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The incidence and severity of COVID-19 infection among vaccinated medical students at the University of Diyala

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Abstract

Rationale: Different COVID-19 vaccines have been shown to be protective approaches against COVID-19 virus infection and related hospitalization. However, the effectiveness of these different vaccines in limiting the incidence and severity of COVID-19 infection in vaccinated people is unclear.

Objectives: To determine the incidence and severity of COVID-19 infection among vaccinated medical students at Diyala university.

Patients and methods: An online questionnaire were distributed among medical students of the College of Medicine at the University of Diyala using the students' Telegram channels. Samples collection started from October 1, 2022, to January 2022 through an online platform (Google forms), and data were collected in a blind fashion to protect the students' privacy.

Results: A total of 346 responses were received during our survey. Ninety-nine percent of the participants received one dose of the COVID-19 vaccine, 87% received two doses, 7.2 %received three doses, and only 2.6% received four doses. Almost all of the participants were previously infected with COVID-19. Ninety-one (24%) students tested positive after vaccination, and 59 (17%) developed symptoms after receiving the COVID-19 vaccine. (How about the severity of the symptoms??)

Conclusion: COVID-19 vaccination is beneficial in both preventing infection and reducing the frequency of symptoms, and almost preventing hospitalization.

Introduction

In December 2019, a series of acute atypical respiratory diseases occurred in Wuhan, China. This rapidly spread from Wuhan to other areas. It was soon discovered that a novel coronavirus was responsible. The novel coronavirus was named the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2, 2019-nCoV) due to its high homology (~80%) to SARS-CoV, which caused acute respiratory distress syndrome (ARDS) and high mortality during 2002–2003 (1). The outbreak of SARS-CoV-2 was considered to have started initially via a zoonotic transmission associated with the seafood market in Wuhan, China. Later it was recognized that human-to-human transmission played a major role in the subsequent outbreak. The disease caused by this virus was called Coronavirus disease 19 (COVID-19), and a pandemic was declared by the World Health Organization (WHO). COVID-19 impacted many people worldwide, reported in approximately 200 countries and territories (2).

The SARS-CoV-2 virus primarily affects the respiratory system, although other organ systems are also involved. Lower respiratory tract infection-related symptoms including fever, dry cough and dyspnea were reported in the initial case series from Wuhan, China. In addition, headache, dizziness, generalized weakness, vomiting and diarrhea were also observed. It is now widely recognized that respiratory symptoms of COVID-19 are extremely heterogeneous, ranging from minimal symptoms to significant hypoxia with ARDS (3).

Increasing mortality with advanced age is now a well-known fact. It is also well known that success in preventing COVID-19 among these age groups directly determines

the mortality rate in countries. Early Chinese reports showed that the mortality rate could be three times higher in older patients, especially those over 80. In an Italian study, ICU mortality was 26%, whereas it was 36% after 65 of age. Demonstration of median days between the onset of symptoms to death was shorter in older patients, which is another important point. As of April 7, 2020, in Italy, 83% of all COVID-19-related deaths were reported in an age group over 70 (4).

Pfizer's COVID-19 vaccine was the quickest vaccine to be developed, taking just about 7 months after its phase I/II trial took place in May 2020 for the FDA to allow for its emergency use in December 2020.8 The previous record set by pharmaceutical company Merck took 4 years to develop the world's first effective vaccine against mumps in 1967 (5). With the success of the Phase I/II trial, Pfizer and BioNTech were approved to proceed to phase III testing. As the ability of the BNT162b2 vaccine to produce neutralizing antibodies to the RBD of SARS-CoV-2 was now well established (6). WHO recommends two doses (30 µg, 0.3 ml each), 4-8 weeks apart given intramuscularly into the deltoid muscle (6).

Figure 1. Pfizer vaccine

The University of Oxford and the British-Swedish pharmaceutical company AstraZeneca partnered to develop a non-replicating chimpanzee viral vector vaccine, formerly known as ChAdOx1nCoV-19 and now called AZD1222.[14] It is branded and popularly known as the 'AstraZeneca Vaccine' or 'Covishield Vaccine' if manufactured by the Serum Institute of India. 'Covishield' is produced based on the same technology by the Serum Institute of India to supply low-to-middle-income countries through COVAX (7). The recommended dosage is two doses given intramuscularly (0.5ml each) with an interval of 8 to 12 weeks (7).

