



## A comparative study of the incidence of covid-19 among patients after vaccination in the city of Shoushtar, IRAN: a cross-sectional study

Esmat Shomalinasab<sup>1</sup>, Mostafa Taheri<sup>1</sup>, Zahra Asadi<sup>1</sup>, Ali Tayebi<sup>2</sup>, Azam Jahangirimehr<sup>3\*</sup>

1. MSc Student, Dep. of Critical Care Nursing, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran
2. MD, department of orthopedic surgery, Shiraz University of Medical Sciences, Shiraz, Iran
3. Msc of Biostatistics, Shoushtar Faculty of Medical Sciences, Shoushtar, Iran

**Corresponding author:** Azam Jahangirimehr, Msc of Biostatistics, Shoushtar Faculty of Medical Sciences, Shoushtar, Iran, a.jahangirimehr@gmail.com

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### Abstract

**Background and aim:** The corona epidemic and its impact on the society led the government policy to support the production of medicine and related vaccines. Vaccination is known to be an effective preventive measure and eradication of this disease. However, information on different brands of vaccines at different times, age groups, occupations or underlying diseases is not available. The present study intends to compare incidence of COVID-19 after AstraZeneca, Sinopharm and Sputnik vaccination in patients referred to hospitals affiliated to Shoushtar University of Medical Sciences, 2021. Also determine the effect of vaccination in reducing the severity of symptoms and death and the necessary information and education to the public about the possibility of coronavirus after vaccination, to continue to follow health protocols.

**Method:** The present study is a retrospective cross-sectional study In order to evaluate and compare the rate of covid-19 and the death rate in vaccinated people in Shoushtar,Iran. The study population of this study includes people who have received one or two doses of Corona vaccine Sputnik V, Sinopharm and AstraZeneca and have referred to medical centers affiliated to Shoushtar University of Medical Sciences (May 2021 to september 2021). 639 Samples were selected based on inclusion criteria from the research community. Patient information including demographic information, information on vaccines, underlying diseases, severity of COVID-19 symptoms, length of hospital stay and previous history of COVID-19. Statistical analysis was performed using Chi-square, Anova at a significance level of 0.05, with SPSS.V18 software.

**Result:** The mean age of study participants was 56.58 years. The median duration of infection after vaccination was 30(IQR: 20-50) days, with the range (4-180).46.9% of patients were



admitted to routine hospital wards and 4.1% of patients were admitted to intensive care units. The prevalence of covid-19 infection in vaccinated is 0.3% in total. There is a significant difference between the three types of vaccines in terms of the proportion ( $p < 0.001$ ). The prevalence of covid-19 in patients vaccinated with Sputnik vaccine was (2.6%) and in Sinopharm vaccine (0.25%). the mortality rate in Sputnik vaccine was zero and in Astrazeneca vaccine was more than Sinopharm vaccine ( $p = .029$ )

**Conclusion:** The results of the present study showed that the rate of death and re-infection in the used vaccines is different, so that re-infection in Sputnik vaccine was more than other vaccines (2.7%), but the duration of hospitalization in this vaccine was less than the others. Also, the death rate in Astrazanka vaccine was higher than others. The mean incidence of COVID-19 was 42.31 days after vaccination; the lowest incidence was reported 4 days after vaccination. Only 5% of patients needed to be admitted to the intensive care unit; the maximum length of hospital stay was estimated to be 3 to 4 days.

**Key word:** covid-19, vaccination, mortality

## 1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the pathogen for the COVID-19, which has caused disease and mortality on an unprecedented scale worldwide(1). Scientific and clinical evidence for the subacute and long-term effects of COVID-19 is evolving, which can affect various systems and organs(2). Early reports show complications of SARS-CoV-2 infection, such as fatigue, shortness of breath, chest pain, cognitive impairment, arthralgia, and decreased quality of life(3). Since the outbreak of COVID-19 in Wuhan, China in December 2019, it has progressed rapidly into a public health crisis and has spread to many countries around the world(4). On February 11, 2020, the World Health Organization (WHO) announced COVID-19 disease(5). The virus, named SARS-CoV-2, is generally asymptomatic but contagious and may have originated in bats.

