JCHR (2024) 14(2), 319-329

Journal of Chemical Health Risks

sanad.iau.ir/journal/jchr

ORIGINAL ARTICLE

Post COVID Vaccination Experience among the United Arab Emirates General Public

Tasnim Alomar, Mirza Rafi Baig*, Hanan S. Anbar*

Department of Clinical Pharmacy and Pharmacotherapeutics, Dubai Pharmacy College for Girls, Dubai, 19099, United Arab Emirates

(Received: 16 November 2023 Accepted: 31 January 2024)

KEYWORDS
Vaccine;
COVID-19;
United Arab Emirates;
Experience

ABSTRACT: The study aimed to investigate the experience of the general public in the United Arab Emirates post-COVID-19 vaccines in order to find out the long-term side effects of COVID-19 vaccines. A cross-sectional survey was conducted among a sample of vaccinated individuals in the United Arab Emirates. A total of 500 respondents completed the survey. Twenty participants (4.7%) expressed concerns about either registering or receiving the COVID-19 vaccination, mainly due to their uncertainty about vaccine safety. 58.8% of the participants who have received Pfizer vaccine have received Sinopharm, Pfizer, or both vaccines together. Of them, 78.6% had experienced vaccine-related side effects. The most common side effects are pain/swelling at the injection site, muscle pain, tiredness, fever, headache, shivering, feeling unwell, and joint pain. Similarly, only 5.4% reported health problems after vaccination while 94.6% did not have any after vaccination. In the same way, only 3.6% developed a new disease after the COVID-19 vaccine. Additionally, 3% reported having contacts who experienced health problems/new diseases after vaccination. Overall, attitudes toward the COVID-19 vaccine were positive. Several differences in the incidence and number of vaccine-related adverse events experienced were due to age, sex, and vaccine type.

INTRODUCTION

The COVID-19 pandemic has overwhelmed most countries' healthcare systems and resulted in huge economic losses. SARS-CoV-2 is typically transmitted through respiratory droplets. Since the revelation of the SARS-CoV-2 genetic sequence on January 11th, 2020, numerous pharmaceutical businesses and academic institutes from numerous nations have joined forces to produce the COVID-19 vaccine [1]. Thankfully, several candidates have entered clinical trial evaluation with success and moved on to phase 3 and beyond [2]. It's worth remembering that the obstacles to vaccine development do not end after a vaccine is developed. A basic concern in public health is skepticism about a vaccine's efficacy and safety, which might sabotage attempts to contain the pandemic. Because vaccinations are frequently provided to healthy individuals who may gain no immediate health benefits, public opinion on the advantages and hazards of immunization focuses on safety. Since the creation of the COVID-19 vaccines, speculations have circulated and been argued on numerous social media sites that the vaccines are associated with various post-vaccination ill effects [3].The perception of the people in the United Arab Emirates of the different vaccines has varied. Many were eager to get vaccinated as soon as the vaccines were available whereas, on the other hand, there were many people against receiving the vaccine. This research has been done to explore the experiences of the public in the United Arab Emirates post COVID-19 vaccinations [4, 5].

*Corresponding author: dr.hanan@dpc.edu; Dr.Mirzabaig@dpc.edu (M. Rafi Baig; H. S. Anbar)
DOI: 10.22034/jchr.2024.2006536.1948

MATERIALS AND METHODS

Study design and setting

The study was confined to the United Arab Emirates. A cross-sectional study with a non-probability sampling technique was performed from Feb 2022 to March 2022. Respondents possessing the criteria for the study were selected randomly. They were asked to fill out a Google Form containing the survey questions. The sample size is 500 respondents. The data preparation and cleaning phase eliminated the outliers in the data. The sample size was calculated using Cochran's formula where:

-e is the desired level of precision (i.e., the margin of error)

-p is the (estimated) proportion of the population that has the attribute in question

-q is 1 – p

Statistical variables, hypotheses, statistical tools, and processing

Collected data were challenged, coded and analyzed using SPSS software. Using a 5% significance level, the chi-square test of independence/associations was used to assess pairwise correlations between categorical variables and Spearman's correlation test to determine if there was a significant relationship between a group of variables. study $P< 0.05$ was considered statistically significant. Statistical analyzes (both descriptive and inferential) were performed using SPSS.

Exclusion and inclusion criteria

1. The eligible participants were males or females who were eligible to be vaccinated against COVID-19 and reside in the United Arab Emirates.

2. Eligible participants should be above the age of 18 years.

The Online Survey Tool

The survey tool was written in English and translated to Arabic then back-translated from Arabic to English through professional translators.

