COVID-19 Vaccination Adverse Reactions among Vaccinated Persons in Mansoura University: A Prospective Study

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COVID-19 Vaccination Adverse Reactions among Vaccinated Persons in Mansoura University: A Prospective Study

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ABSTRACT

Background: *Health-care workers are at highest risk for COVID-19 and its complications. Vaccine development might be the best choice for ending this pandemic. Hence, studies are essential to follow the vaccination adverse reactions.* ***Objectives:*** *To determine the prevalence of adverse effects among COVID-19 vaccinated persons after getting the first and/or the second dosage of the vaccines.* ***Methodology:*** *This research was conducted on 509 vaccinated participants to investigate the adverse symptoms of the available COVID vaccines through an online survey. The questionnaire comprised 3 compartments; background, vaccination adverse symptoms and the comorbidities data. It was delivered to participants via social media.* ***Results:*** *Adverse symptoms were reported by more significant participants following the 1st dosage (n = 208, 80.0%) than following the 2nd dosage (n = 169, 67.9%) (P=0.002). The most prevalent adverse effects included fatigue, injection site pain, headache, fever, bone, and muscular pain. AstraZeneca and Sputnik led to more common adverse symptoms following 1st and 2nd doses. Females were more likely to experience post 1st dose (p=0.005) and 2nd dose (p=0.022) side effects. Resident doctors had higher odds (OR = 6.0 95% confidence interval [CI]:1.03 -35.1, p=0.029) than the other jobs to develop 1st dose post-vaccination effects. Participants with autoimmune and chronic diseases had a higher risk to develop post 1st dose adverse effects.* ***Conclusion:*** *About 80% of participants who obtained the COVID-19 vaccination experienced adverse effects. The most prevalent side effect following the 1st dosage was fatigue while pain at the injection site was the most prevalent symptom following the 2nd dosage.*

INTRODUCTION

On March 11th, 2020, the World Health Organization (WHO) declared the coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) to be a pandemic [1]. The public health and social impact of the disease have increased significantly since it was first discovered in Wuhan, China, in December 2019. It had both indirect and direct impact on every nation, population, and individual worldwide [2]. The virus has been linked to long-term pulmonary, cardiac, and neurological complications. Old people, persons with coexisting conditions, and healthcare workers (HCWs) are at highest risk for COVID and its complications [3].

To stop the pandemic, several preventative policies have been used, including lockdown, social isolation, wearing facemasks, and limiting travel. Vaccine development, on the other side, might be the best choice for ending the pandemic[4].

Vaccinations aid in protection against infectious diseases through creating long-lasting immune responses. Each year, vaccinations stop between 2 and 3 million fatalities[5]. Coronavirus vaccines act by stimulating the production of antibodies by the immune system shielding individuals against catching the virus or experiencing severe symptoms [6-7]. Following immunization, the antibodies produced bind to the invader spike protein and stop the virus from infecting cells [8].

Developing immunity after vaccination may occasionally have adverse effects. These post vaccine even minimal reactions can cause vaccine hesitancy levels to rise at a time when mass vaccination is urgently needed. So, success of the vaccination strategies relies mainly on population's acceptance of the vaccines benefits and risks [9-10].

According to the WHO's Strategic Advisory Group of Experts on Immunization (SAGE), a fundamental factor in the decline in vaccine adoption may be the public's doubts of the safety information provided by pharmaceutical organizations [10]. For the reason, objective studies for vaccination safety and side effects are an essential tool to increase public confidence in COVID vaccines and their efficacy.

On 24 January 2021, Egyptian Ministry of Health and Population started the vaccination campaigns with the Oxford–AstraZeneca and Sinopharm COVID vaccines and then other types of COVID vaccine were subsequently introduced. The first doses of COVID vaccines were applied to HCWs, the elderly, and those with chronic illnesses according to a values framework for the allocation and prioritization of COVID vaccination that was published in September 2020 [11].

This study main goal was to assess the prevalence of COVID-19 vaccines adverse reactions among vaccinated people after obtaining the first and/or second dosages of the vaccine in Mansoura University Hospitals, Egypt. The secondary goal was to evaluate the relation between these adverse effects levels and patient demographic and medical characteristics that could indicate risk factors for the presence and severity of vaccination adverse effects.

METHODOLOGY

An observational descriptive longitudinal study that was carried out between December 2021 and February 2023 via an online survey. Participants were Egyptian residents (HCWs at Mansoura University Hospitals and their first-degree relatives). The study enrolled those participants' who administered a minimum of one dosage of the AstraZeneca, Sinopharm, Sinovac, Pfizer or Sputnik COVID vaccines. Vaccinated persons who had obtained a vaccine other than the above-mentioned were excluded. A web-based survey using google form was conducted through four steps [12].