Nowadays, the mechanisms related to the infection and outbreak of SARS-CoV-2 have been distinguished from other previous coronaviruses. Early diagnosis and supportive treatment are essential for the treatment of patients with covid-19. Initial observations showed that children are infected with this new virus at the same rate as adults. It is now known that children often show more gastrointestinal symptoms than adults, and many children infected with SARS-CoV-2 are asymptomatic. Recently, more than 300 vaccine development projects have been designed by the scientific community to prevent the disease of Covid-19. However, these vaccines may lose their effectiveness due to unpredictable reasons, including the emergence of new variants of SARS-CoV-2(6). Due to the widespread prevalence of this disease, the need for an effective vaccine worldwide, by combining phases,



accelerated the development of the corona vaccine(7). AstraZeneca vaccine is one of the vaccines made against COVID-19, which was widely used in December 2020 after completing its clinical trial process(8). The composition of the vaccine contains the genetic code for an important part of the SARS-cov-2 virus called the spik protein, which is identified by the vaccine's immune system and provides immunity to the virus(9). Sinopharm vaccine was also introduced by China in early 2020(10). The composition of the Sinopharm vaccine is based on inactivated viruses of this disease, which are injected into the body and stimulate the immune system and produce antibodies(11). The Sputnik vaccine was registered by Russia on August 11, 2020 and entered the clinical study cycle(12). The composition of this vaccine is based on a weak adenovirus that does not cause pathogenicity in humans and stimulates the immune system of vaccinated people to produce antibodies and immunogenicity against the disease(13). Globally, as of 4:48pm CET, 10 December 2021, there have been 267,865,289 confirmed cases of COVID-19, including 5,285,888 deaths, reported to WHO. As of 9 December 2021, a total of 8/2 billion vaccine doses have been administered(14). In Iran (Islamic Republic of), from 3 January 2020 to 4:48pm CET, 10 December 2021, there have been 6/2 million confirmed cases of COVID-19 with 130,524 deaths, reported to WHO. As of 4

December 2021, a total of 107 million vaccine doses have been administered(15). According to the announcement of the Ministry of Health of Iran, until December 11, 2021, the total number of injected vaccines is 110 million cases. To date, a total of 58,7 million people have received the first dose of Corona vaccine and 49/4 million people have received the second dose and 2,5 million people have received the third dose of the vaccine(16). Due to the extent of infection and spread of Covid-19 in the world, many studies are being conducted in order to find treatment methods and make vaccines or anti-viral compounds to deal with this virus. The covid-19 pandemic is not only a challenge for global health, but it has also affected global mental, social and economic health. In addition, post-corona conditions will certainly be associated with many social and economic challenges. The use of vaccines by people is done by researching the types of vaccines and comparing them with each other. However, some people do not want to be vaccinated. On the other hand, vaccines may lose their effectiveness due to unpredictable reasons, including the emergence of new variants of SARS-CoV-2. Also, information about different vaccine brands at different times, age groups, occupations or underlying diseases is not available. Therefore, the present study intends to compare the prevalence of covid-19 (temporary hospitalization,



hospitalization in the ward, intensive care unit (ICU) and mortality rate) in people vaccinated with AstraZeneca, Sinopharm and Sputnik vaccines in Shushtar Medical Sciences Hospitals. One of the reasons for choosing hospitals affiliated to Shushtar University of Medical Sciences is not observing social distance and wearing masks. Also, it seems that determining the effect of vaccination in reducing the severity of symptoms and death in case of corona disease is necessary in order to be able to provide the necessary information and training to the public about the possibility of contracting corona virus after vaccination, in order to continue to follow health protocols. This analytical cross-sectional study was conducted from May 2020 to May 2021 on 93 COVID-19-positive patients (41 male and 52 female) who were admitted to Khatam Al-Anbia Hospital.

## 2. Method

### 2.1. Study type and patient selection

The present study is a retrospective cross-sectional study was conducted from May 2021 to september 2021 on 639 COVID-19-positive patients (317 male and 322 female) who were admitted to Khatam Al-Anbia Hospital in Shoushtar, Iran.

The protocol was approved by the ethics committee of the Shoushtar Faculty of Medical Sciences (Ethics code: IR.SHOUSHTAR. REC.1400.013). All patients'

data was kept confidential in compliance with the principles of the declaration of Helsinki.