RESULTS

Demographic data

The survey consisted of two major information sections; the first section has socio-demographic and healthcare-related information, and the second one has measurement constructs. The first section included information about participants' characteristics including age, gender, nationality, education level, occupation sector, and any chronic diseases the participant is suffering. The second section contained items related to the side effects of the COVID-19 vaccine and the symptoms the participant suffered. A total of 500 responses were included in the study (51.80% males, and 48.20% females). The educational level of the participants shows that 58.80% have completed a bachelor's degree, 35.80% are master's degree holders, 2% are diploma holders, 1% are Ph.D. degree holders, and 2.40% attended school. More than half of the participants are employed in the private sector at a percentage of 60.40% while around 22.40% are working in the public sector and 13.40% are self-employed. Approximately 2.60% are students while only 1.20% is non-employed. Table [1] shows the details of the demographic data of the survey participants.

Table 1. Demographic data of participants

Demographic data of participants		N (%)
Gender	Males	241 (48.2%)
	Females	259 (51.8%)
Age (Yrs.)	18-30	173(34.6%)
	31-40	250(50%)
	41-50	44(8.8%)
	51-60	19(3.8%)
	61-70	11(2.2%)

	71-80	3(0.6%)
Education	School	12 (2.4%)
	Diploma	10 (2.0%)
	Bachelor's degree	294 (58.8%)
	Master's degree	179 (35.8%)
	PHD degree	5 (1.0%)
Occupation	Public sector	112 (22.4%)
	Private sector	302 (60.4%)
	Self employed	67 (13.4%)
	Non employed	6 (1.2%)
	Student	13 (2.6%)

Pre-vaccination

Health wise, a significant number (79.40%) of the participants reported no history of chronic diseases before vaccination. Approximately 20.60% had a history of chronic diseases. Figure 1 demonstrates the details of the diseases reported by the participant's pre-vaccination. A large percentage of the participants reported suffering from high blood pressure. Almost 20% of the participants who reported a history of chronic disease suffer from asthma. Around the same percentage was reported from participants who suffer from migraines. Less than 15% of the participants are suffering from diabetes mellitus. A similar percentage was reported by participants who have osteoarthritis. Few participants reported having ischemic heart diseases, GERD, kidney diseases, and other diseases.

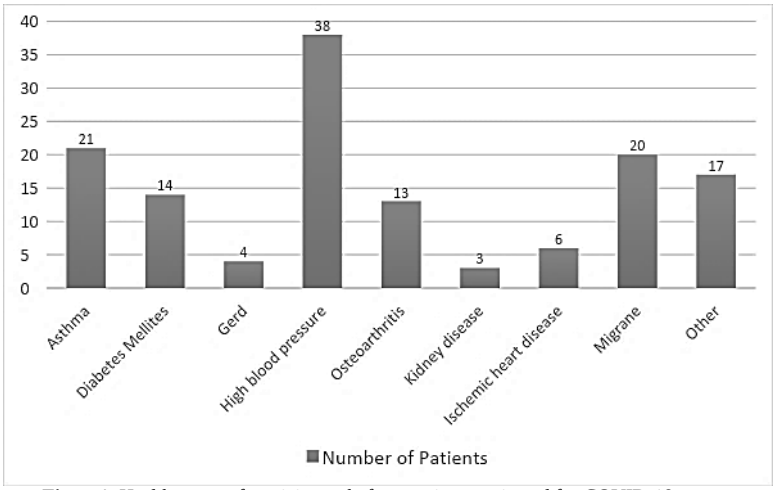

Figure1. Health status of participants before getting vaccinated for COVID-19

The majority of the participants reported that they had not been diagnosed with COVID-19 before being vaccinated (64.6%), whereas 35.40% reported having tested positive for COVID-19 before vaccination. Around 65.8% of participants had at least a member of the family or close relative who had tested positive for COVID-19 whereas 34.20% had no members of the family or close relatives who tested positive for COVID-19, Figure 2.

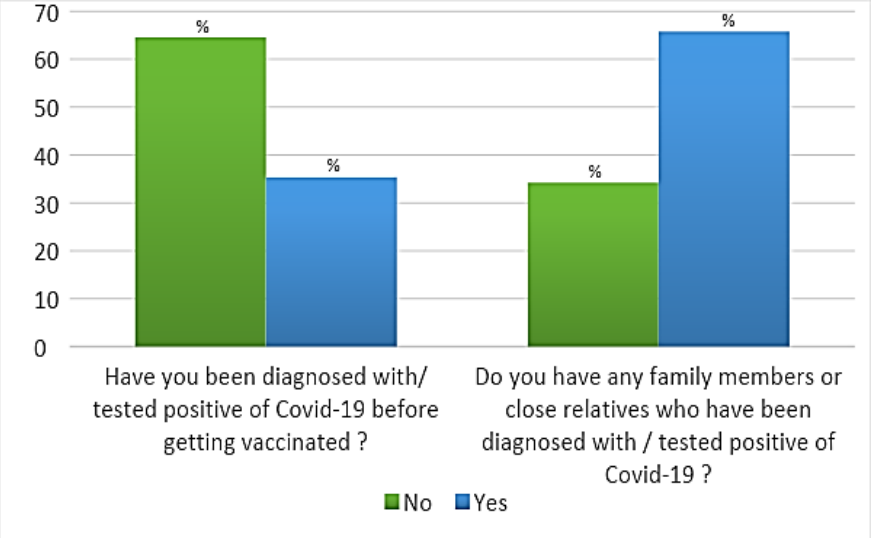

Figure 2. Participants tested positive before getting vaccinated for COVID-19.

