Original Research Article

The Likelihood of the Saudi Population to Accept Covid-19 Vaccine

ABSTRACT

Background: The global spread of the severe acute respiratory syndrome coronavirus 2 (COVID-19) pandemic has threatened public health systems and aggravated international economic situations. The study investigated the different factors affecting the feasibility of Saudi intention to take Covid-19 Vaccines. A Cross-sectional study based on an online questionnaire from 9th February 2021 to 9th April 2021.
Results: Most respondents would wear a face mask during all activities with a positive attitude toward using hand sanitizers to prevent COVID-19. Most respondents (88.8%) were not vaccinated yet and, less than half of them stated that they have a family member or a close relative who got immunized (43.4%), the acceptance of vaccination if the vaccine is generally available was 64.4%. More than half of the respondents agreed about the vaccine's safety while 34.8% stated having fears about the vaccine.
Conclusion: The participants have proper information about the Covid-19 pandemic, preventive measures, and the role of vaccines in preventing the spread of the disease with a high acceptance rate to vaccines and low levels of fear regarding the side effects of the vaccines.

Keywords: Covid-19 pandemic, vaccines, Saudi Community

1. INTRODUCTION

Coronaviruses (CoV) are a vast family of viruses that cause common colds and more serious infections such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV) (COVID-19). Novel coronaviruses were discovered in China on December 31, 2019, and the WHO Regional Office was told of cases of pneumonia of unknown origin in Wuhan City, Hubei Province of China. However, in March 2020, the WHO declared the outbreak of COVID-19 a pandemic [1].

COVID-19 had signs and indications that showed up from two days to fourteen days after divulgence; hence the common signs and indications of this widespread were incorporated fever, tiredness, and shortness of breath which may exaggerate into pneumonia in some severe cases also, people with immunodeficiency, the elderly and people with chronic disorders such as asthma, heart disease, and lung infection may cause severe complications [2]. On the other side, this infection can spread primarily when an infected person is in direct contact with another person through coughing, sneezing, laughing, singing, or breathing profoundly or by indirect contact with surfaces in the immediate atmosphere or with items used by the infected person. It spread rapidly around the world

since last December, the virus has quickly spread, affecting 217 countries and territories around the world, and the number of confirmed global cases has now reached 53,146,272 cases, and 352,160 confirmed cases in KSA, as well as global deaths cases have reached 1,300,762 cases and 5,605 cases in KSA. These numbers were taken on November 13 of 202 and may be increased [3-5].

The purpose of the COVID-19 vaccination is to create an immune response that will prevent infection. There was an extensive knowledge base regarding the structure and role of coronaviruses prior to the COVID-19 pandemic, allowing for the rapid development of several vaccine technologies in early 2020. The genetic sequence data of SARS-CoV-2 was exchanged via GISAID on January 10, 2020, and on March 19, 2020, the global pharmaceutical sector made a substantial commitment to solving COVID-19. Results from Phase III studies of COVID-19 vaccines have shown the efficacy of up to 95% in preventing symptomatic COVID-19 infections [4, 6].

As of April 2021, at least one national regulatory authority had approved 13 vaccines for use in the general public: two RNA vaccines, five conventional inactivated vaccines, four viral vector vaccines, and two protein subunit vaccines [6]. By March 2021, 308 potential vaccines have been developed to varying degrees. Many nations have started using staggered delivery schedules to protect both the elderly, who are more likely to experience complications; and healthcare workers, who are particularly exposed to the virus and spread it to patients. Until a better vaccine supply exists, Stanley Plotkin and Neal Halsey of Oxford Clinical Infectious Diseases argued that a single interim dosage should be administered to as many individuals as feasible [7].

Studies and media sources advocated postponing second dosages. As of 30 April 2021, 1.13 billion doses of COVID-19 vaccination have been delivered globally. In 2021, AstraZeneca-Oxford, Pfizer–BioNTech, Sinopharm, Sputnik V, Sinovac, and Johnson & Johnson intended to generate 3 billion doses apiece. Moderna targets 600 million Convidecia doses and 500 million Moderna doses in 2021. By December 2020, nations had pre-ordered over ten billion vaccine doses, with 14% of the world's population in high-income countries [8].