In order to evaluate and compare the rate of covid-19 and the death rate in vaccinated people in Shoushtar,Iran. The study population of this study includes people who have received one or two doses of Corona vaccine Sputnik V, Sinopharm and AstraZeneca and have referred to medical centers affiliated to Shoushtar University of Medical Sciences due to covid-19. In order to determine the sample size according to the ratio formula and the similar article (17), the death rate after vaccination in people  $P = 0.12$  error rate  $\alpha = 0.05$ , with accuracy  $d = 0.03$ , at least sample size was estimated as 445 . Finally, 639 patients with covid-19 in Shoushtar city, who had received vaccine and met the study entry criteria, were investigated in a targeted manner.

The subjects were enrolled in the study via a purposive sampling method. Nasopharyngeal and/or oropharyngeal swabs were used to detect the nucleic acid of SARS CoV 2 by real-time reverse transcriptase polymerase reaction (RT PCR). Inclusion criteria : 1. Persian race and resident of Shoushtar, 2. Definite infection with COVID-19 based on PCR test, 3. the patient has received at least one or two doses of Sputnik V, Sinopharm and AstraZeneca vaccine. Exclusion criteria also include : 1- vaccination with vaccines other than Sputnik V, Sinopharm and



AstraZeneca. 2- Failure to receive medical services in case of re-infection 3- Incomplete medical records of patients.

## 2.2. Data collection

The collection of information will be from the registered medical records of people with covid-19. In this way, after receiving the code of ethics and receiving the referral letter, The sampler goes to the medical records department of Khatam Al-Anbiah Hospital and collects the desired information from the health records of the people using a targeted sampling method. If part of the required data was not recorded in their files, the patients were contacted by phone call and after assuring them that their information would remain confidential and with their consent, the missing information was added to the files.

Patient information through a checklist that includes demographic information (age, gender, education and marital status ), information about vaccines (Type of vaccine (Astrazenka, Sputnik, Sinopharm),Vaccine dose received (dose 1, dose 2)), underlying diseases(Heart disease pulmonary,diseases kidney,diseases diabetes), severity of covid-19 symptoms (outpatient, inpatient and intensive care unit) , length of hospital stay , disease outcome (recovery, death)), type of service to illness(outpatient, admission, special care), length of hospital stay , previous

history of covid-19 and duration of infection after vaccination , were collect.

## 2.3. Statistical analysis

The results demographic and clinical information of the subjects were presented as mean, standard deviation, and median (IQR: Q1-Q3), minimum and maximum, and for the qualitative (categorical) variables were reported as the frequency with percentage. Independent t-test was employed to compare means, ANOVA test to compare means between levels of variables, and Chi-square test to compare qualitative variables. Selecting a statistical test was dependent on data normality, which was assessed using the Kolmogorove Smirnov test. The significance level of the above tests was viewed as less than .05. The collected data were analyzed using IBM SPSS software for Windows (version 18).

## 3. Result

In this study, out of 209,681 people who had injected each type of vaccine (Astrazinka, Spetnik and Sinopharm,) from May 2021 to September 2021, 639 people were infected with Corona. The mean age of study participants was 56.58 (sd= 17.74) years. The minimum age was 18 and the maximum age was 100 years. 50.4% (n=322) of them were women and 49.6% (n= 317) men. 89.8% of the participants were married and the higher education level of the participants was reported below the



diploma (45.2%). According to the findings, 40% were housewives.

51.5% (n=329) people had underlying disease, with the highest prevalence being diabetes and heart disease. 94.5% (n=604) people did not have COVID-19 before the vaccine. The median duration of infection after vaccination was 30(IQR: 20-50) days, with a minimum of 4 days and a maximum of 180 days. 52% of the participants had injected the first dose and 48% had injected the two doses.

The length of hospital stay in 14.5% was 4 days. The severity of symptoms reported by

participants was 48.9% low, 46.9% moderate and 4.2% severe, respectively. Finally, about 49.0% of patients were treated on an outpatient basis. Also, about 46.9% of patients were admitted to routine hospital wards and 4.1% of patients were admitted to intensive care units.