Post-vaccination

Most of the participants received Pfizer-BioNTech and Sinopharm vaccines, 49.80% and 37.60% respectively, while 37.60% of participants reported taking two doses of two different COVID-19 vaccines, i.e., Pfizer-BioNTech and Sinopharm. Around 52.40% of participants reported being infected with COVID-19 after receiving the vaccine. Tables 2 & 3 show the percentage of infected participants varied between the different vaccine types.

Table 2. Type of COVID-19 vaccine received by participants.

Type of COVID-19 Vaccine	N (%)
Pfizer	249 (49.8%)
Sinopharm	55 (11.0%)
Pfizer; Sinopharm	188 (37.6%)
Not sure	8 (1.6%)

Table 3. Participants' infection with COVID-19 after vaccination.

Have you been diagnosed with / tested positive for COVID-19 after getting vaccinated?		Yes	No
		N (%)	N (%)
Type of vaccine received	Pfizer	140 (58.8%)	109 (41.6%)
	Sinopharm	41 (17.2%)	14 (5.3%)
	Pfizer-Sinopharm	54 (22.7%)	134 (51.1%)
	not sure	3 (1.3%)	5 (1.9%)

A variety of potential post-vaccination adverse events were assessed among participants in this study. Table 3 shows that most patients reported suffering side effects post-COVID-19 vaccination (78.60%), whereas only 21.40% didn't suffered from side effects post-vaccination. Around 36.20% of the participants claimed that the side effects with the second dose of the vaccination were more severe than the first dose, whereas 34.20% suffered from severe side effects with the first dose compared to the second one. As shown, approximately 8.40% of the participants have suffered from severe side effects with both doses of the vaccine. Figure 3 illustrates the details of the intensity of COVID-19 vaccine side effects respective to the dose.

The most common side effects are pain/swelling at the injection site (63.20%), muscle pain (62.80%), tiredness (62.2%), fever (59%), headache (58.8%), shivering (53%) feeling unwell (45.8%) and joint pain (38.8%). Other side effects were less common among vaccinated participants as shown in Figure 4. Also data tabulated in tables 4-8.

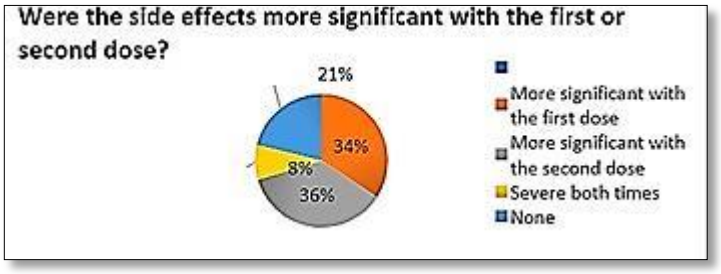

Figure 3. Side effects difference between the first dose and second dose of COVID vaccines

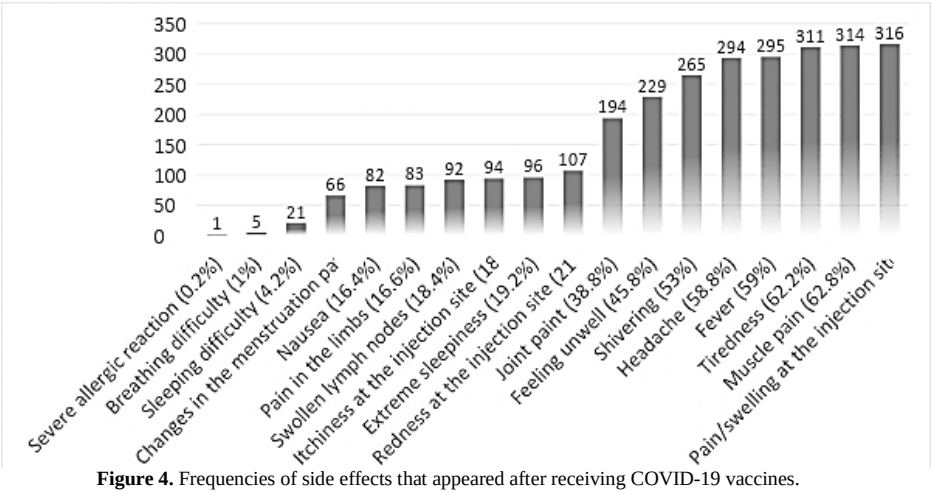

Figure 4. Frequencies of side effects that appeared after receiving COVID-19 vaccines.