The Kingdom had a pioneering and crucial role in limiting the COVID-19 epidemic. Due to the lack of a vaccine or treatment that alters the virus's transmission, Saudi Arabia has imposed tight restrictions on all residents and visitors since the WHO declared a pandemic. The Saudi government moved well to manage the virus. The first intervention was the 4 March 2020 suspension of visits to the Holy Mosque in Saudi Arabia. Due to an increase in COVID-19 cases, the government banned Inlet inhabitants from entering Makkah and Al Medina on 27 February 2020. Most of these instances included travel to Iran. KSA takes severe measures to prevent the spread of illness, including the MOH's use of hotline 937 for any suspected disease or inquiry [9].

Saudi researchers studied COVID-19's diagnosis, treatment, and prevention. Their study was published in highly regarded publications globally, making KSA one of the top nations for viral research and the first Arab country [10, 11].

During COVID-19, a healthy diet was essential. What a person eats and drinks affects his body's ability to fight illnesses and recuperate [12]. COVID-19 infection cannot be avoided or treated with foods or dietary supplements. Healthier diets should improve immunity mechanisms to keep it short; there is currently little evidence that COVID-19 can be transmitted by contact with food or food packaging [13]. COVID-19 is widely believed to be spread from person to person. However, care should still be taken when handling food to

avoid any food-borne pathogens by following proper hygiene habits. Simply obey the five keys to healthy food from WHO, keep clean, distinguish raw and prepared, prepare thoroughly, keep food at safe temperatures and use clean water and raw materials [1]. This study aimed to measure the feasibility of the different groups of citizens in KSA to take the Covid-19 vaccine.

2. METHODOLOGY

Research Design

A qualitative, prospective, cross-sectional non-interventional questionnaire-based study was performed from 9th February 2021 to 9th April 2021.

Ethical considerations

The study followed the Helsinki Declaration and Saudi CDC research rules. All individuals gave informed permission before participation.

Population and Study Sample

The study included citizens and residents of the western region of the Kingdom of Saudi Arabia during the COVID-19 pandemic. The inclusion criteria were educated individuals aged 18 and over including women, men, healthy subjects, and others suffering from chronic diseases. It was anticipated that a sample size of 384 participants would be sufficient to identify a single proportion with a margin of error of 5 percentage points and a 95% confidence interval [14].

Tools:

This study included a self-administrated questionnaire sheet. The preliminary questionnaire was written in both Arabic and English. It included questions about the participant's demographic information, their familiarity with COVID-19, and their willingness to receive the COVID-19 vaccine in the future. To ensure that it can be completed quickly and with slight confusion, we kept the questionnaire to a minimum of questions. Experts reviewed the questionnaire for both content and clarity. There were preliminary tests of the questionnaire. The Participants completed the survey on their own time.

Data Analysis Strategies

The data and values were processed for descriptive analysis through ANOVA using IBM SPSS software program (24.0). The continuous variables were processed for statistical analysis through Chi-square test (Two-tailed) for obtaining the significance of the results.

3. RESULTS

Demographic and baseline attributes

The demographic characteristics of the respondents include different qualities such as age, gender, region, income, occupation, and education are presented in Table 1. There were 1467 participants, including 656 males and 811 females. So, the overall frequency of females was higher compared to males. Also, the age distribution of the participants showed that 420 participants (15-25 years), 982 participants (26-60 years), and 65 participants were older than 60 years. The study included participants from 16 different nationalities 1339 were Saudi, 14 were Egyptian, and the rest were from various races. As for the educational Status, most of the participants were well-educated as 206 were

diploma holders, 814 were university bachelors, and 137 had post-graduate degrees. Also, 541 participants were unemployed, 374 were health workers, and 506 were non-health workers.