The prevalence of corona infection in people vaccinated with these three vaccines is 0.3% in total. There is a significant difference between the three types of vaccines in terms of the proportion ( $p < 0.001$ ). (table 1)

**Table 1. Number and percentage of disease of COVID-19 after vaccination by vaccine type**

Type of vaccine	Total number of people vaccinated	Infection with COVID-19 n(%)	Do not get infected COVID-19 n(%)	P-value
Sinopharm vaccine	192337	481(0.25%)	191856(99.7%)	<0.001
Astrazinka vaccine	14371	81(0.56%)	14290(99.4%)	
Sputnik vaccine	2973	77(2.6%)	2896(97.4%)	

The statistical test used is chi-square test

According to Table (2), the mortality rate in different vaccines was different. According to the number of patients, the mortality rate in Sputnik vaccine was zero and in Astrazinka vaccine was more than Sinopharm vaccine ( $p = .029$ )



**Table 2. The cross tables between vaccination and death risk**

Type of vaccine	Outcome			P-value
		recovery	Death	
	Total number of patients with Covid-19	N=596	N=43	
Sinopharm	N=481	444/481 (92.3%)	35/481 (7.27%)	0.029
AstraZeneca	N=81	73/81 (90.1%)	8/81 (9.87%)	
Sputnik V	N=77	77/77 (100%)	0/77 (0%)	

The statistical test used is chi-square test

The rate of death/ admission, rate of death/ ICU admission and total rate of vaccination failure was 14.33%, 76.92% and 6.71%, respectively (table3).

**Table 3. Rate of death, vaccination failure**

	Event/total	Rate
rate of death/ admission	43/300	14.33%
rate of death/ ICU admission	20/26	76.92%
total rate of vaccination failure/ outpatient management	43/639	6.72%

**Table 4. Comparison of demographic variables in disease of COVID-19 after vaccination by vaccine type**

		Total (n=639)	Sinopharm (n=481)	AstraZeneca (n=81)	Sputnik (n=77)	Significance level
<b>Age (years)</b>		57(IQR: 44-69)	59.24±16.01	59.79±20.25	36.64±11.53	.000
<b>Outcome of the disease</b>	Death	43(6.7)	35(7.3)	8(9.9)	0(0.0)	.029
	Recovery	596(93.3)	446(92.7)	73(90.1)	77(100.0)	
<b>Gender</b>	Female	323(50.5)	240(49.9)	36(44.4)	47(61.0)	.096



	Man	316(49.5)	241(50.1)	45(55.6)	30(39.0)	
<b>Marital status</b>	Married	574(89.8)	458(95.2)	73(90.1)	43(55.8)	.000
	Single	65(10.2)	23(4.8)	8(9.9)	34(44.2)	
<b>Education</b>	High school	289(45.2)	247(51.4)	40(79.4)	2(2.6)	.000
	Diploma	205(32.1)	172(35.8)	27(33.3)	6(7.8)	
	Bachelor	139(21.8)	60(12.5)	14(17.3)	65(84.4)	
	Masters	1(.2)	0(0)	0(0)	1(1.3)	
	Doctorate	5(.8)	2(.4)	0(0)	3(3.9)	
<b>Job</b>	Unemployed	37(5.8)	28(5.8)	8(9.9)	1(1.3)	.000
	Free	171(26.8)	147(30.6)	23(28.4)	2(2.5)	
	Governmental	175(27.4)	84(17.5)	20(24.7)	71(91.0)	
	housewife	256(40.1)	222(46.2)	30(37.0)	4(5.1)	

The statistical tests used are chi-square test and Anova

**Table 5: Comparison of Under lying diseases variables disease of COVID-19after vaccination by vaccine type**

		<b>Total (n=639)</b>	<b>Sinopharm (n=481)</b>	<b>AstraZeneca (n=81)</b>	<b>Sputnik (n=77)</b>	<b>Significance level</b>
<b>Underlying diseases</b>	Yes	329(51.5)	284(59.0)	38(46.9)	7(9.1)	.000
	No	310(48.5)	197(41.0)	43(53.1)	70(90.9)	
<b>Diabetes</b>	Yes	139(21.8)	119(24.7)	17(21.0)	3(3.9)	.000





	No	500(78.2)	362(75.3)	64(79.0)	74(96.1)	
<b>Heart disease</b>	Yes	208 (32.6)	185(38.5)	20(24.7)	3(3.9)	.000
	No	431(67.4)	296(61.5)	61(75.3)	74(96.1)	
<b>kidney disease</b>	Yes	38(5.9)	33(6.9)	4(4.9)	1(1.3)	.147
	No	601(94.1)	448(93.1)	77(95.1)	76(98.7)	
<b>Lung disease</b>	Yes	12(1.9)	11(2.3)	1(1.2)	0(0.0)	.351
	No	627(98.1)	470(97.7)	80(98.8)	77(100.0)	