Figure 2. AstraZeneca Vaccine

The first Chinese COVID-19 vaccine that WHO authorized for emergency use is Sinopharm COVID-19 vaccine or BBIBP-CorV as inactivated vaccine produced by Beijing Bio-Institute of Biological Products (BBIBP). In the trials, Sinopharm was safe and well tolerated in such a way that a robust humoral immune response was reported in 100% of vaccinated individuals. Additionally, animal studies about Sinopharm

performed on rats, mice, rabbits and guinea pigs showed acceptable protection against SARSCoV-2 (8). According to the report on Sinopharm/ BBIBP COVID-19 vaccine released by the WHO, the most common side effect of Sinopharm vaccine (with 79% efficacy against symptomatic COVID-19 and 79% efficacy against hospitalization) were dizziness, fatigue, headache, nausea, vomiting, fever and allergic dermatitis (9). WHO recommends the use of Sinopharm vaccine as 2 doses (0.5 ml) given intramuscularly (9).

The reasons for COVID-19 vaccine acceptance and hesitancy remain complex. As new SARS-CoV-2 variants emerge, adding further complexity, and new vaccines come to the market, it will be important to maintain a delicate balance in between communicating what is known and acknowledging the remaining uncertainties. Researchers and pharmaceutical manufacturers should be as forthcoming as possible, with research data on vaccines against COVID-19 made readily available (10).

Figure 4. COVID-19 vaccination

To assess a vaccine's impact on infectiousness, some phase 3 trials examine the amount or duration of viral shedding in laboratory-confirmed, symptomatic participants by home collecting of saliva samples and frequent polymerase chain reaction (PCR) testing. However, this would not capture any change in viral shedding for asymptomatic participants. Moreover, serology tests detect previous infections and cannot reconstruct shedding during active infection. To measure viral load in both symptomatic and asymptomatic participants, it is necessary to conduct frequent (e.g., weekly) viral testing, irrespective of symptoms, to capture participants during their period of acute infectiousness. The Oxford-AstraZeneca vaccine trial tests participants in the United Kingdom for the virus weekly regardless of symptoms, but not in other trials for which protocols have been released. Even weekly testing will not provide detailed information about the effect of the vaccine on viral shedding, and the relationship between viral loads and infectiousness is unknown; nonetheless, this approach is likely to provide some evidence if viral loads are on average lower among vaccinated people (11).

Aim of the study

To determine the incidence and severity of COVID-19 infection among vaccinated medical students in the College of Medicine at the University of Diyala.

Methods

Questionnaire design

An online questionnaire was created using Google Forms (https://docs.google.com/forms/d/12pUEFHDQvFh_15Q1WrszWkh28CJ5RMVD0By9EbdRykg/viewform?edit_requested=true) with the students' university emails. The link to the online questionnaire was distributed among medical students using the students' Telegram channels. Data collection was conducted in a blind fashion where any identification information was not collected as part of this study to protect the students' privacy and sensitivity information. Data collection started from October 1, 2022, until January 31, 2022. Once the form was closed, data were extracted as an excel file for statistical analysis.

Statistical analysis

The results were analyzed by entering the data in Statistical Package for the Social Sciences SPSS (version 25). We expressed the qualitative data by frequencies and the quantitative data by arithmetic mean and standard deviation.

Results

The distribution of students who filled out the questionnaire is shown in Table 1, where the highest response was received from year 6 medical students (96 out of 346).

Table 1. The distribution of students who responded to the online questionnaire based on their yea

Year	Frequency	Percent
1	50	14.4
2	50	14.4
3	50	14.4
4	50	14.4
5	50	14.4
6	96	27.7
Total	346	100.0

We found that 99% of the participants received one dose, 89% received two doses, 7.2% received three doses, and 2.6% received four doses. The COVID-19 vaccine and their type of vaccination are summarized in Table 2.

Table 2. The distribution of the types of vaccines received by the students who were included in the study

Type	Frequency	Percent
Pfizer	256	74
AstraZeneca	44	12.7
Sinopharm	46	13.2
Total	346	100.0

87% of the students received a second dose of their corresponding vaccine. In contrast, only 7.2 % and 2.6% received third and fourth doses from their corresponding vaccines, respectively (you need to show the data for third and fourth doses).