Table 1. Distribution of participants according to their demographics:

	Number	Percent
Gender		
Male	656	44.7
Female	811	55.3
Age		
15-25 Years	420	28.6
26-60 Years	982	66.9
>60 Years	65	4.4
Nationality		
Saudi	1339	91.3
Non Saudi	128	8.7
Educational Qualification		
Less than high school	310	21.1
Diploma	206	14.0
University - bachelor's	814	55.5
Post graduate studies	137	9.3
Employment		
Unemployed	541	36.9
Health workers	370	25.2
No health workers	556	37.9
Total	**1467**	**100.0**

Type of vaccine preferred

According to the preferred vaccine of participants, 176 participants preferred AstraZeneca, 788 Pfizer, 93 Pfizer and Astra, 36 Sinopharm, 43 Sputnik, 21 Sinovac, 44 Moderna, and 20 Sinopharm and Sinovac. The remaining participants responded mix-up of all mentioned vaccines without any unique or individual one. Thus, the most common preferred vaccines were Pfizer, AstraZeneca, Sinopharm, and Sputnik Table 2.

Table 2. Distribution of the studied group regarding the type of vaccine received

Type of vaccine	Number	Percent
AstraZeneca	176	12.0
Moderna	44	3.0
Pfizer	788	53.7
Sinopharm	36	2.5
Sinovac	25	1.7
Sputnik	43	2.9
Mixed	190	13.0
Non	165	11.2
Total	**1467**	**100.0**

Face mask and sanitizers to prevent Covid 19

Most participants (86%) think that face masks prevent COVID-19 infection spread while 10.8% responded neutral, and the remaining disagreed (3.1%). About 66.9% of participants agreed that they could do all daily activities with a face mask. Data related to the views that wearing a face mask when it wasn't mandatory showed that 67.4% of participants agreed with this logic. As for hand sanitizers, 82.6% of participants agreed about using hand sanitizers to prevent Covid-19, 11.6% responded neutral and the remaining (17.2%) disagreed. The general practice score was Excellent among the majority of participants (Table 3).

Table 3. Distribution of the studied group regarding their practice towards ways to protect and prevent covid.

	Number	Percent
I think that the face mask does prevent coronavirus (Covid 19)		
Agree	1262	86.0
Neutral	159	10.8
Disagree	46	3.1
I can do all activities while I wear a face mask		
Agree	982	66.9
Neutral	247	16.8
Disagree	238	16.3
I would have worn the face mask even if it wasn't mandatory		
Agree	989	67.4
Neutral	225	15.3
Disagree	253	17.2
Always use hand sanitizers to prevent Covid 19		
Agree	1211	82.6
Neutral	170	11.6
Disagree	86	5.9
General practice score		
Excellent	1108	75.5
Good	203	13.8
Fair	156	10.6
Total	**1467**	**100.0**

Attitude toward Covid 19 Vaccination:

During the research period, most respondents (88.8%) were not vaccinated yet, and less than half of them stated that they have a family member or a close relative who got vaccinated (43.4%). As for their acceptance of vaccination if the vaccine is generally available, about 64.4% agreed this logic and 26.8 agreed the same idea concluding that more than half of them tend to have the vaccine. On the other hand, 34.8% agreed about having fears of the vaccine. Also, 51.5% agreed about the vaccine's safety while 41.2% were neutral. Most of the participants had positive attitudes toward the efficiency of the vaccine against Covid-19 and the need to have the vaccine even if they've been diagnosed with Covid-19. The overall attitude score was positive among more than half of the respondents (55.9%) and neutral among 32.9% (Table. 4).

Table 4. Distribution of the studied group regarding the attitude towards the vaccine

	Number	Percent
Have you been vaccinated?		
No	1302	88.8
Yes	165	11.2
Did a family member or close relative (acquaintances) take the Covid-19 vaccine?		
No	821	56.7
Yes	646	43.4
I would like to take the Covid-19 vaccine if it is generally available		
Agree	944	64.4

Neutral	376	25.6
Disagree	147	10
Do you have a fear of getting Coronavirus vaccine?		
Agree	510	34.8
Neutral	455	31
Disagree	502	34.3
Do you think the Coronavirus (Covid-19) vaccine is safe		
Agree	756	51.5
Neutral	605	41.2
Disagree	106	7.3
Do you believe that the Covid-19 vaccine will protect you from disease?		
Agree	654	44.6
Neutral	653	44.5
Disagree	160	10.9
If you have been diagnosed with Covid-19, do you still need to have a Covid-19 vaccine?		
Agree	853	58.2
Neutral	464	31.6
Disagree	150	10.3
Do you think that there are some medical conditions for that doctors do not recommend vaccination?		
Agree	974	66.4
Neutral	437	29.8
Disagree	56	3.8
Do you think that the available Covid-19 may protect you from the new types of Covid-19?		
Agree	547	37.3
Neutral	730	49.8
Disagree	190	12.9
General attitude score		
Positive	820	55.9
Neutral	482	32.9
Negative	165	11.2
Total	**1467**	**100.0**

As presented in Table. 5 and 6, the higher attitude and practice scores were significantly associated with female gender, Saudi nationality, younger age, higher educational status, and being a health care worker.