The statistical test used is chi square test

**Table 6: Comparison of Clinical profile variables in patients with coronary artery disease after vaccination by vaccine type**

		<b>Total (n=640)</b>	<b>Sinopharm (n=481)</b>	<b>AstraZeneca (n=81)</b>	<b>Sputnik (n=77)</b>	<b>Significance level</b>
<b>Vaccine dose</b>	The first dose	331(51.8)	276(57.4)	48(59.3)	7(9.1)	.000
	The second dose	308(48.2)	205(42.6)	33(40.7)	70(90.9)	
<b>Previous infection with COVID-19</b>	Yes	35(5.5)	22(4.6)	3(3.7)	10(13.0)	.008
	No	604(94.5)	459(95.4)	78(96.3)	67(87.0)	
<b>Type of service</b>	Outpatient	313(49.0)	202(42.0)	40(49.4)	71(92.2)	.000
	Hospitalization	300(46.9)	256(53.2)	38(46.9)	6(7.8)	
	ICU	26(4.1)	23(4.8)	3(3.7)	0(0.0)	
<b>Severity of symptoms</b>	Low	312(48.8)	201(41.8)	40(49.4)	71(92.2)	.000
	Medium	300(46.9)	256(53.2)	38(46.9)	6(7.8)	
	Severe	27(4.2)	24(5.0)	3(3.7)	0(0.0)	



<b>Became ill a few days after the vaccine</b>	The first dose	27.75±16.43	25.34±12.17	41.66±27.45	27.75±16.43	.000
	The second dose	58.04±43.53	42.04±30.73	36.69±21.69	58.04±43.53	.000
<b>Duration of hospitalization of patients</b>	The first dose	2.50±2.89	2.60±2.88	2.02±2.99	1.71±2.21	.169
	The second dose	2.53±3.45	3.33±3.70	2.60±3.00	.17±.83	.000

The statistical test used is chi square test

#### 4. Discussion

Given that information on different vaccine brands is not available at different times, age groups, occupations or underlying diseases, the present study intends to compare the incidence of covid-19 (temporary hospitalization, inpatient treatment, Intensive care unit (ICU) and death) in people vaccinated with AstraZeneca, Sinopharm or Sputnik vaccines in Shoushtar medical hospitals and also to determine the effect of vaccination in reducing the severity of symptoms and death in case of covid-19 And provide the necessary information and training to the public on the possibility of contracting the corona virus after vaccination, in order to continue adhering to health protocols. The aim of this study was to compare the incidence of COVID- 19 after vaccination in patients referred to hospitals affiliated to Shoushtar University of Medical Sciences in 1400. 208 people reported cardiovascular

disease, 38 had kidney disease and 12 had lung infection and were hospitalized. 314 patients were referred to the hospital on an outpatient basis, 300 patients were hospitalized and only 26 patients needed to be admitted to the intensive care unit. In a case-control study conducted by Bernal et al., 2021 on the efficacy of Pfizer-BioNTech and Oxford-AstraZeneca vaccines on COVID-19 symptoms, hospitalization and mortality in the elderly in the United Kingdom. The study included 156,630 adults aged 70 years and older who had symptoms of COVID-19 between December 8, 2020 and February 19, 2012. The results of the study showed that by injecting the vaccine on people 80 years and older, they found that the first dose of the vaccine after 70 to 13 days is 70% effective and 14 days after the second dose is 89% effective and also vaccination with one dose reduces hospitalization to 80% and prevention of mortality with COVID-19 is 19 to 85%(17). The results of



the study by Balachandran et al. (2022) showed that severe infection, length of hospital stay, need for ventilation and death among vaccinated patients were significantly lower compared to patients who were not vaccinated(18). The results of the study by Wright et al. (2022) showed that vaccination remains highly effective against hospitalisation, but vaccine effectiveness declined after 200 days, particularly for older patients or those with specific comorbidities. Additional protection (eg, a booster vaccination) might be warranted for everyone, but especially for these populations. In addition to promoting general vaccine uptake, clinicians and policy makers should consider prioritising booster vaccinations in those most at risk of severe COVID-19(19). The results of the study by Gallo et al. (2022) showed that ORs for a number of adverse events and patient groups were (largely) increased, most notably for the occurrence of cerebral venous sinus thrombosis after vaccination with the Johnson & Johnson vaccine. The overall population OR of 10 increases to 12.5 when limited to women, and further yet (to 14.4) among women below age 50 yrs. In addition, elevated risks were found (i) for Guillain–Barré syndrome (OR of 11.6) and (ii) for myocarditis/pericarditis (ORs of 5.3/4.1, respectively) among young men (<25 yrs) vaccinated with the Pfizer/BioNTech vaccine(20). The results of the study by