1. Design and develop a web-based survey

A questionnaire (appendix 1), was designed on google forms (https://docs.google.com/forms/d/e/1FAIpQLSeyUJgn0jScOGpjbDRmaRF8lvlkLovMcNWsjpMNvYgZ7X8RA/viewform) and it was written in Arabic language (the scientific terms for the symptoms were written and explained in the public language). Based on prior literature findings, significant items were identified and incorporated in the questionnaire [13-14].

The questionnaire comprised 3 compartments. First group included the basic background data of participants including the name, gender, age, job, type of administered vaccine, and date of the first and next doses. The second group of inquiries was concerned with the short term adverse effects affiliated with administering the COVID vaccine, in addition to the timing of the appearance of these effects (after the 1st and/ or 2nd dosage). Regarding the adverse effects, the participants were followed for 2 weeks and were asked to choose from symptoms including, local symptoms (pain, bruises, edema at the injection site), systemic symptoms (fever, chills, headache, fatigue, drowsiness), flu-like symptoms (sore throat, runny nose, coughing, sneezing), gastrointestinal symptoms (loss of appetite, nausea, vomiting, abdominal pain, diarrhea), hypersensitivity symptoms like skin rash, arthralgia, myalgia, lymphadenopathy, limb oedema and to state any other symptoms that they experienced following the vaccination.

The third group focused on the associated comorbidities that participants may suffer such as prior infection with COVID, immune deficiency disorders like leukemia, autoimmune disorders as systemic lupus or rheumatoid arthritis, any other chronic illnesses like hypertension or diabetes and the usage of immune suppressive drugs like chemotherapeutics or corticosteroids.

2. Hosting the web-based survey for data collection

Once the questionnaire was ready, a web Uniform Resource Locator (URL) for the survey was automatically generated and the link was sent to the intended participants (study sample) to fill the online survey. Online forums and social media platforms like Facebook and WhatsApp were used for sending the google form link. Communication between the investigators and the participants in the study was established via phone calls when required.

3. Data Response and Data Coding Sheet

The settings were adjusted to that each participant sent only one response. Responses were carefully reviewed to confirm that responses were not repeated. All participants were permitted to terminate the survey at any time of the study. All precautionary actions were applied to preserve the data's confidentiality.

Google forms recorded the respondent data in its spreadsheet and provided an opportunity to export data to other statistical packages for analysis and minimizing coding errors.

4- Data Analysis and Graphical Representation of Data

Following online completion of the questionnaire, results were automatically entered into a Google Spreadsheet in a manner that could be analyzed, allowing for data tabulation and graphical depiction. Graphics and descriptive statistics were easily exported.

Ethical approval:

The study protocol was proven by Institutional Review Board (IRB) ethical committees in Mansoura Faculty of Medicine and given a code number R.21.10.1482. Written consent was collected from each candidate. The survey was performed according to Declaration of Helsinki Ethical rules for Medical Research.

Statistical analysis:

Data were analyzed using the Statistical Package of Social Science (SPSS) program for Windows (Standard version 26). The normality of data was first tested with one-sample Kolmogorov-Smirnov test. Qualitative data were described using number and percent. Association between categorical variables was tested using Chi-square test while Monte carlo test and Fisher exact test were used when expected cell count less than 5. Continuous variables were presented as mean ± SD (standard deviation) for normal distributed data and median (min-max) for non-normal data.

Significant variables on univariate analysis entered into regression model using the enter-statistical technique to predict the most significant determinants and to control for possible interactions and confounding effects. For all above mentioned statistical tests done, the threshold of significance is fixed at 5% level.The results was considered significant when $p \leq 0.05$.

RESULTS

During the study period, 509 vaccinated persons against COVID were included with mean age ± SD was 40.34±11.24 and 51.9% of them were females. Regarding their job, resident doctors and nurses represented the majority (19.8% and 18.1% respectively). AstraZeneca was the predominant vaccine applied (38.3%), followed by Sinovac and Sinopharm (28.7% and 27.7% respectively) with 48.9% received 2 doses and 51.1% received only one dose. Prior COVID infection was found in 27.9% of the vaccinated persons. There is history of underlying chronic illnesses (hypertension and diabetes mellitus), autoimmune diseases and immunodeficiency disorders in 23.4%, 6.9% and 3.5% of vaccinated persons, respectively. Table 1 and figure 1.