Table 4. Vaccination Type and Reported Side Effects Cross Tabulation.

What type of vaccine have you received?	Did you experience any side effects after the vaccination?	Chi Square test (45.255) p value <0.05
	No	Yes
	N%	N%
Pfizer	43 (40.2)	206 (52.4%)
Sinopharm	31 (29.0%)	24 (6.1%)
Pfizer & Sinopharm	31 (29.0%)	157 (39.9%)
Not sure	2 (1.9%)	6 (1.5%)

Table 5. Age and Post-Vaccination Side Effects Cross Tabulation.

Did you experience any side effects after the vaccination?			No	Yes	
Age (yrs.)	18-30	N(%)	40(37.7%)	133(33.9%)	*Chi-square test (6.240)* *P value <0.05*
	31-40	N(%)	46(43.4%)	203 (51.8%)	
	41-50	N(%)	14(13.2%)	30 (7.7%)	
	51-60	N(%)	5(4.7%)	14(3.6%)	
	61-70	N(%)	1 (0.9%)	10 (2.6%)	
	71-80	N(%)	0(0.0%)	2(0.5%)	

5.4% have reported health problems post COVID-19 vaccination as shown in Tables 6 & 7. Similarly, 3.6% of participants reported having new diseases post COVID-19 vaccination as illustrated in Tables 6 & 8.

Table 6. Health experiences reported by participants and their contacts post-COVID vaccination.

Health experiences reported by participants and their contacts post COVID vaccination	Yes	No
	N (%)	N(%)
Did you experience any health problems after vaccination?	27(5.4%)	473(94.6%)
Did you have any new disease after vaccination?	18(3.6%)	482(96.4%)
Did any of your contacts experience health problems/new diseases after vaccination?	15(3%)	485 (97%)

Table 7. Health problems post vaccination.

Health Problems After the Vaccination	N (%)
Allergy	1(0.2%)
High blood pressure	1(0.2%)
Changes in menstruation	3 (0.6%)
Drooping of eyelids	1(0.2%)
Feeling unwell and tired	1(0.2%)
Frequent muscle injuries while playing sports	1(0.2%)
Irregular heart beats	1(0.2%)
Hormonal imbalances	1(0.2%)
Lymph nodes swelling and tenderness	1(0.2%)
Migraine	1(0.2%)

Table 8. Participants who experienced new diseases post COVID-19 vaccine,

New Disease After the Vaccination	N(%)
Gallbladder inflammation	1(0.2%)
Arrhythmia	1(0.2%)
Migraine	1(0.2%)
Severe dysmenorrhea	1(0.2%)

In this study, the perceptions of the participants toward COVID-19 vaccination were observed. Most participants (65.8%) still adhere to SOP (standard operating procedure) even after getting vaccinated whereas only 34.2% of the participants do not adhere to SOP. Most of the participants claimed feeling safe and protected post-vaccination (88.2%), but only 11.8% reported that they did not feel safe or protected after vaccination. Many participants (94.6%) feel that the benefits outweigh the risks associated with getting COVID-19 vaccination and only 5.4% feel the opposite. Furthermore, 93% answered "Yes" when asked if they plan to receive the booster dose of the vaccination, and only 7% answered "No". The details of the participant's perceptions of COVID-19 vaccination are shown in Figure 5.

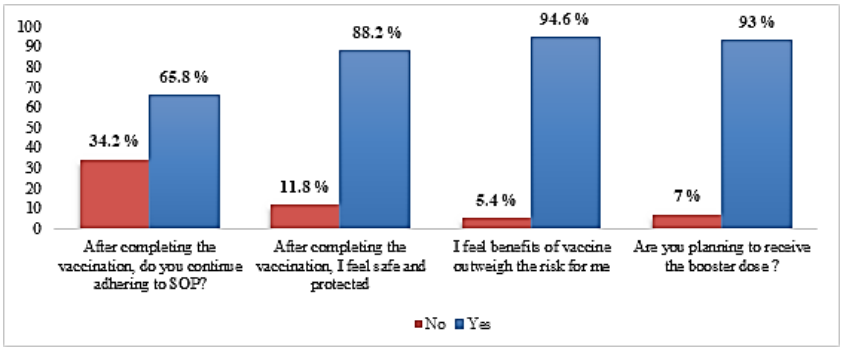

Figure 5. Participants' perceptions towards COVID-19 vaccine.

Respondents were divided into two groups according to the type of vaccine received. Normal distribution, skewness test, interquartile range and box plot helped us identify outliers in the data that could affect inferential statistics. Extreme outliers were removed and small ones were replaced by the median value, as it is not affected by outliers.

•Does the type of vaccine affect the nature of COVID-19 vaccine post side effects?

Hypothesis 1: The type of vaccine affects the nature and severity of post-vaccine side effects.

•To determine whether COVID vaccine affects women more significantly than men.