Table 5. Relation between demographic data of the studied group in relation to their practice score

	General practice score						**Total**	**P value**
	Excellent "n=1108"		**Good "203"**		**Faire "156"**			
	No.	**%**	**No.**	**%**	**No.**	**%**		
Gender								
Male	320	28.9	182	89.7	154	98.7	656	62.25
Female	788	71.1	21	10.3	2	1.3	811	0.0014*
Age								
15-25 Years	350	31.6	20	9.9	50	32.1	420	

26-60 Years	758	68.4	180	88.7	44	28.2	982	61.71
>60 Years	0	0.0	3	1.5	62	39.7	65	0.0013*
Nationality								
Saudi	1060	95.7	182	89.7	97	62.2	1339	93.34
Non Saudi	48	4.3	21	10.3	59	37.8	128	0.001*
Educational Qualification								
Less than high school	114	10.3	130	64.0	66	42.3	310	
Diploma	142	12.8	40	19.7	24	15.4	206	
University - bachelor's	720	65.0	28	13.8	66	42.3	814	88.6 0.0011*
Post graduate studies	132	11.9	5	2.5	0	0.0	137	
Employment								
Unemployed	289	26.1	125	61.6	127	81.4	541	
Health workers	370	33.4	0	0.0	0	0.0	370	28.24
No health workers	449	40.5	78	38.4	29	18.6	556	0.004*

Table 6: Relation between demographic data of the studied group in relation to attitude score

	General attitude score						**Total**	**X^2 P value**
	Positive "n=820"		**Neutral "n=482"**		**Negative "n=165"**			
	No.	**%**	**No.**	**%**	**No.**	**%**		
Gender								
Male	325	29.3	302	148.8	29	18.6	656	20.47
Female	495	44.7	180	88.7	136	87.2	811	0.0018*
Age								
15-25 Years	351	31.7	55	27.1	14	9.0	420	
26-60 Years	425	38.4	410	202.0	147	94.2	982	98.57
>60 Years	44	4.0	17	8.4	4	2.6	65	0.0017*
Nationality								
Saudi	800	72.2	465	229.1	74	47.4	1339	50.60
Non Saudi	20	1.8	17	8.4	91	58.3	128	0.0011*
Educational Qualification								
Less than high school	89	8.0	118	58.1	103	66.0	310	
Diploma	91	8.2	95	46.8	20	12.8	206	
University - bachelor's	505	45.6	267	131.5	42	26.9	814	32.11
Postgraduate studies	135	12.2	2	1.0	0	0.0	137	0.002*
Employment								
Unemployed	285	25.7	152	74.9	104	66.7	541	
Health workers	370	33.4	0	0.0	0	0.0	370	50.73
No health workers	165	14.9	330	162.6	61	39.1	556	0.0016*

4. DISCUSSION

Vaccination is widely regarded as one of the 21st century's most significant contributions to public health. Its acceptance rate varies according to geographical location, historical period, socioeconomic status, racial background, and cultural setting [15, 16]. This study is one of the minor studies conducted in Saudi Arabia to study the acceptance of the COVID-19 vaccine administration.

In the current study, most participants preferred Pfizer followed by AstraZeneca, Sinopharm, and Sputnik. The remaining participants responded mix-up of all mentioned vaccines without any unique or individual one. The characteristics of COVID-19 pose several risks for vaccine-based elimination strategies, including the dwindling nature of both natural and vaccine-mediated immunity, the capability for vaccinated individuals to transmit the infection, the age-dependence of disease severity and (potentially) vaccine-mediated immunity [3, 13, 17]. Numerous cases of reinfection with COVID-19 have been established using direct molecular techniques. Participants' preference for the type of vaccine may be associated with the global and local vaccination reports as in mid-December 2020, KSA authorized the Pfizer-BioNTech vaccine. Five hundred thousand dosages were provided in December and given by January 2021. Then, the Oxford-AstraZeneca vaccine was authorized for use in KSA in February 2021. Due to the vaccine's flexible storage and handling, it may be sent to all parts of the Kingdom and held in central warehouses before distribution thus, it may be the first two considerations for the Saudi population to administrate [18].