Table 1: Demographic and clinical characteristics among the vaccinated persons

Characteristics	Vaccinated persons (n=509)
Age (Years)	
Mean ± SD	40.34±11.24
Min-Max	19-76
Sex	
Male	245 (48.1%)
Female	264 (51.9%)
Current job	
Housewife/ non-worker	11 (2.2%)
Professor	22 (4.3%)
Associate professor	50 (9.8%)
Lecturer	51 (10.0%)
Associate lecturer	42 (8.3%)
Resident doctors	101 (19.8%)
Nursery	92 (18.1%)
Technician	18 (3.5%)
Pharmacist	14 (2.7%)
Students	30 (5.9%)
Others (Social worker-Workers-secretory)	78 (15.3%)
Type of COVID-19 vaccine	
AstraZeneca	195 (38.3%)
Sinovac	146 (28.7%)
Sinopharm	141 (27.7%)
Pfizer	23 (4.5%)
Sputnik	4 (0.8%)
Doses	
One dose	260 (51.1%)
Two doses	249 (48.9%)
Previous COVID-19 infection	142 (27.9%)
Chronic diseases	119 (23.4%)
• **HTN**	78 (15.3%)
• **DM**	41 (8.1%)
Autoimmune diseases	35 (6.9%)
Duration of disease (years)	
Median (min-Max)	5 (2-20)
Immunodeficiency diseases	18 (3.5%)
Use immunosuppressive drugs	14 (2.7%)

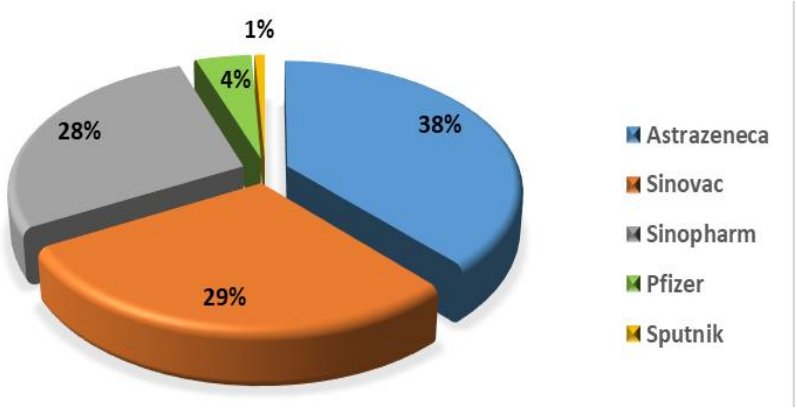

Fig. 1: Type of COVID-19 vaccine received among the studied group.

Vaccinated participants were followed for the possible adverse reactions in the following 2 weeks after COVID vaccine. In general, adverse effects were noted by more significant participants following the 1st dosage (n = 208/260, 80.0%) than after the 2nd dosage (n = 169/249, 67.9%) (P=0.002), as demonstrated through flowchart in figure 2.

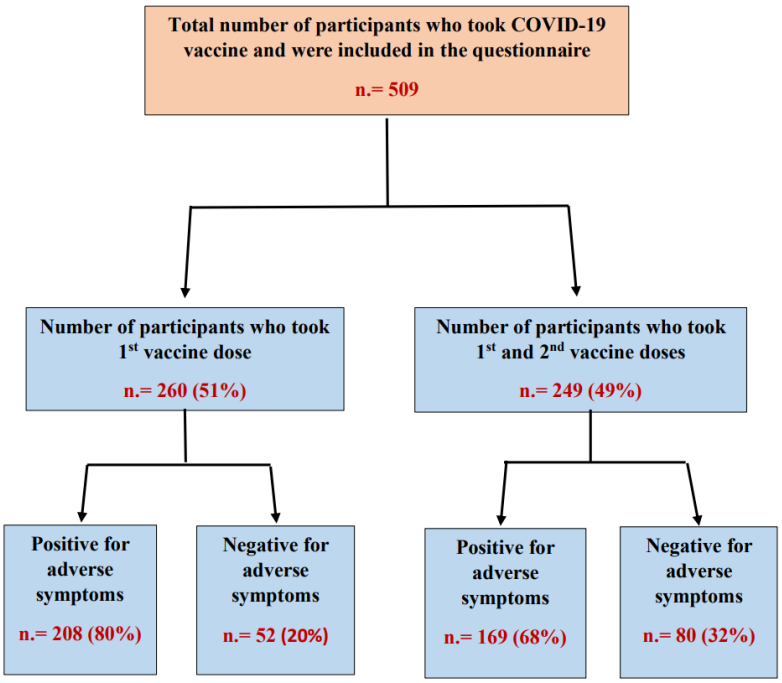

Fig. 2: Flow diagram for the COVID-19 vaccine questionnaire participants and vaccine adverse reactions.

