)	16 (2.6)	
	Strongly Agree	665 (31.6)	645 (97)	20 (3)	
Booster dose prevents the community transmission of SARS-CoV-2 and its variants	Strongly Disagree	166 (7.9)	58 (34.9)	108 (65.1)	<0.01 *
	Disagree	422 (20.1)	325 (76.9)	97 (23.1)	
	Neutral	663 (30.1)	610 (92)	53(8)	
	Agree	510 (24.3)	500 (98.1)	10 (1.9)	
	Strongly Agree	340 (17.6)	329 (96.9)	11 (3.1)	
Booster dose is as safe as the previous doses of COVID-19 vaccines	Strongly Disagree	244 (11.6)	110 (42.9)	134 (57.1)	<0.01 *
	Disagree	280 (13.3)	213 (65.8)	67 (34.2)	
	Neutral	444 (21.1)	408 (91.3)	36(8.7)	
	Agree	587 (27.9)	566 (96.4)	21(3.6)	
	Strongly Agree	546 (26.1%)	525 (96.1)	21 (3.9)	
I believe that the benefits of the booster doses outweigh their risks	Strongly Disagree	222 (10.6)	101 (45.5)	121 (54.5)	<0.01 *
	Disagree	274 (13.1)	189 (68.9)	85 (31.1)	
	Neutral	452 (21.5)	419 (92.7)	33 (7.3)	
	Agree	543 (25.8)	527 (97.1)	16 (2.9)	
	Strongly Agree	610 (29)	586 (96.1)	24 (3.9)	

Table 3. *Cont.*

Statements	Answers		Accepted Booster Dose		*p*-Value
I will not receive a booster dose until I find reliable evidence confirming their ability to tackle the new circulating variants of SARS-CoV-2	Strongly Disagree	501 (24)	415(82.9)	86 (17.1)	<0.01 *
	Disagree	504 (24)	457 (90.7)	47 (9.3)	
	Neutral	559 (26.6)	523 (93.6)	36 (6.4)	
	Agree	314 (14.9)	286 (91.1)	28 (8.9)	
	Strongly Agree	223 (10.5)	141 (71.7)	82 (28.3)	
I would receive additional booster doses of the COVID-19 vaccine if it were required to achieve an adequate level of immunity	Strongly Disagree	244 (11.7)	110 (42.9)	134 (57.1)	<0.01 *
	Disagree	280 (13.3)	213 (65.8)	67 (34.2)	
	Neutral	444 (21.2)	408 (91.3)	36(8.7)	
	Agree	587 (27.9)	566 (96.4)	21(3.6)	
	Strongly Agree	546 (25.9)	525 (96.1)	21 (3.9)	

* statistically significant $p < 0.05$.

3.4. Willingness to Receive COVID-19 Booster Vaccine and Public Health Prevention Measures

Table 4 shows the association between COVID-19 vaccine booster acceptance and adherence to various public health prevention measures. Adherence to the public health prevention measures (wearing masks, hand sanitization, etc.), as well as concern for COVID-19 variants and following COVID-19 news, had a statistically significant association with COVID-19 vaccine booster acceptance (all p values < 0.01).

Table 4. Associations between COVID-19 booster vaccine acceptability and adherence to various public health prevention measures.