Fiolet et al. (2022) showed that all COVID-19 vaccines had a high efficacy against the original strain and the variants of concern, and were well tolerated. BNT162b2, mRNA-1273 and Sputnik V after two doses had the highest efficacy (>90%) in preventing symptomatic cases in phase III trials. mRNA vaccines, AZD1222, and CoronaVac were effective in preventing symptomatic COVID-19 and severe infections against Alpha, Beta, Gamma or Delta variants. Regarding observational real-life data, full immunization with mRNA vaccines and AZD1222 seems to effectively prevent SARS-CoV-2 infection against the original strain and Alpha and Beta variants but with reduced effectiveness against the Delta strain. A decline in infection protection was observed at 6 months for BNT162b2 and AZD1222. Serious adverse event rates were rare for mRNA vaccines—anaphylaxis 2.5–4.7 cases per million doses, myocarditis 3.5 cases per million doses—and were similarly rare for all other vaccines(21).

The study also found that vaccination against covid-19 reduced the incidence of the disease(22). Hellewell et al., 2020 reported Vaccination with different vaccines against covid-19 reduces new cases and reduces mortality from the disease(23). The result of Billon-Denis et al., 2020 showed that vaccination is not the ultimate solution to covid-19 and non-pharmacological measures should be considered against covid-19(24). In an



analytical study conducted by Fukutani et al., 2021 on the relationship between vaccination and the prevalence of COVID-19 and mortality. Approved by the World Health Organization, it reduces mortality and new cases of the disease(25). Jahromi et al., 2021 relative protection of the Sinopharm vaccine against SARS COV2 during the recent outbreak in Bahrain. The statistical population was those who received a single dose or dose of the Sinopharm vaccine. Of the 26 people who received the same dose of vaccine, 23 became infected with COVID-19, and of those 23, 10 developed lung infection and were hospitalized(26). Currently, the vaccines available in the country's vaccine portfolio are the vaccines approved by the National Technical Committee for Covid-19 Vaccination. With all the current limitations regarding the documentation of the long-term effects of this disease, scientists in response to the critics of the long-term or late effects of the anti-Covid-19 vaccines point out that you should also think about the long-term and late effects of the Covid-19 disease itself if you are infected. Among them can be permanent damage to lung or heart tissue. Some scientists consider strokes, epilepsy and Guillain-Barré disease to be long-term complications of Covid-19. We conclude that up to this moment and based on the available documentation, the risk of long-term side effects for the covid-19 vaccines has not been reported, and

based on the global history of vaccination, it is unlikely that any side effects will occur in the future that would be worth stopping vaccination or avoiding receiving it. It should be noted that long-term complications of covid-19 are much more common and frequently reported, and every now and then a new case is added to the list of symptoms of this dreaded disease, which is one of the signs of the need to receive a vaccine. At the same time, it is expected that the responsible institutions record the side effects of vaccines in a scientific and continuous way.

### **5. Conclusion**

The results of the present study showed that the rate of death and re-infection in the used vaccines is different, so that re-infection in Sputnik vaccine was more than other vaccines (2.7%), but the duration of hospitalization in this vaccine was less than the others. Also, the death rate in Astrazanka vaccine was higher than others. The mean incidence of COVID-19 was 42.31 days after vaccination; the lowest incidence was reported 4 days after vaccination. Only 5% of patients needed to be admitted to the intensive care unit; the maximum length of hospital stay was estimated to be 3 to 4 days. More research is needed to consider booster doses, heterologous vaccination, dosing intervals, vaccine breakthrough infections, and duration of vaccine immunity against variants of concern.



## Declarations

### Ethics approval and consent to participate

Not applicable

### Consent for publication

Not applicable

### Competing interests

No competing interests to declare.

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### Authors' contributions

ES has done data collection and major contributor in review manuscript writing. AJ has checked the writing of the manuscript. ME has screened the articles. AT has screened the articles. MT has designed the concept, corrections, and drafting of the manuscript. All the authors have read and approved the manuscript.

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