The 5 most frequent adverse symptoms included fatigue, injection site pain, headache, fever, bone, and muscular pain. Symptoms at the injection site were more found in persons received one vaccine dosage than those received 2 doses, but it was statistically non-significant. Except for drowsiness, systemic manifestations were significantly more detected following the 1st dose than 2nd dose as regard to fever (p≤0.001), chills (p=0.011), headache (0.003), fatigue (p≤0.001) and flu-like symptoms (p=0.04). In addition, bone and muscular pain was comparable post 1st dose with significant p=0.002 difference. Gastrointestinal symptoms were more observed in persons who received the 1st dose than the 2 doses with statistically significant difference as regard nausea and loss of appetite (p=0.009 and p=0.038), respectively. Skin rashes and other allergies were insignificant among our participants receiving the 1st dose (16/260, 6.1%) and the 2nd dose (11/249, 4.4%). Otherwise, back pain, chest pain, limb edema and swollen lymph nodes were rarely recorded. Figure 3 and table 2.

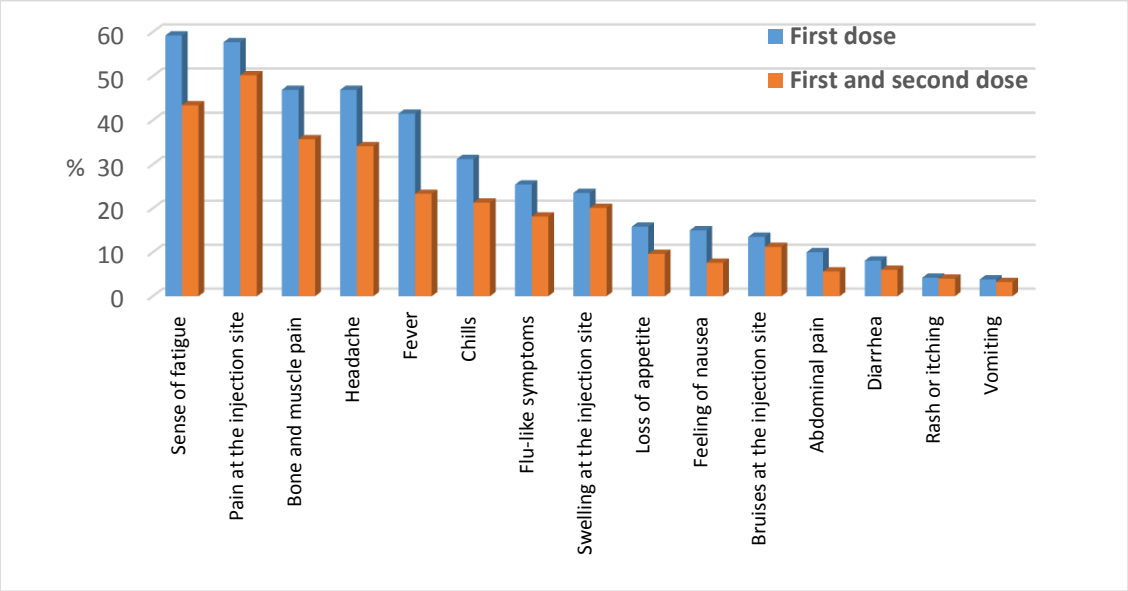

Fig. 3: The frequencies of COVID-19 vaccine adverse reactions after the vaccine's first and second doses.

Table 2: COVID-19 vaccination adverse reactions and their relationship to the first and second vaccine doses

Adverse reactions	First dose (n=260)	First and second doses (n=249)	Test of significance (p value)
Presence of symptoms Present Absent	**208 (80.0%)** 52 (20.0%)	**169 (67.9%)** 80 (32.1%)	χ^2=9.7 **P=0.002***
Local symptoms			
Pain at injection site	150 (57.7%)	125 (50.2%)	χ^2=2.8, p=0.09
Bruises at injection site	35 (13.5%)	28 (11.2%)	χ^2=0.57, p=0.44
Swelling at injection site	61 (23.5%)	50 (20.1%)	χ^2=0.8, p=0.36
Systemic symptoms			
Fever	108 (41.5%)	58 (23.3%)	χ^2=19, **p≤0.001***
Chills	81 (31.2%)	53 (21.3%)	χ^2=6.3, **p=0.011***
Headache	122 (46.9%)	85 (34.1%)	χ^2=8.6, **p=0.003***
Sense of fatigue	154 (59.2%)	108 (43.4%)	χ^2=12.8,**p≤0.001***
Drowsiness	1 (0.4%)	0 (0.0%)	FET=, p=1.0
Flu-like symptoms			
Sore throat, runny nose, coughing, sneezing	66 (25.4%)	45 (18.1%)	χ^2=3.9, **p=0.04***
Bone and muscle symptoms			
Bone and muscle pain	128 (46.9%)	89 (35.7%)	χ^2=9.5, **p=0.002***
Back pain	2 (0.8%)	0 (0.0%)	FET, p=0.499
Gastrointestinal symptoms			
Nausea	39 (15.0%)	19 (7.6%)	χ^2=6.8, **p=0.009***
Loss of appetite	41 (15.8%)	24 (9.6%)	χ^2=4.3, **p=0.038***
Vomiting	10 (3.8%)	8 (3.2%)	χ^2=0.15, p=0.69
Abdominal pain	26 (10.0%)	14 (5.6%)	χ^2=3.4, p=0.07
Diarrhea	21 (8.1%)	15 (6.0%)	χ^2=0.81, p=0.37
Hypersensitivity symptoms			
Rash or itching	11 (4.2%)	10 (4.0%)	χ^2=0.01, p=0.9
Swelling of the face or suffocation	4 (1.5%)	1 (0.4%)	χ^2=, p=0.373
Other allergy	1 (0.4%)	0 (0.0%)	FET=, p=1.0
Miscellaneous symptoms			
Limb edema	1 (0.4%)	0 (0.0%)	FET, p=1.0
Chest pain	2 (0.8%)	0 (0.0%)	FET, p=0.499
Menorrhagia	1 (0.4%)	2 (0.8%)	FET, p=0.616
Swollen lymph nodes	1 (0.4%)	3 (1.2%)	χ^2=, p=0.362