Statements	Answers		Accepted Booster Dose		*p*-Value
Whole sample		Total n (%) 2101	No n (%) 279	Yes n (%) 1822	
I don't wear a mask anymore	Strongly Disagree	679 (32.32%)	85 (12.52%)	594 (87.48%)	<0.01 *
	Disagree	523 (24.89%)	43 (8.22%)	480 (91.78%)	
	Neutral	419 (19.94%)	55 (13.13%)	364 (86.87%)	
	Agree	269 (12.8%)	37 (13.75%)	232 (86.25%)	
	Strongly Agree	211 (10.04%)	59 (27.96%)	152 (72.04%)	
I no longer sanitize hands	Strongly Disagree	575 (27.37%)	82 (14.26%)	493 (85.74%)	<0.01 *
	Disagree	529 (25.18%)	45 (8.51%)	484 (91.49%)	
	Neutral	451 (21.47%)	45 (9.98%)	406 (90.02%)	
	Agree	305 (14.52%)	43 (14.1%)	262 (85.9%)	
	Strongly Agree	241 (11.47%)	64 (26.56%)	177 (73.44%)	
I'm no longer afraid of COVID-19 and its variants	Strongly Disagree	486 (23.13%)	59 (12.14%)	427 (87.86%)	<0.01 *
	Disagree	499 (23.75%)	36 (7.21%)	463 (92.79%)	
	Neutral	505 (24.04%)	62 (12.28%)	443 (87.72%)	
	Agree	339 (16.14%)	45 (13.27%)	294 (86.73%)	
	Strongly Agree	272 (12.95%)	77 (28.31%)	195 (71.69%)	
I don't follow the news about COVID-19 in my country	Strongly Disagree	527 (25.08%)	66 (12.52%)	461 (87.48%)	<0.01 *
	Disagree	528 (25.13%)	36 (6.82%)	492 (93.18%)	
	Neutral	483 (22.99%)	55 (11.39%)	428 (88.61%)	
	Agree	311 (14.8%)	53 (17.04%)	258 (82.96%)	
	Strongly Agree	252 (11.99%)	69 (27.38%)	183 (72.62%)	
I don't follow the news of COVID-19 in the world	Strongly Disagree	320 (15.23%)	47 (14.69%)	273 (85.31%)	<0.01 *
	Disagree	487 (23.18%)	45 (9.24%)	442 (90.76%)	
	Neutral	487 (23.18%)	51 (10.47%)	436 (89.53%)	
	Agree	314 (14.95%)	80 (25.48%)	234 (74.52%)	
	Strongly Agree	493 (23.47%)	56 (11.36%)	437 (88.64%)	

* statistically significant $p < 0.05$.

3.5. Predictors for Receiving COVID-19 Booster Doses

Multiple logistic regression analysis showed that participants aged 18–24 years (aOR = 2.54; 95% CI = 1.14–5.74), who were single (aOR = 2.85; 95% Cl = 1.42–5.72),

and who had received the influenza vaccine in the past (aOR = 2.45; 95% Cl = 1.80–3.34) were significantly more willing to receive the COVID-19 vaccine booster dose. Meanwhile, having a bachelor's degree or above (aOR = 0.95; 95% CI = 0.81–0.99) and not following the news about COVID-19 in the country (aOR = 0.70; 95% CI = 0.52–0.89) were significantly associated with an unwillingness to receive the COVID-19 vaccine booster dose (Table 5).

Table 5. Multiple logistic regression analysis for the determinants of willingness to receive the COVID-19 vaccine booster dose.

Factor	aOR	95% CI	
Age	2.54	1.14	5.74
Being single	2.85	1.42	5.72
Having higher education, a bachelor's degree and above	0.95	0.81	0.99
Hypertension	1.06	0.92	1.33
Obesity	1.10	0.93	1.33
Received influenza vaccination in the past	2.45	1.80	3.34
Adverse events following 1st dose of COVID-19 vaccination	1.31	0.11	2.09
Adverse events following 2nd dose of COVID-19 vaccination	1.10	0.90	1.30
I'm no longer afraid of the COVID-19 and its variants	1.87	0.96	3.14
I don't follow the news about COVID-19 in my country	0.70	0.52	0.89

aOR = adjusted odds ratio; Cl = confidence interval.

3.6. Participants' Booster Dose Acceptability and Perception of COVID-19 Information Sources

Table 6 shows the association between COVID-19 booster vaccine acceptability and perception of sources of COVID-19 information. Loss of faith in Saudi MOH ($p < 0.01$), World Health Organization (WHO) ($p < 0.01$), COVID-19 vaccines ($p < 0.01$), and healthcare practitioners ($p < 0.01$) were significantly associated with an unwillingness to receive COVID-19 vaccine boosters.

Table 6. Association between COVID-19 booster vaccine acceptability and the perceptions of sources of COVID-19 information.