Hypothesis 3: Do COVID-19 Vaccine side effects affect women more significantly than men?

•To find out if age affects the side effects on people vaccinated.

Hypothesis 4: Younger age had a higher risk of experiencing side effects than the older population.

DISCUSSION

Perceptions toward COVID-19 vaccine

In the present study, the acceptance of the vaccines was acceptable despite the side effects reported. Most of the participants claimed feeling safe and protected post-vaccination (88.2%), while only 11.8% reported that they did not feel safe or protected after vaccination. Many participants (94.6%) feel that the benefits outweigh the risks associated with getting COVID-19 vaccination and only 5.4% didn't feel the same. Furthermore, 93% answered "Yes" when asked if they plan to receive the booster dose of the vaccination and only 7% answered "No". The details of the participants' perceptions of COVID-19 vaccination are shown in Figure 5.

Several studies evaluated how well-received COVID-19 vaccinations were among healthcare professionals before the vaccines were made available to the general public. Only 8% of the 3479 healthcare workers in a U.S. study who planned to refuse the COVID-19 vaccine did so, indicating the possibility of a significant uptake[6]. An additional survey from the Asia-Pacific area revealed that about 95% of 1720 healthcare professionals were open to receiving the COVID-19 vaccine. Healthcare professionals were chosen to examine the potential side effects following the COVID-19 immunization based on data from various early-stage studies [7].

A cross-sectional study was conducted between 14 and 29 January 2021 and targeted Arabic-speaking health professionals around the world. The study included 5708 participants (55.6% male, 44.4% female, age 30.6 ± 10 years) from 21 Arab countries (87.5%) and 54 other countries (12.5%). The analysis showed significant vaccine hesitancy among Arabic-speaking HCWs living in and outside Arab countries (25.8% and 32.8%, respectively) [8].

Another study done in 2021 in Canada to assess the Intention to receive a COVID-19 vaccine. 79.8% of the 4948 responders said they planned to get the COVID-19 vaccine. Older people (and those in their 60s) were more likely to plan to get the vaccine, while women with less than a high school education were more likely to consider themselves nonwhite, Native American, and not in need of health care. workers were less likely to receive the COVID-19 vaccine [9].

Vaccine type and post vaccine side-effects

In this study, almost half of the participants (49.8%) received the Pfizer-BioNTech vaccine, 11% with Sinopharm, and 37.6% received both the Pfizer-BioNTech and Sinopharm vaccines. The research data shows a significant association between the vaccine type and the severity of the side effects. As shown in Table 6 the most abundant severe side effects were reported by participants who received the Pfizer-BioNTech vaccine (52.4%) and those who received both Pfizer-BioNTech and Sinopharm vaccines (39.9%). The percentage decreased significantly with participants who received the Sinopharm vaccine (6.1%), where "no symptoms" are mostly reported.

In a previous study done in Jordan, the data showed a strong association between the type of vaccine and the severity of post-COVID-19 vaccine side effects reported. Severe and moderate side effects are mostly associated with AstraZeneca followed by Pfizer vaccines [10].

Another study was done in Poland on the same subject. All of the side effects listed in the survey were reported by 17.1% of respondents. 93.9% of respondents who had received the first dose of the Pfizer vaccine reported experiencing vaccination reactions; just 2% of respondents experienced every side effect listed in the poll. Most of the individuals experienced post-vaccinal reactions following the Pfizer vaccine's second dose: 54.8% of respondents reported greater adverse reactions, 15.8% reported less adverse reactions, and 29.4% reported the same side effects following both doses [11].

A similar study conducted in Saudi Arabia shows that The Pfizer-BioNTech vaccine yielded a higher occurrence of mild-to-moderate side effects in comparison to vaccines produced by other manufacturers. This observation was made independently for the first, second, and third doses, considering that individuals may have received doses from different manufacturers [12].

Similarly, an online cohort study in California to study the Adverse effects and their severity varied among different vaccine brands. In comparison to individuals who received the BNT162b2 vaccine, those who received the mRNA-1273 vaccine had twice the likelihood of reporting adverse effects. Furthermore, individuals who received the mRNA-1273 vaccine had 1.88 times the odds of reporting severe or very severe adverse effects compared to those receiving the BNT162b2 vaccine [13].

In another research which was conducted in Iran, results illustrate that the Sputnik V vaccine exhibit the highest occurrence of adverse effects, with the AstraZeneca and Sinopharm vaccines following suit. It is noteworthy that the COVID-19 vaccines administered in Iran have demonstrated safety, with no instances of serious adverse effects reported [14].