χ^2: Chi square test, FET: Fisher exact test, *significant p≤0.05

As depicted in table 3, no association was identified between age of the vaccinated persons and development of adverse symptoms. female participants were more likely to experience post 1st dose (OR= 2.4, 95% confidence interval [CI]: 1.3-4.6, p=0.005) and 2nd dose (OR = 1.9, 95% CI: 1.1-3.2, p=0.022) vaccination side effects compared to males. Resident doctors were significantly recorded (85.7%, p=0.003) to develop post vaccine symptoms after 1st dosage rather than other job categories. AstraZeneca and Sputnik vaccines led to more common adverse effects following 1st and 2nd doses compared to other received vaccines (p=0.001and p=0.008, respectively). In addition, appearance of adverse symptoms after the 1st dose was significantly reported in individuals with underlying chronic disorders and autoimmunity (p= 0.012 and p=0.038), respectively. However, previous COVID-19 infection, underlying immunodeficiency disorders and intake of immunosuppressive drugs were not correlated to adverse symptoms development.

Table 3: Association between development of adverse symptoms and vaccinated persons' characteristics

Characteristics	First dose			First and second doses		
	Total (n=260)	**Adverse symptoms after 1st dose (n=208)**	**P value**	**Total (n=249)**	**Adverse symptoms after 1st, 2nd dose (n=169)**	**P value**
Age (Years)						
<40 y	130	108 (83.1%)	1.53	125	86 (68.8%)	0.09
>40 y	130	100 (76.9%)	(0.22)	124	83 (66.9%)	(0.75)
Sex						
Male	125	91 (72.8%)	7.8	120	73 (60.8%)	5.3
Female	135	117 (86.7%)	**(0.005*)**	129	96 (74.4%)	**(0.022*)**
Current Job						
Housewife/ non-worker	6	3 (50%)		5	2 (40%)	
Professor/Associate professor	38	28 (73.7%)		34	20 (58.8%)	
Lecturer/Associate lecturer	44	29 (56.9%)		49	29 (59.2%)	
Resident	56	48 (85.7%)	MC	45	34 (75.5%)	MC
Nursery	55	35 (63.6%)	**(0.003*)**	37	29 (78.4%)	(0.32)
Technician	11	6 (54.5%)		7	5 (71.4%)	
Pharmacist	10	7 (70%)		4	3 (75%)	
Others	40	18 (45%)		68	47 (69.1%)	
Type of vaccine						
AstraZeneca	100	95 (95.0%)		95	76 (80.0%)	
Sinovac	75	56 (74.7%)	MC	71	45 (63.4%)	MC
Sinopharm	71	44 (62.0%)	**(≤.001*)**	70	39 (55.7%)	**(≤.008*)**
Pfizer	12	11 (91.7%)		11	7 (63.6%)	
Sputnik	2	2 (100%)		2	2 (100%)	
Previous COVID-19 infection						
Yes	74	60 (81.1%)	0.07	68	45 (66.2%)	0.12
No	186	148 (79.6%)	(0.78)	181	124 (68.5%)	(0.72)
Autoimmune diseases						
Yes	25	24 (96.0%)	**4.27**	10	8 (80.0%)	0.70
No	235	185 (78.7%)	**(0.038*)**	239	161 (67.7%)	(0.40)
immunodeficiency diseases						
Yes	12	9 (75%)	0.23	6	3 (50.0%)	0.94
No	248	200 (80.6%)	(0.36)	243	167 (68.7%)	(0.33)
Chronic diseases						
Yes	65	59 (90.7%)	6.28	54	42 (77.8%)	3.1
No	195	149 (76.4%)	**(0.012*)**	195	127 (65.1%)	(0.078)
Immunosuppressive drugs						
Yes	7	7 (100%)	1.79	7	4 (57.1%)	0.38
No	253	201 (79.4%)	(0.18)	242	165 (68.2%)	(0.53)