We also found that almost all (99%) of the participant were infected with the COVID-19 virus before they received their vaccine. and their clinical features are demonstrated in table 3.

Table 3. The symptoms of COVID-19 infection.

Symptoms	Frequency	Percent
Fever	151	43.6
Chills	84	24.3
Nasal congestion	78	22.5
Shortness of breath	81	23.4
Cough	104	30.1
Loss of taste or smell	109	31.5
Diarrhea, vomiting	74	21.4
Headache	120	34.7
Fatigue	130	37.6

As shown in table 3 fever was the most common symptom with frequency of 43.6%, 37.6% fatigue, 34.7% headache, 31.5% loss of smell and appetite, 30.1% cough, 24.3% chills, 23.4 % SOB, 22.5% nasal congestion and finally the least common were the Diarrhea and vomiting with 21.4%.

We also found that among 346 students, only 6 (1.7%) needed hospitalization after receiving the COVID-19 vaccines. The data showed that only 7% had chronic diseases, as shown in Table 4.

Table 4. The list and percentages of chronic diseases declared by the medical students.

Diseases	Frequency	Percent
Asthma	8	2.0
Diabetes	2	.3
Epilepsy	2	.3
Hematological disease	1	.3
Hypertension	6	2.0

We found that 59 students developed some symptoms after receiving the COVID-19 vaccine, and their clinical features are summarized in Table 5.

Table 5. clinical features of COVID-19 infection after vaccination

Symptoms	Frequency	Percent
Fever	49	79.6
Chills	44	73.5
Nasal congestion	33	56
Shortness of breath	46	78
Cough	59	100
Loss of taste or smell	43	72.8
Diarrhea, vomiting	38	64.4

Headache	38	64.4
Fatigue	59	100

The survey showed that students sourced information about the vaccine from different sources, as demonstrated in Figure 2.

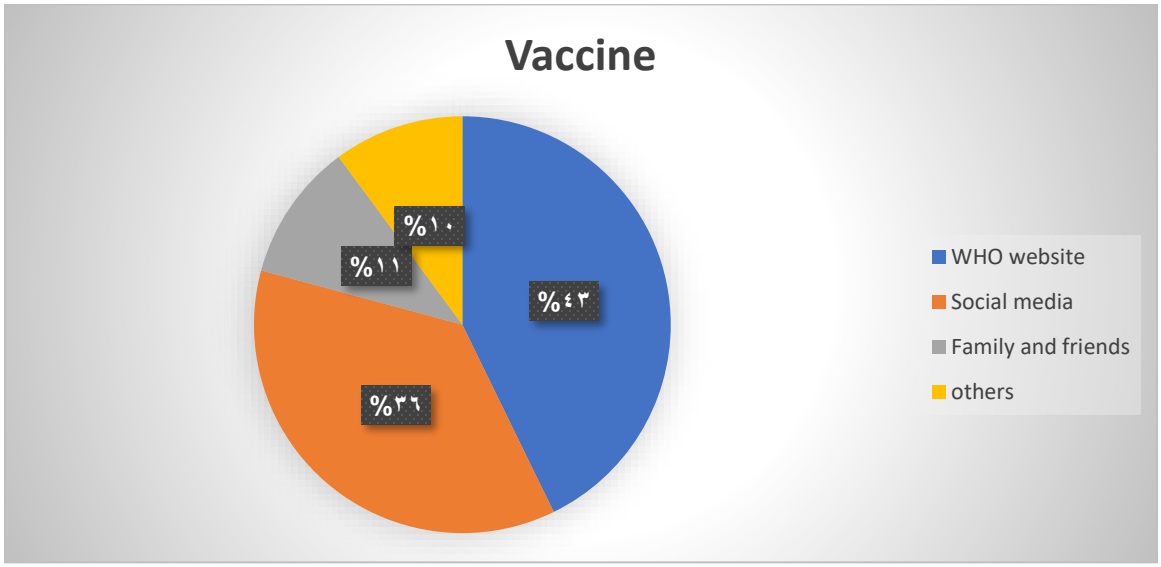

Figure 4. Sources of information used by the medical students to learn about COVID-19 vaccines.