In a cohort study included 1,736 individuals spanning the age spectrum from 18 to 86 years. The study comprised individuals who had received either the first dose or the complete two-dose vaccination regimen at least 30 days prior to their participation. Furthermore, participants were categorized into subgroups based on whether they had received the Pfizer, AstraZeneca, or Sinopharm vaccine. Based on the research data it was determined that Pfizer, AstraZeneca, and Sinopharm vaccines were safe. Notably, the Sinopharm vaccine demonstrated a lower occurrence of adverse effects in comparison to the Pfizer and AstraZeneca vaccines after the first and second doses, respectively. The duration and severity of adverse effects were not significantly influenced by age or gender. It is essential to closely monitor unusual adverse effects to establish their potential association with the vaccine [15].

Risk of side effects among younger population

The question of whether a higher risk of side effects resides in the younger population over the older population was studied in this research. When considering the chi-square value (6.24), we can see a strong correlation between age and a higher possibility of experiencing side effects post-COVID-19 vaccine as shown in Table 5. However, since the sample participants within this research belong mostly to two age groups, 31-40 and 18-31 respectively, further studies with larger sample sizes need to be conducted to expand the study on the correlation between age and the side effects post COVID-19 vaccine.

A previous study was conducted by Elnaem el at. in Malaysia in 2021 has shown that younger age groups have a higher tendency to develop more side effects post-COVID-19 vaccines. Most of the participants in this study were between the 31 and 40 years of age category, followed by people in the 18 to 30 years of age range[16].

Another study done in Japan was conducted to assess how age influences the occurrence of specific vaccine-related adverse symptoms. They conducted a comparative analysis. The participants were divided into two groups: one comprising individuals aged 60 years and older, and the other consisting of those aged 59 years or younger. Following the administration of the first vaccine dose, the younger group exhibited a significantly higher frequency of side effects compared to the older group. After the second vaccine dose, the younger group experienced significantly more systemic symptoms such as general fatigue, headache, joint pain, chills, fever, and nausea in comparison to the older group. These findings indicate that age plays a crucial role in contributing to the occurrence of side effects

associated with COVID-19 mRNA vaccines[17].

A study in Ethiopia showed that there was a notable difference in the prevalence of reported adverse reactions among different age groups. Specifically, the age group ranging from 50 to 60 years experienced a significantly higher prevalence of adverse reactions compared to those under 50 and over 60 years. Among the reported adverse reactions, headaches, and local pain were more frequently reported in the age group of 50 to 60 years [18].

Fadime Tosun and Mehmet Bulbul, 2022 conducted a study to assess the relationship between COVID-19 vaccine side effects and age. In their study, the participants were categorized into four age groups: 20-35, 36-50, 51-65, and those over 65 years old. Notably, vaccine-related side effects were primarily observed in individuals aged 20-35 and at least in those over 65 years old [19].

A meta-analysis conducted in 2021, compared the efficacy and safety of five kinds of COVID-19 vaccines in different age groups. Young individuals who received COVID-19 vaccinations exhibited a more robust immune response compared to older individuals. However, the safety profile was less favorable among the younger age group, with the most common adverse events being fever, rash, and localized muscle pain, although these were generally manageable. On the other hand, older individuals experienced fewer adverse events, suggesting that they can also safely receive vaccinations. The reduced antibody response observed in the elderly is attributed to immunosenescence. Ongoing research is necessary to understand vaccine tolerance across various age groups [20].

In a cross-sectional study done in Singapore adverse events that were addressed by the Occupational Health Clinic (OHC), post-vaccination was generally of a mild and self-limiting nature. According to the results, Participants under the age of 60 were significantly more likely to experience fever/chills, injection site reactions, headache, aches and pains, and a general feeling of unwellness compared to those aged 60 or older [21].

Gender and post-vaccine side effects

In the present study, females (51.8%) participated which is slightly higher than the percentage of male participants. A higher number of female participants who belonged to the age category (31-40) is explained by the fact that the participants were mostly from the circle of connection of the researcher. On the other hand, a total of 241 males participated in this study, from which 184 or 76% of them experienced side effects post-COVID-19 vaccination, and 57 participants reported having no side effects. A total of 259 females participated in this study, most of them (209 participants or 81% of the total female participants) have reported experiencing side effects of COVID-19 vaccination while only 50 reported no symptoms. (Table 1)

From the data collected in this study, it can be observed that females are more likely to experience side effects than males. Therefore, as observed there is a correlation between the gender of the participant and the possibility of experiencing side effects of COVID-19 vaccines proved by a value of (1.302) of the chi-square test conducted on this data as in Table 6.

Gender association with COVID-19 vaccine side effects has been studied in earlier studies done in Jordan, Malaysia, and Saudi Arabia. All previous studies have shown that females are more prone to experience side effects of the COVID-19 vaccine [4, 5].

A cross-sectional study was carried out, in which 1351 workers from a tertiary care center in the Mexican southeast were included. A total of 1,351 healthcare professionals took part in the online survey. Their average age was 37.8 years with a standard deviation of 10.9, and 56.4% of them were female. Notably, the occurrence of side effects was linked to being female, and these side effects were more common among younger participants compared to older participants [22].