MC: Monte carlo test, FET: Fisher exact test

After multivariate regression analysis and adjustment of the confounding factors, the following variables were independent predictors for development of adverse symptoms after 1st dosage; female (OR= 2.4) resident doctors (OR= 6.0) received AstraZeneca (OR= 11.6) or Pfizer (OR= 6.7) vaccines and had autoimmunity (OR= 6.5) and chronic diseases (OR= 3.04). Furthermore, multivariate analysis for risk factors that develops adverse symptoms after both 1st and 2nd doses showed that only two variables were independent predictors: females (OR= 1.9) received AstraZeneca vaccine (OR= 3.2). table 4.

Table 4: Multivariate regression analysis for independent risk factors for development of vaccine adverse reactions

Patients characteristics	Adverse symptoms after 1st dose		Adverse symptoms after 1st & 2nd doses	
	OR (95%CI)	P value	OR (95%CI)	P value
Sex				
Male (r)	**2.4 (1.3-4.6)**	**0.005***	**1.9 (1.1-3.2)**	**0.022***
Female				
Type of vaccine				
AstraZeneca	**11.6 (4.2-32.3)**	**≤0.001***	**3.2 (1.6-6.3)**	**0.001***
Sinovac	1.8 (0.9-3.7)	0.098	1.4 (0.7-2.7)	0.353
Sinopharm (r)	1	-	1	-
Pfizer	**6.7 (1.04-55)**	**0.044***	1.4 (0.37-5.2)	0.621
Sputnik	NA	-	NA	-
Current Job				
Housewife/ non-worker (r)	1	-		
Professor/Associate professor	2.8 (0.48-16)	0.237		
Lecturer/Associate lecturer	1.9 (0.34-10.7)	0.466		
Resident	**6.0 (1.03-35.1)**	**0.029***	-	-
Nursery	1.7 (0.32-9.5)	0.512		
Technician	1.2 (0.16-8.8)	0.857		
Pharmacist	2.3 (0.3-18.9)	0.437		
Others	0.82 (0.14-4.6)	0.818		
Autoimmune diseases				
Yes	**6.5 (1.2-49)**	**0.038***	-	-
No (r)				
Chronic diseases				
Yes	**3.04 (1.2-7.5)**	**0.012***	-	-
No (r)				

(r): Reference group, OR: odds ratio, CI: Confidence interval

DISCUSSION

A pandemic illness that continued to endanger the world is the coronavirus infection[15-16]. Effective immunization remained the only practical approach to combat the COVID-19 pandemic spread, especially in the absence of an efficient and sustainable infection control strategy and the absence of a specialized COVID treatment. Within a year of the first instance of the pandemic being reported, numerous coronavirus vaccinations had been developed as a result to a tremendous deal of human work and the sense of necessity to have an efficient vaccine [17]. But the vaccine must be secure and efficient to be widely utilized by people worldwide [18].

This survey based study on 509 vaccinated participants from a tertiary hospital in Egypt investigated the adverse symptoms of five available COVID vaccines (Oxford-AstraZeneca, Sinovac, Sinopharm, Pfizer, and Sputnik) through an online survey.

AstraZeneca (Oxford) was the most frequently received vaccine in our survey. A probable explanation could be that it was the first approved vaccine for use in United Kingdom vaccination program and our government had a strategy of immunizing HCWs first because they are on the front lines of the COVID outbreak, so it was first authorized for usage in Egypt. Later, the government began receiving newer approved vaccines including Sinopharm, Pfizer, and others.

Due to their ongoing interaction with COVID patients and desire to protect themselves from getting occupational infection, HCWs in our cohort had a favorable attitude towards immunization than the other participants in agreement with previous surveys which stated higher vaccination rate in patient care settings than other jobs [19-20]. Resident doctors and nurses in this cohort represented the majority (19.8% and 18.1% respectively) compared to other HCWs categories which was also stated by an earlier study [21], where HCWs vaccination rates were greater in hospitals (66%) and outpatient clinics (64%) than in medical offices (52%). Therefore, direct exposure to the COVID infection, such as in the ICU, may provide a higher inducement for vaccination.