As for the preventive measures, most respondents would wear a face mask to prevent COVID-19 spread and tend to wear it during all activities. Also, the majority have positive attitudes toward using hand sanitizers to prevent COVID-19. The high level of acceptance of subjects to the preventive measures indicated proper knowledge among Saudi subjects as Individuals who are sick or caring for those who may have COVID-19 are the only ones who should wear face masks, according to the World Health Organization and the Centers for Disease Control and Prevention [17, 19]. The government, at all levels, has made significant efforts, including public awareness initiatives. Through its website, national television, and other forms of social media, the Saudi Arabian Ministry of Health (MOH) has launched a comprehensive public education campaign. The Ministry of Health has released a COVID-19 reference book with information and safety tips in over ten languages. The MOH also interacts with the general public and the press through social media. There has been a significant expansion of these initial activities to involve the public in preventative and control measures and efforts to counter rumors and disinformation. The Kingdom of Saudi Arabia (KSA) is in a rare situation, having successfully contained two epidemics caused by linked viruses [20-22]. Thanks mainly to this novel experience, the government has been able to swiftly respond to and take precautions against the spread of COVID-19.

However, most respondents (88.8%) were not vaccinated yet, and less than half of them stated that they have a family member or a close relative who got immunized (43.4%), the acceptance of vaccination if the vaccine is generally available was 64.4%. Those results are in accord with those found in both the United States (80%) and China (72.5%) [23, 24]. A Saudi study showed that about 64.7% were enthusiastic about getting the COVID-19 vaccination [10]. Our findings on the willingness to get the COVID-19 vaccine were more positive on a regional scale when compared to those obtained in Qatar (60.5%) [25], Kuwait (53.1%) [26], Jordan (34.9%) [27], and Egypt (6.0%) [28] which showed lower acceptance rates.

More than half of the respondents agreed about the vaccine's safety, while 34.8% stated having fears about the vaccine. Lower levels of hesitancy due to worries about the vaccine were found in a Saudi study conducted among university students as a minority (6.1% to be exact) flat-out refused to have the COVID-19 vaccination [29]. Vaccine safety and efficacy worries and worries about possible adverse effects were the most critical factors in vaccine rejection [30]. Researchers discovered that those who thought vaccinations posed health hazards were less likely to be vaccinated [11, 26]. Another Saudi Arabian research found that concerns about the vaccine's effectiveness and safety were significant factors in people's reluctance to get the shot [9]. Long-term adverse effects were a concern, although the CDC in the United States stated there was little risk of them happening. Typically, adverse reactions to vaccines manifest themselves within the first six weeks after vaccination. That's

why the FDA required follow-up checks on all people who received the COVID-19 vaccination for at least two months following the last dosage [17].

A chi-square test and logistic regression to determine whether the demographics impacted their willingness to get the COVID-19 vaccination showed that higher attitude scores were significantly associated with female gender, Saudi nationality, younger age, higher educational status, and being a health care worker. This result runs in line with numerous other types of research [10, 11, 26, 29] that found statistical correlations between demographic variables, including gender, age, and marital status, with the acceptance of the COVID-19 vaccination.

This study has some limitations as it is cross-sectional research reflecting the community's reaction during the study period. We asked respondents whether they'd get COVID-19 if it became accessible. When the vaccination is available, the goal may change. 14 It's intriguing to see how research participants' intentions change through time and circumstance. Second, a web-based self-administered survey was used instead of a face-to-face interview. This may cause bias in their replies. Third, the research did not examine COVID-19 vaccination acceptance or hesitation reasons. During the study time (lockdown due to COVID-19), an online questionnaire was the only way to obtain participant data.