We also accessed how vaccination influenced the incidence and severity of COVID-19 infection in vaccinated students. We found that 91 people (24%) tested positive after vaccination. The symptoms after the first dose are demonstrated in Table 6.

Table 6. Frequency of symptoms after receiving one dose of Pfizer and AstraZeneca.

Symptoms	Pfizer	AstraZeneca
Fever	107 (41%)	23 (65%)
Chills	63 (24%)	10 (28.5%)
Nasal congestion	53 (20%)	11 (30%)
Shortness of breath	54 (20%)	11 (29%)
Cough	71 (27%)	19 (54%)
Loss of taste or smell	73 (28%)	18 (51%)
Diarrhea, vomiting	46 (17.6%)	18 (51%)
Headache	80 (30%)	18 (51%)
Fatigue	94 (36%)	17 (48.5%)
Pfizer	261	
AstraZeneca	35	

The severity of symptoms after receiving two doses of Pfizer and AstraZeneca are demonstrated in Table 7.

Table 7. severity of symptoms after receiving two doses of Pfizer and AstraZeneca vaccines.

Symptoms	Pfizer	AstraZeneca
Fever	70 (26.5%)	11 (31%)
Chills	32 (12%)	4 (11.4%)
Nasal congestion	20 (7.5%)	7 (20%)
Shortness of breath	23 (8.5%)	8 (23%)
Cough	45 (17%)	9 (26%)
Loss of taste or smell	50 (18.8%)	18 (51.5%)
Diarrhea, vomiting	26 (10%)	14 (40%)
Headache	80 (30%)	22 (63%)
Fatigue	74 (28%)	25 (71.5%)
Pfizer	265	
AstraZeneca	33	

Discussion

Almost all individual symptoms of COVID-19 were less common in vaccinated versus unvaccinated participants, and more people in the vaccinated than in the unvaccinated groups were completely asymptomatic. This increased incidence of asymptomatic or minimally symptomatic infection in vaccinated participants underlines the importance of individuals who interact with unvaccinated or clinically vulnerable groups (e.g., healthcare workers and social care workers) continuing to regularly take tests for SARS-CoV-2, even if vaccinated, in line with current UK testing guidelines (12).

We also found that COVID-19 was less severe (in terms of the number of symptoms in the first week of infection and the need for hospitalization) in participants after their first or second vaccine doses compared with unvaccinated participants (13).

However, vaccination effectiveness may vary according to prevalent SARS-CoV-2 variants and appear greater for Delta than Omicron. Vaccinated students with prior SARS-CoV-2 infection had near-total protection against infection with the Delta variant, with re-infection close to null for at least 100 days; currently, insufficient data are available to make similar comments regarding the Omicron variant. However, >90% of children in the UK are currently thought to have had SARS-CoV-2 infection (modelled antibody prevalence from December 7, 2020, to February 4, 2022, of 82% in children aged 8-11 years and 94% in children
aged 12-15 years (14).

Vaccination also resulted in a modest change in the COVID-19 profile. Vaccinated students with post-vaccination SARS-CoV-2 infection appeared to have a milder disease (i.e., fewer symptoms) than unvaccinated students, at least during Delta

predominance. Less difference was evident during Omicron predominance, especially in adolescents, noting here that disease appeared milder during Omicron predominance compared with Delta predominance in both vaccinated and unvaccinated students. Relevantly, our data on unvaccinated students are consistent with our earlier study (15).

We found that Persons who previously had COVID-19 endured worse side effects after the first dose of the vaccine, while those who had not previously had COVID-19 felt stronger side effects after the second dose. Undesirable post-vaccination reactions may result from an individual reaction of the vaccinated person to the vaccine administration. This vaccine implementation error is consistent with the findings of Jęśkowiak et al and Wingert et al.(16,17).

Conclusion

COVID 19 vaccination is beneficial in both preventing the infection. We found that vaccine reduced the risk of reinfection by about 85% in people with one dose vaccine and about 92% in two doses receivers. it’s also beneficial in reducing the frequency of symptom by 80% and almost prevent the hospitalization (0%) in the two doses receivers. We found a slight advantage of Pfizer vaccine over AstraZeneca but due to low numbers of AstraZeneca vaccine users in our study (only 35) it cannot be conclusive.

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