PRESENTATION AND OUTCOMES OF THE COVID-19 AMONG THE VACCINATED AND NON-VACCINATED PATIENTS

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Abstract:

Background: *Previous infection or vaccination boosts up the body's immune system. It may have a protective effect or an exaggerated immune response. Knowledge about the impact of vaccination or previous infection on the presentation and outcome of the new variant of COVID-19 is scarce.*

Objectives: *In this study, vaccine effectiveness, reinfection rate and severity prediction among vaccinated and non-vaccinated COVID-19 infected patients were assessed.*

Methods: *This observational study was conducted in the COVID-19 unit of Dhaka Medical College Hospital. Three hundred forty-four patients who presented in the triage and were admitted to DMCH were enrolled as per inclusion criteria and were followed up for three months for outcome variables. Patients were divided into four groups by vaccination and previous infection.*

Results: *Of the 344 participants reinfection rate was 70(36%) in vaccinated and 89(58%) in non vaccinated. Mortality was 18(14.6%), 10(14.3%), 14(22.6%), and 40(44.9%) in new COVID-19 in vaccinated, reinfection in vaccinated, new COVID-19 infection in unvaccinated, and reinfection in unvaccinated patients respectively. 5 (4.1%) of the newly infected vaccinated and 4 (6.5%) freshly infected unvaccinated, 14 (15.7%) reinfected unvaccinated patients were transferred to ICU for mechanical ventilation. The mean duration of the hospital stay was significantly ($p<0.05$) lower among the vaccinated group than in non-vaccinated patients.*

Conclusion: *This study suggests that vaccination of previously infected people may be associated with reducing the adverse outcome of COVID-19 infection.*

Keywords: *COVID-19, second surge, vaccination program, previously infected, immune system, new variant of COVID-19*

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Introduction:

SARS-CoV-2, the deadly virus, has caused ever-known devastation in humanity.[1] Vaccination against the SARS-CoV-2 virus has managed to reduce the ferocity of the pandemic with safety.[2-3] However, COVID-19 infections after vaccination have occurred in the general population and among healthcare workers.[4-5]

Moghadas *et al.*,[6] reported that vaccination with 10% pre-existing immunity substantially mitigated the attack rate across all age groups with a mean overall attack rate of 4.6% (95% Credible intervals: 4.3%-5.0%) on day 300. Despite antibodies, reinfection with other human coronaviruses is common.[7]

Das *et al.,*[8] in Bangladesh reported a case series of five clinically and laboratory-confirmed COVID-19 patients suffering the second episode of COVID-19 after over 70 days free of symptoms. The recurrent cases had predominantly mild symptoms in both the first and second episodes of illness, but only one case had moderate symptoms during their second episode. Their data showed that approximately 1% of all staff had the second episode of COVID-19.

Fatima *et al.,*[9] stated that people could acquire severe and critical COVID-19 infection from vaccination, but this rate is low compared to the unvaccinated population. Thus, it is noteworthy that intensive efforts to vaccinate as many individuals as possible should continue. Furthermore, it needs more robust research to generate evidence-based data while formulating strategies for effective vaccinations to decrease the high death toll of COVID-19 infection.

Das *et al.,*[8] stated that patients tended to show a higher frequency of severity in the recurrence compared to the first episode, but the differences did not reach statistical significance. They reported dyspnea in 57.6% in reinfection versus 33.3% in their first episode. Sixty percent of the patients attended an emergency room during recurrence versus 57.6% in the first episode.

Anand *et al.,*[10] emphasized that a vaccine could substantially reduce the incidence, hospitalizations, and deaths, especially among individuals with co-morbidities and risk factors associated with severe COVID-19.

A study showed the vaccine was 95% effective in preventing COVID-19 (95% credible interval, 90.3 to 97.6). Similar vaccine efficacy (generally 90 to 100%) was observed across subgroups. Among 10 cases of severe COVID-19 with onset after the first dose, nine occurred in placebo recipients and 1 in a BNT162b2 recipient.[11]

With the above scenarios of facts and controversies, if the present study reveals reinfection led to a significant decrease in incidence, attack rates, and adverse outcomes across all age groups, this will ultimately reduce the health and economy of government, morbidity, mortality, ICU admission, complications, and huge vaccination burden. If vaccination reveals a decrease in incidence, attack rates, and adverse outcomes, the government will take more initiative for vaccination for all age groups. There is very little data regarding the presentation and outcomes of COVID-19 infection in vaccinated or reinfected patients worldwide, and no similar study has been conducted in our country. The study has been designed to determine the different outcomes among vaccinated, non-vaccinated, and reinfected COVID-19 patients.

Materials and Methods:

This observational study was conducted in the COVID-19 unit of Dhaka Medical College Hospital for one year (January 2021 to December 2021). A total of 344 patients who were presented in the triage and were admitted to the COVID unit of DMCH were enrolled as per inclusion and exclusion criteria. The recruited patients were divided into four groups: vaccinated with a new infection, vaccinated with reinfection, unvaccinated with a new infection, and reinfection. We obtained informed written consent from all the participants and followed up with them for three months after enrollment for outcomes. The follow-up was given in the post-COVID-19 clinic or over the telephone according to a structured telephonic guide.