Despite the aforesaid constraints, this research is one of the most miniature studies with a representative sample size throughout the county that demonstrated the population's desire to get the COVID-19 vaccination.

5. CONCLUSION

The current research provides crucial new information on the viability of administering the Covid-19 vaccine to various populations in the Kingdom of Saudi Arabia. Vaccine development, production, and distribution provide hope for controlling the global COVID-19 outbreak. A few common misunderstandings about how COVID-19 is spreading needed to be cleared up. Health education and novel measures should be implemented to ensure that vaccination is accessible to everybody to bring COVID-19 under total control.

CONSENT

All individuals gave informed permission before participation.

ETHICAL APPROVAL (WHERE EVER APPLICABLE)

This study was approved by the hospital committee as it was done during our regular conferences during the era of Covid-19. Also, the study followed the Helsinki Declaration and Saudi CDC research rules.

REFERENCES

1. Vincent JL, Levi M, Hunt BJ. Prevention and management of thrombosis in hospitalised patients with COVID-19 pneumonia. Lancet Respir Med. 2022;10(2):214-20. doi:10.1016/s2213-2600(21)00455-0.

2. Corey L, Mascola JR, Fauci AS, Collins FS. A strategic approach to COVID-19 vaccine R&D. Science (New York, NY). 2020;368(6494):948-50. doi:10.1126/science.abc5312.

3. Burdick CE, Christopher CH. Perspectives about COVID-19 vaccine boosters among the U.S. paralysis community. Rehabil Psychol. 2022. doi:10.1037/rep0000471.

4. Kaur U, Chakrabarti SS. Need for focused pharmacovigilance in the face of rapid COVID-19 vaccine development. Curr Drug Saf. 2022. doi:10.2174/1574886317666220928151519.

5. Kim JE, Choi H, Choi Y, Lee CH. The economic impact of COVID-19 interventions: A mathematical modeling approach. Frontiers in public health. 2022;10:993745. doi:10.3389/fpubh.2022.993745.