Statements		Answers	Accepted Booster Dose		*p*-Value
Whole sample		Total n (%) 2101	No n (%) 279	Yes n (%) 1822	
I lost faith in Saudi MOH	Strongly Disagree	400 (19.1)	25 (6.2)	375 (93.8)	<0.01 *
	Disagree	406 (19.3)	15 (3.7)	391 (96.3)	
	Neutral	614 (29.2)	51 (8.3)	563 (91.7)	
	Agree	360 (17.1)	59 (16.4)	301 (83.6)	
	Strongly Agree	321 (15.3)	129 (40.2)	192 (59.8)	
I lost faith in the WHO	Strongly Disagree	673 (32.1)	33 (5.0)	640 (95.0)	<0.01 *
	Disagree	523 (24.9)	25 (4.8)	498 (95.2)	
	Neutral	542 (25.8)	86 (15.9)	456 (84.1)	
	Agree	188 (8.9)	57 (30.3)	131 (69.7)	
	Strongly Agree	175 (8.3)	78 (44.6)	97 (55.4)	
I lost my trust in health practitioners	Strongly Disagree	727 (34.7)	46 (6.3)	681 (93.7)	<0.01 *
	Disagree	555 (26.4)	35 (6.3)	520 (93.7)	
	Neutral	511 (24.3)	85 (16.6)	426 (83.4)	
	Agree	162 (7.7)	48 (29.6)	114 (70.4)	
	Strongly Agree	146 (6.9)	65 (44.5)	81 (55.5)	
I lost faith in COVID-19 vaccines	Strongly Disagree	570 (27.1)	39 (6.8)	531 (93.2)	<0.01 *
	Disagree	569 (27.1)	30 (5.3)	539 (94.7)	
	Neutral	527 (25.1)	60 (11.4)	467 (88.6)	
	Agree	219 (10.4)	51 (23.3)	168 (76.7)	
	Strongly Agree	216 (10.3)	99 (45.8)	117 (54.2)	

* statistically significant $p < 0.05$.

4. Discussion

This study has explored the Saudi Arabian people's willingness to receive a COVID-19 vaccine booster dose and identified the factors affecting this willingness. The results depicted that less than a quarter of the participants were reluctant to receive the booster vaccine. The majority would receive a COVID-19 booster vaccine and comply with other public health prevention measures (wearing masks, hand sanitization, etc.). Most participants were also concerned about emerging SARS-CoV-2 variants and followed COVID-19-related news updates, and these two factors had a statistically significant association with the acceptability of a COVID-19 booster vaccine. The study may have found a possible psychological factor, with an overwhelming majority preferring and showing confidence in Pfizer's vaccine. In addition, age, marital status, and the prior receipt of an influenza vaccine were independent predictors of the willingness to receive the COVID-19 vaccine booster dose, whereas having a bachelor's degree or above, not following the news about COVID-19 in the country, and mistrusting public health and healthcare professionals were associated with refusal to receive the COVID-19 vaccine boosters.

People resisted receiving vaccines due to certain factors, such as sociocultural factors, vaccine-related factors, and individual and group influences [7]. The factors associated with hesitancy toward having a COVID-19 vaccine may include misconceptions and misinformation about vaccines, efficacy, the safety of vaccines, mistrust in the healthcare system, unfavorable outcomes, and a lack of appropriate knowledge regarding COVID-19 [9]. Our study showed that only 13% (279/2101) of the participants were unwilling to receive a booster dose of the COVID-19 vaccine. This proportion is lower than what has been found in different studies across the globe. Folcarelli et al. found that the COVID-19 vaccine booster dose hesitancy rate was 24.7% in Italy [9], whereas Kheil et al. found it to be 26.3% among adult Americans [27]. COVID-19 vaccine booster dose hesitancy varies according to study settings and study country, and the hesitancy level reduced as the pandemic progressed. For example, in the USA, about 25.4% were hesitant to get vaccinated in January 2021; by May 2021, only 16.6% were hesitant [27]. As time passes, public concerns about the booster doses continue to decline.

Our study has identified several factors associated with hesitancy toward COVID-19 vaccine uptakes, such as gender, age, marital status, and education level. Our results are in line with that of previous studies that showed some concerns about the possible adverse effects COVID-19 vaccines might have on the fetus and their possible contribution to infertility and miscarriages [28–30].

Our study also shows that education level is associated with hesitancy toward COVID-19 vaccine uptake. This probably indicates that the more educated the participants are, the more cautious they are about vaccination [31] and consequently become more hesitant. Hence, there is a need to raise awareness among educated people about COVID-19 vaccine booster dose safety. While there is no clear explanation to support why the majority of the unmarried (single) participants did not want to receive the COVID-19 vaccine booster dose, there is evidence to justify why more married people prefer receiving the booster doses, such as a moral obligation to protect their spouses and children, motivating them to receive the booster doses [8,31].