Our participants were mostly moderate in age and females who showed greater enthusiasm than other groups for taking the poll and discussing their experiences. Another explanation might be because young women are more commonly than men to have post vaccine side effects [13].

Adverse effects following vaccination were experienced by the vast majority of our subjects either following 1st dosage or 2nd dosage, demonstrating that their immune systems functioned as intended [22]. But side effects were detected by more significant participants following the 1st dosage (n = 208, 80.0%) than the 2nd dosage (n = 169, 67.9%) (P=0.002). This decreased reactogenicity following the 2nd dose aligned earlier research [23-24]. On the other hand, The Centre for Disease Control and Prevention (CDC) demonstrated that if the adverse symptoms occur following the 2nd vaccine dosage, it will be more intense than after the 1st dosage [25].

The most frequent post vaccination adverse effects included fatigue, pain at the injection site, headache, fever, bone, and muscular pain due to the results of cytokines produced by the immune system on the muscles, blood vessels, and other body organs. This is in keeping with prior studies in Egypt [25] and other countries [26-27] with sense of fatigue (59.2%) representing the most common symptom (systemic) following the 1st dosage while pain at the injection site (50.2%) was the most typical symptom (local) following the 2nd dosage in our survey.

Additionally, our results suggest that systemic side effects have more significant experience after 1st dose contrasted to those obtained after 2 doses than local side effects as regard to fever ($p \leq 0.001$), chills ($p=0.011$), headache (0.003), fatigue ($p \leq 0.001$), flu-like symptoms ($p=0.04$), bone and muscular pain ($p=0.002$), nausea ($p=0.009$), and loss of appetite ($p=0.038$). Likewise, systemic side effects showed more significant variations than local adverse effects among Iranian tertiary hospital staff vaccinated with Sputnik, Oxford–AstraZeneca, and Sinopharm, as stated by Oghazian et al. data [23].

Skin rashes and other allergies were insignificant among our participants receiving the 1st dose (6.1%) and the 2nd dose (4.4%). Conversely, increased rates of cutaneous and oral allergies were reported following COVID vaccination using both viral vector and mRNA [28]. Consequently, a person cannot receive a vaccination if they have a severe allergy (anaphylaxis) or an allergy to any component of the vaccine [29].

Regarding the relation between development of adverse symptoms and vaccinated persons' characteristics, female participants were more likely to experience post 1st dose (OR= 2.4, 95% CI: 1.3-4.6, $p=0.005$) and 2nd dose (OR = 1.9, 95% CI: 1.1-3.2, $p=0.022$) vaccination side effects compared to males. These results concurred with the CDC reports of a study in the USA revealing that women experienced 79.1% of the adverse symptoms from the COVID vaccine [30]. Menni et al. also noted this result post Pfizer and AstraZeneca vaccines [14]. Additionally, this link was found in numerous research [13,31].

This post vaccination gender-based discrimination is also known for other vaccines, like the influenza H1N1 vaccine, Bacillus Calmette-Guerin (BCG), measles, mumps, and rubella. Women had more side effects from vaccinations due to a stronger immunological response beside the female sex hormone that stimulate the production of antibodies. However, testosterone has the opposite effect, weakening the immune system while also rendering men more vulnerable to viral infections [32-33].

Two by one dose side effects comparisons revealed that AstraZeneca and Sputnik vaccines led to more prevalent side effects following 1st and 2nd doses compared to other received vaccines ($p=0.001$and $p=0.008$, respectively), harmonized with that recently reported in Iran [23]. After adjustment of the confounding factors, participants received AstraZeneca vaccine had a higher odd of experiencing adverse effects Upon obtaining the 1st (OR= 11.6) and 2nd (OR= 3.2) doses of the vaccine. This finding was consistent with the outcomes of a previous survey where Astra-Zeneca recipients had reported more side effects with 2 doses of the vaccine compared to recipients of 2 doses of other forms of vaccines [34].

Our study also detected that participants with chronic disorders had a greater risk to develop post 1st dose vaccination adverse effects. Previous research among Arabs has shown a strong correlation between comorbid diseases and the development of adverse effects among the participants [34-35]. This may be due to chronic health problems complexity and multifaceted nature. Another Turkish study, however, found no correlation between the development of adverse effects following the Sinovac vaccine and chronic illness in HCWs [10]. This discrepancy in the results could be clarified by the different research population and vaccine types.

Regression analysis for the risk factors also reported autoimmune diseases to be a risk factor for the emergence of adverse effects following the 1st dose in our participants (OR = 6.5). According to a previous meta-analysis, individuals having a history of autoimmunity almost half of the side effects following the initial doses of the COVID vaccinations[36].