6. Algaissi AA, Alharbi NK, Hassanain M, Hashem AM. Preparedness and response to COVID-19 in Saudi Arabia: Building on MERS experience. J Infect Public Health. 2020;13(6):834-8. doi:10.1016/j.jiph.2020.04.016.
7. Haynes BF, Corey L, Fernandes P, Gilbert PB, Hotez PJ, Rao S, et al. Prospects for a safe COVID-19 vaccine. Sci Transl Med. 2020;12(568). doi:10.1126/scitranslmed.abe0948.
8. Malik AA, McFadden SM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine. 2020;26:100495. doi:10.1016/j.eclinm.2020.100495.
9. Almaghaslah D, Alsayari A, Kandasamy G, Vasudevan R. COVID-19 Vaccine Hesitancy among Young Adults in Saudi Arabia: A Cross-Sectional Web-Based Study. Vaccines. 2021;9(4). doi:10.3390/vaccines9040330.
10. Al-Mohaithef M, Padhi BK. Determinants of COVID-19 Vaccine Acceptance in Saudi Arabia: A Web-Based National Survey. Journal of multidisciplinary healthcare. 2020;13:1657-63. doi:10.2147/jmdh.S276771.
11. Qattan AMN, Alshareef N, Alsharqi O, Al Rahahleh N, Chirwa GC, Al-Hanawi MK. Acceptability of a COVID-19 Vaccine Among Healthcare Workers in the Kingdom of Saudi Arabia. Frontiers in medicine. 2021;8:644300. doi:10.3389/fmed.2021.644300.
12. Sarkesh A, Daei Sorkhabi A, Sheykhsaran E, Alinezhad F, Mohammadzadeh N, Hemmat N, et al. Extrapulmonary Clinical Manifestations in COVID-19 Patients. The American journal of tropical medicine and hygiene. 2020;103(5):1783-96. doi:10.4269/ajtmh.20-0986.
13. Armaly Z, Kinaneh S, Skorecki K. Renal Manifestations of Covid-19: Physiology and Pathophysiology. J Clin Med. 2021;10(6). doi:10.3390/jcm10061216.
14. OpenEpi. Sample Size for X-Sectional, Cohort, and Clinical Trials. Available online: https://www.openepi.com/SampleSize/
SSCohort.htm.
15. Habersaat KB, Jackson C. Understanding vaccine acceptance and demand-and ways to increase them. Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz. 2020;63(1):32-9. doi:10.1007/s00103-019-03063-0.
16. Xiao X, Wong RM. Vaccine hesitancy and perceived behavioral control: A meta-analysis. Vaccine. 2020;38(33):5131-8. doi:10.1016/j.vaccine.2020.04.076.
17. CDC. Centers for Disease Control and Prevention. Safety of COVID-19 vaccines. Available online: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/safety-of-vaccines.html 2021.
18. Assiri A, Al-Tawfiq JA, Alkhalifa M, Al Duhailan H, Al Qahtani S, Dawas RA, et al. Launching COVID-19 vaccination in Saudi Arabia: Lessons learned, and the way forward. Travel Med Infect Dis. 2021;43:102119. doi:10.1016/j.tmaid.2021.102119.
19. WHO. WHO Coronaviruses (COVID-19). Available online at: https://www.who.int/news-room/q-a-detail/q-a-coronaviruses 2020.
20. Almutairi KM, Al Helih EM, Moussa M, Boshaiqah AE, Saleh Alajilan A, Vinluan JM, et al. Awareness, Attitudes, and Practices Related to Coronavirus Pandemic Among Public in Saudi Arabia. Fam Community Health. 2015;38(4):332-40. doi:10.1097/fch.0000000000000082.
21. Elbur A, Alharthi A, Aljuaid A, Hasan N. Knowledge of Middle East respiratory syndrome coronavirus (MERS-CoV) and its management: a survey among Saudi people in Taif; Kingdom of Saudi Arabia. IOSR J Pharm. 2016;6(8):33-9.
22. Nooh HZ, Alshammary RH, Alenezy JM, Alrowaili NH, Alsharari AJ, Alenzi NM, et al. Public awareness of coronavirus in Al-Jouf region, Saudi Arabia. Z Gesundh Wiss. 2021;29(5):1107-14. doi:10.1007/s10389-020-01209-y.
23. Fu C, Pei S, Li S, Sun X, Liu P. Acceptance and preference for COVID-19 vaccination in health-care workers (HCWs). MedRxiv. 2020.
24. Thunström L, Ashworth M, Finnoff D, Newbold SC. Hesitancy toward a COVID-19 vaccine. Ecohealth. 2021;18(1):44-60.
25. Alabdulla M, Reagu SM, Al-Khal A, Elzain M, Jones RM. COVID-19 vaccine hesitancy and attitudes in Qatar: A national cross-sectional survey of a migrant-majority population. Influenza Other Respir Viruses. 2021;15(3):361-70. doi:10.1111/irv.12847.

26. Alqudeimat Y, Alenezi D, AlHajri B, Alfouzan H, Almokhaizeem Z, Altamimi S, et al. Acceptance of a COVID-19 Vaccine and Its Related Determinants among the General Adult Population in Kuwait. Med Princ Pract. 2021;30(3):262-71. doi:10.1159/000514636.
27. Sallam M, Dababseh D, Eid H, Hasan H, Taim D, Al-Mahzoum K, et al. Low COVID-19 Vaccine Acceptance Is Correlated with Conspiracy Beliefs among University Students in Jordan. International journal of environmental research and public health. 2021;18(5). doi:10.3390/ijerph18052407.
28. Saied SM, Saied EM, Kabbash IA, Abdo SAE. Vaccine hesitancy: Beliefs and barriers associated with COVID-19 vaccination among Egyptian medical students. J Med Virol. 2021;93(7):4280-91. doi:10.1002/jmv.26910.
29. Almalki MJ, Alotaibi AA, Alabdali SH, Zaalah AA, Maghfuri MW, Qirati NH, et al. Acceptability of the COVID-19 Vaccine and Its Determinants among University Students in Saudi Arabia: A Cross-Sectional Study. Vaccines. 2021;9(9):1-4. doi:10.3390/vaccines9090943.
30. Qunaibi EA, Helmy M, Basheti I, Sultan I. A high rate of COVID-19 vaccine hesitancy in a large-scale survey on Arabs. Elife. 2021;10:e68038. doi:10.7554/eLife.68038.