The observation that the majority of the participants were not working in healthcare settings and were unemployed may be explained by the randomness of the data collection. This is because evidence from other studies also indicates that healthcare workers are more knowledgeable in making better decisions in favor of receiving booster doses as opposed to nonhealthcare workers [32]. However, it is also essential to note that some people experienced side effects from the first and second doses of the COVID-19 vaccines. Therefore, such people are not willing to receive the booster doses. This is supported by previous studies across Europe [33], the United States [34], and China [35] that reported concerns about vaccine safety and adverse outcomes as the most important reasons for their vaccine hesitancy.

In line with these observations (that the majority of the participants were willing to receive a COVID-19 vaccine booster dose and believed that the booster dose would protect them from severe COVID-19 infection as the benefits outweighed the risks), this belief comes from much sensitization efforts, since, as the COVID-19 pandemic progresses, the sensitizations and lessons generated are appreciated more by the people [27], resulting in the acceptance of boosters in 2022 by people who rejected them in 2021. This indicates that deliberate and sustained sensitization campaigns across the country should encourage people to receive booster doses. As per this study, the most common barriers to receiving vaccine boosters for COVID-19 in Saudi Arabia were information related. That is why the source of information and its credibility are vital. The majority of the participants (who had not received the booster doses) reported losing trust in MOH, the WHO, and healthcare practitioners. Since health information flows from the WHO through MOH to the health practitioners and then to the population, mistrust in these stakeholders is disastrous for a nation. Amicable solutions should, therefore, be sought to address the people's loss of trust in these pertinent stakeholders [26].

Participants' level of susceptibility reduces their hesitancy toward a COVID-19 vaccine booster dose. Participants who reported having a comorbidity had a statistically significant association with hesitancy to booster doses. For example, participants who had respiratory diseases and obesity were reported to be less likely to resist the COVID-19 vaccine boosters. Studies showed that the booster doses are of high significance among immunocompromised individuals, and people with comorbidities were more susceptible to COVID-19 infection [26–36]. Therefore, there is a lower hesitancy among the participants with comorbidities since they are the ones who become more sensitized to comply with all preventive measures. As individuals consult their healthcare professionals more often for their conditions, they are more educated and eager to get accurate information as they are worried about their general health, which makes them more accepting of the vaccine booster dose.

5. Strengths, Limitations, and Future Direction

Our study is novel, with a large sample size and our use of spatial identifiers, such as region of residence, to explore COVID-19 vaccine acceptance and hesitancy; the respondents were well distributed across various regions, age groups, employment statuses, and income compared with census data available through Saudi Arabia Statistics. Yet, some limitations were unavoidable. Our study was self-reported and, therefore, subject to information bias. Additionally, our study was conducted online, which means we may not have reached the vulnerable groups of the population, such as those who are illiterate or from a low socioeconomic background.

Qualitative studies could be appropriate for digging out other factors related to vaccine hesitancy with a focus on the attitudes of those who were vaccinated with a second dose. Additionally, clinical trials with larger sample sizes should be conducted to get a better and broad understanding regarding the acceptance and perceptions of the general population in association with the COVID-19 vaccine.

Ultimately, future studies should focus on continuous education, raising awareness programs, and establishing strategies to overcome the identified barriers to COVID-19 booster vaccination to combat the COVID-19 pandemic in Saudi Arabia effectively through listening to the concerns of the public and incorporating public perspectives in planning vaccine policies and programs, as well as the psychological factors influencing Saudi people's vaccination intention.

6. Conclusions

We found that most participants had good attitudes and perceptions toward the COVID-19 booster dose and were willing to receive the vaccine. However, age, marital status, and having had a previous influenza vaccine were independent predictors of their willingness to receive the COVID-19 booster vaccine, whereas having a higher educational

degree, not following the news about COVID-19 in the country, and mistrusting public health and healthcare professionals were associated with a refusal to receive the COVID-19 vaccine boosters.

This study sheds light on the challenges of COVID-19 vaccination and acceptance, which could guide decision-makers in establishing targeted programs to resolve them. In addition, this study's results could also help mobilize Saudi citizens in the prevention of diseases using vaccination as it provides vital information to design effective approaches reflecting Saudi Arabia's particularities.

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