In as retrospective study examined 4,341 individuals who had received the initial doses of COVID-19 vaccine at the Jio Health Clinic in Ho Chi Minh City, Vietnam. The study found that being aged $\leq$ 60 years females were significant independent risk factors for both local and systemic side effects [23].

A total of 492 participants took part in the study conducted in Saudi Arabia, all of whom were vaccinated against the COVID-19 virus. There were 152 men (30.9%) and 340 women (69.1%), average age

35 ± 10.7 years. Approximately 72.2% of participants received three doses of the vaccine, of which 75.6% received the Pfizer-BioNTech vaccine, 22.2% the Oxford-AstraZeneca vaccine, and 2.2% the Moderna vaccine. Gender was significantly correlated with injection site pain, headache, lethargy or seizures and flu-like symptoms [24].

In a study involved a total of 522 participants in Slovakia, with 77% being females, 55.7% falling within the age range of 31 to 54 years, and 41.6% hailing from Banska Bystrica. A significant majority of participants (91.6%) reported experiencing at least one side effect. It was observed that females and young adults were more likely to report post-vaccination side effects, which aligns with findings from other phase IV studies conducted globally [25].

CONCLUSIONS

The current study found that the approved COVID-19 vaccines are safe and that becoming immunized makes people in the United Arab Emirates feel more secure, despite significant disparities in the existence and severity of adverse effects between these vaccinations. Females and younger ages are more prone to experience side effects post COVID-19 vaccinations when compared to males and older ages. Most adverse effects following vaccination are mild to moderate. However, only a small number of instances reported long-lasting adverse effects, health problems, and new diseases after vaccination necessitating the completion of additional research with a larger sample size.

ETHICAL CONSIDERATION

Ethical approval of this study was granted by the Research Ethics Committee of Dubai Pharmacy College with reference number REC/PG/2021/043**.**

Funding

This research received no external funding.

Institutional review board statement

Ethical approval for this study was granted by the Dubai Pharmacy Research Ethics Committee (Ref# REC/PG/2021/04). Participation information sheets and informed consent forms were included in the online survey form. Participation was entirely voluntary, with no monetary compensation.

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

REFERENCES

1. Al-Hosani F., Al-Mazrouei S., Al-Memari S., Al-Yafei Z., Paulo M. S., Koornneef E., 2021. A review of COVID-19 mass testing in the United Arab Emirates. Frontiers in Public Health. 9, 661134-661140.

2. Berry D.A., Berry S., Hale P., Isakov L., Lo A.W., Siah K.W., Wong C.H., 2020. A cost/benefit analysis of clinical trial designs for COVID-19 vaccine candidates. PloS one. 15(12), e0244418- e0244425.

3. Tan C.M., Owuamalam C.K., Sarma V., 2022. Improving vaccination intent among skeptics through confidence in governments' handling of the COVID-19 pandemic. Acta Psychologica. 225,1-9.

4. Saddik B., Al-Bluwi N., Shukla A., Barqawi H., Alsayed H.A.H., Sharif-Askari N.S., Temsah M.H., Bendardaf R., Hamid Q., Halwani R., 2022. Determinants of healthcare workers perceptions, acceptance and choice of COVID-19 vaccines: a cross-sectional study from the United Arab Emirates. Human Vaccines & Immunotherapeutics. 18(1), 1-9.

5. Ahamed F., Ganesan S., James A., Zaher W.A., 2021. Understanding perception and acceptance of Sinopharm vaccine and vaccination against COVID–19 in the UAE. BMC Public Health. 21, 1-11.

6. Shekhar R., Sheikh A.B., Upadhyay S., Singh M., Kottewar S., Mir H., Barrett E., Pal S., 2021. COVID-19 vaccine acceptance among health care workers in the United States. Vaccines. 9(2), 119-126.

7. Chew N. W., Cheong C., Kong G., Phua K., Ngiam J.N., Tan B.Y., Wang B., Hao F., Tan W., Han X., 2021. An Asia-Pacific study on healthcare workers' perceptions of, and willingness to receive, the COVID-19 vaccination. International Journal of Infectious Diseases. 106, 52-60.

8. Qunaibi E., Basheti I., Soudy M., Sultan I., 2021. Hesitancy of Arab healthcare workers towards COVID-

19 vaccination: a large-scale multinational study. Vaccines. 9(5), 446-452.

9. Ogilvie G.S., Gordon S., Smith L.W., Albert A., Racey C.S., Booth A., Gottschlich A., Goldfarb D., Murray M. C., Galea L. A., 2021. Intention to receive a COVID-19 vaccine: results from a population-based survey in Canada. BMC Public Health. 21(1), 1017-1022.

10. Hatmal M.M.M., Al-Hatamleh M.A., Olaimat A.N., Hatmal M., Alhaj-Qasem D.M., Olaimat T.M., Mohamud R., 2021. Side effects and perceptions following COVID-19 vaccination in Jordan: a randomized, cross-sectional study implementing machine learning for predicting severity of side effects. Vaccines. 9(6), 556-563.