The present study also found that resident doctors had higher odds (OR = 6.0 95% CI:1.03 -35.1, *p*=0.029) than the other jobs to develop a variety of 1st dose post-vaccination effects. Correspondingly, numerous post-vaccination symptoms were recorded among HCWs, the majority of which were not life-threatening [37]. However, HCWs were not shown to have a greater risk of developing adverse effects, according to another study[38].

Although the likelihood of having frequent adverse events among those who had received the vaccine was significantly increased by having a previous COVID infection [13, 39], our study found the history of prior infection not to be a significant factor for the development of adverse effects.

So generally, and similar to our findings, female gender, comorbid patients, and AstraZeneca vaccine were risk factors for experiencing post-vaccination side effects [39].

One limitation of this study is that the information was gathered using a self-administered online survey, which raises the probability of reporting bias. Additionally, the study focused on vaccinated people in Mansoura University Hospitals, so additional research covering the entire nation is advised to corroborate the results of this study. Lastly, the study designed to follow short term adverse reaction following COVID vaccination, so further studies are required to follow long term reactions.

CONCLUSION

Approximately 80% of recipients of the COVID-19 vaccine reported side effects. Fatigue was the most prevalent symptom after the 1st dosage of the vaccine, but injection site pain was the most prevalent complaint following the 2nd dosage. Female resident doctors who had received the 1st dose of AstraZeneca vaccine with a history of chronic diseases and autoimmune diseases, were at greater odds of developing adverse effects post COVID vaccination as opposed to the others. While female participants who had received the 2nd dosage of AstraZeneca vaccine were at greater odds of developing adverse effects post vaccination compared to the others.

This study has not been published before and is not under consideration in any other reviewed media. I have participated sufficiently to the research to be involved as an author. To the best of my knowledge, no conflict of interest, financial or others present. All authors have contributed in the design, analysis, and interpretation of data, drafting and revising of the manuscript, and that they have approved the manuscript as submitted. The authors would like to acknowledge all the supporting staff and the vaccinated HCWs participated in this study.

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APPENDIX

Checklist for monitoring adverse effects after receiving the COVID-19 vaccine

1) Personal Data
Full name .....
Gender..... **Age** .....
Current job .....
Vaccine type .....
Date of receiving the first dose of the vaccine..... **& second dose** .....

Vaccine recipients are followed up after the first dose and after the second dose Mark √ in the answer box

Answer		2) Adverse effects
No	**Yes**	
		Do you suffer from pain at the injection site? If the answer is yes, write the duration.....
		Do you suffer from bruising at the injection site? If the answer is yes, write the duration.....
		Do you suffer from swelling at the injection site? If the answer is yes, write the duration.....
		Do you suffer from a fever after receiving the vaccine? If the answer is yes, write the temperature value.....and the duration.....
		Do you suffer from chills after receiving the vaccine? If the answer is yes, write the duration.....
		Do you suffer from a headache after receiving the vaccine? If the answer is yes, write the duration.....
		Do you suffer from drowsiness after receiving the vaccine? If the answer is yes, write the duration.....
		Do you suffer from fatigue after receiving the vaccine? If the answer is yes, write the duration.....
		Do you suffer from bone and muscle pain after receiving the vaccine? If the answer is yes, write the duration.....
		Do you suffer from a feeling nausea after receiving the vaccine? If the answer is yes, write the duration.....
		Do you suffer from loss of appetite after receiving the vaccine? If the answer is yes, write the period.....
		Do you suffer from vomiting after receiving the vaccine? If the answer is yes, write the period.....
		Do you suffer from abdominal pain after receiving the vaccine? If the answer is yes, write the period.....
		Do you suffer from diarrhea after receiving the vaccine? If the answer is yes, write the period.....
		Do you suffer from flu-like symptoms (sore throat, runny nose, cough or sneezing) after receiving the vaccine? If the answer is yes, write down the duration.....
		Do you suffer from swollen lymph nodes after receiving the vaccine? If the answer is yes, write the period.....
		Do you suffer from a skin rash or itching after receiving the vaccine? If the answer is yes, write the period.....
		Do you suffer from facial swelling or suffocation after receiving the vaccine? If the answer is yes, write the period.....
		Are you experiencing any other symptoms? What they are, the duration of other symptoms, if any, are written .....duration ....duration ....duration .....
		3) Associated comorbidities
		Have you been infected with COVID-19 in the past period? If the answer is yes, write the duration.....
		Do you suffer from immunodeficiency diseases (such as leukemia)? If the answer is yes, write the period.....
		Do you suffer from autoimmune diseases? (such as lupus or rheumatoid arthritis)? If the answer is yes, did disease activity occur after vaccination?
		Do you suffer from any other chronic diseases? (DM and HTN)
		Do you use immunosuppressive medications (such as chemotherapeutics or corticosteroids)?