11. Andrzejczak-Grzadko S., Czudy Z., Donderska M., 2021. Side effects after COVID-19 vaccinations among residents of Poland. Eur Rev Med Pharmacol Sci. 4418-4421.

12. Almalki O.S., Santali E.Y., Alhothali A.A., Ewis A.A., Shady A., Fathelrahman A.I., Abdelwahab S.F., 2023. The role of blood groups, vaccine type and gender in predicting the severity of side effects among university students receiving COVID-19 vaccines. BMC Infectious Diseases. 23(1), 1-11.

13. Beatty A.L., Peyser N.D., Butcher X.E., Cocohoba J.M., Lin F., Olgin J.E., Pletcher M.J., Marcus G.M., 2021. Analysis of COVID-19 vaccine type and adverse effects following vaccination. JAMA Network Open. 4(12), e2140364-e2140364.

14. Babaee E., Amirkafi A., Tehrani-Banihashemi A., SoleimanvandiAzar N., Eshrati B., Rampisheh Z., Asadi-Aliabadi M., Nojomi M., 2022. Adverse effects following COVID-19 vaccination in Iran. BMC Infectious Diseases. 22(1), 1-8.

15. Al Khames Aga Q.A., Alkhaffaf W.H., Hatem T.H., Nassir K.F., Batineh Y., Dahham A.T., Shaban D., Al Khames Aga L. A., Agha M. Y., Traqchi M., 2021. Safety of COVID-19 vaccines. Journal of Medical Virology. 93(12), 6588-6594.

16. Elnaem M.H., Mohd Taufek N.H., Ab Rahman N.S., Mohd Nazar N.I., Zin C.S., Nuffer W., Turner C.J., 2021. Covid-19 vaccination attitudes, perceptions, and side effect experiences in malaysia: Do age, gender, and vaccine type matter? Vaccines. 9(10), 1156-1165.

17. Mori M., Yokoyama A., Shichida A., Sasuga K., Maekawa T., Moriyama T., 2022. Impact of Sex and Age on mRNA COVID-19 Vaccine-Related Side Effects in Japan. Microbiology Spectrum. 10(6), e01309-01322.

18. Alemayehu A., Demissie A., Yusuf M., Abdullahi Y., Abdulwehab R., Oljira L., Feleke D., 2022. COVID-19 vaccine side effect: age and gender disparity in adverse effects following the first dose of AstraZeneca COVID-19 vaccine among the vaccinated population in Eastern Ethiopia: a community-based study. SAGE Open Medicine. 10, 1-8.

19. Tosun F., Bulbul M., Tosun İ., 2022. Comparison of severe acute respiratory syndrome coronavirus 2 (COVID-19) vaccine side effects by age groups. Revista da Associação Médica Brasileira. 68, 476-481.

20. Wang J., Tong Y., Li D., Li J., Li Y., 2021. The impact of age difference on the efficacy and safety of COVID-19 vaccines: a systematic review and meta-analysis. Frontiers in Immunology. 12, 1-7.

21. Lim S.M., Chan H.C., Santosa A., Quek S.C., Liu E.H.C., Somani J., 2021. Safety and side effect profile of Pfizer-BioNTech COVID-19 vaccination among healthcare workers: A tertiary hospital experience in Singapore. Ann Acad Med Singap. 50(9), 703-711.

22. Ruiz-Quiñones J.A., Narváez-Osorio V.M., Ulín-Tejeda O.A., Flores-Barrientos O.I., Suárez-Méndez S., del Carmen Baeza-Flores G., 2022. Side effects of the Pfizer BioNTech vaccine in health workers of a hospital in the southeast of Mexico. The Journal of Infection in Developing Countries. 16(09), 1413-1416.

23. Nguyen S.V., Nguyen B.T., Duong H.N.V., Lenh P.T., Tran K.T., Tran H.M., Nguyen T.C., Nguyen D.P., Ta M.N., Trieu N.N.M., 2023. Side effects following first dose of COVID-19 vaccination in Ho Chi Minh City, Vietnam. Human Vaccines & Immunotherapeutics. 19(1), 1-7.

24. Mohammedsaeed W., Alrashidi H., Alsharif S.M., Aljardi O., Al-Sehli A., Mohammed Saeed W., Alsharif S., 2023. COVID-19 Vaccine Impacts in Saudi Arabia: A Cross-Sectional Study. Cureus. 15(6) 1-9.

25. Riad A., Hocková B., Kantorová L., Slávik R., Spurná L., Stebel A., Havriľak M., Klugar M., 2021. Side effects of mRNA-based COVID-19 vaccine: nationwide phase IV study among healthcare workers in Slovakia. Pharmaceuticals. 14(9), 873-880.