Inclusion and exclusion criteria:

We included patients with RT-PCR for COVID-19 positive admitted to the COVID-19 unit irrespective of severity and vaccination status above 18. Those admitted immediately after the vaccination (<14 days of vaccination) were excluded from the study.

Operational definition:

In this study, we defined different severity of COVID-19 according to Bangladesh National guidelines. The **Asymptomatic** cases were

patients with no symptoms but tested positive for SARS-CoV 2. We labeled **Mild cases** as those with mild symptoms and without evidence of pneumonia. We defined a **Moderate case** as an adolescent or adult with clinical signs of pneumonia (fever, cough, dyspnea, fast breathing) but no signs of severe pneumonia (SpO2 > 90% on room air). The **Severe cases** were the adolescent or adults with clinical signs of pneumonia (fever, cough, dyspnea, fast breathing) plus one of the following: severe respiratory distress, respiratory rate > 30 breaths/min or SpO2< 90% on room air. The **Critical cases** were defined as severe COVID-19 case meeting any of the following criteria: Respiratory failure and requiring mechanical ventilation, Sepsis, Septic shock, ARDS, any organ failure that requires ICU care, Acute venous thrombosis, Acute coronary syndrome, Acute stroke.[12] We defined the **Vaccinated** as those who completed 21 days after the first dose or 14 days after the second vaccine dose (irrespective of vaccine type). We defined **Reinfection** according to the Centers for Disease Control and Prevention (CDC), considering 90 days between two positive SARS-CoV-2 RNA along with genomic evidence of reinfection. The basis for choosing 90 days is the studies showing prolonged viral shedding for up to 82 days.[13]

Statistical analysis: The results' statistical analysis was obtained using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-23.0). Continuous variables were expressed as mean, standard deviation, and categorical variables as frequencies and percentages. The differences among groups were analyzed by chi-square (c2) test cross-tabulation and ANOVA test as appropriate. A p-value <0.05 was considered significant.

Results:

A total of 344 patients presented in the triage and admitted in COVID unit of DMCH were enrolled as per inclusion and exclusion criteria, out of which 193 cases were vaccinated and rest 151 cases were non-vaccinated. Among vaccinated 123 cases were new COVID-19, and 70 (36%) cases were re-infection. Among non-vaccinated 62 cases were new COVID-19, and 89 (58%) cases were re-infection.

Table I

Distribution of the study patients according to demographic profile (N=344)

Demographic profile	Vaccinated (n=193)				Non-vaccinated (n=151)				P-value
	New COVID-19 (n=123)		Re-infection (n=70)		New COVID-19 (n=62)		Re-infection (n=89)		
	n	%	n	%	n	%	n	%	
Age in years									
≤50	42	34.1	32	45.7	27	43.5	47	52.8	
>50	81	65.9	38	54.3	35	56.5	42	47.2	
Mean±SD	54.36±12.86		49.54±14.22		54.74±14.89		52.18±12.03		[a]0.063[ns]
Range (Min-Max)	21-84		29-70		16-85		30-75		
Sex									
Male	75	61.0	34	48.6	27	43.5	40	44.9	[b]0.051[ns]
Female	48	39.0	36	51.4	35	56.5	49	55.1	
Occupation									
Housewife	30	24.6	20	28.6	30	48.4	40	44.9	
Retired	22	18.2	10	14.3	7	11.3	9	10.1	
Businessman	19	15.9	5	7.1	4	6.5	10	11.2	
Govt. service	12	9.9	5	7.1	6	9.7	5	5.6	
Farmer	8	6.5	5	7.1	4	6.5	2	2.2	
Nurse	8	6.5	5	7.1	1	1.6	2	2.2	
Teacher	7	6.1	2	2.9	2	3.2	8	9.0	
Student	3	2.4	0	0.0	2	3.2	0	0.0	

Table I (Cont'd)

Demographic profile	Vaccinated (n=193)				Non-vaccinated (n=151)				P-value
	New COVID-19 (n=123)		Re-infection (n=70)		New COVID-19 (n=62)		Re-infection (n=89)		
	n	%	n	%	n	%	n	%	
Physician	5	1.8	8	11.5	0	0.0	1	1.1	
Banker	2	1.8	1	1.4	1	1.6	1	1.1	
Driver	2	1.8	1	1.4	1	1.6	1	1.1	
Engineer	1	0.9	3	4.3	0	0.0	8	9.0	
Biochemist	0	0	3	4.3	0	0.0	0	0.0	
Govt. workers	4	3.6	2	2.9	3	4.8	2	2.2	
Politician	0	0	0	0.0	1	1.6	0	0.0	
Socio-economic status									
Low	13	10.6	10	14.3	10	16.1	10	11.2	
Middle	108	87.8	60	85.7	50	80.7	79	88.8	[b]0.424[ns]
High	2	1.6	0	0.0	2	3.2	0	0.0	
Education									
No formal	5	4.1	15	21.5	10	22.6	6	6.7	
≤ Class 5	13	10.6	5	7.1	16	25.8	7	7.9	
≤ Class 8	27	22.0	10	14.3	20	32.3	30	33.7	[b]0.001[s]
≤ Class 12	39	31.6	20	28.6	9	14.5	22	24.7	
Graduate	24	19.5	10	14.3	4	1.6	4	4.5	
Postgraduate	15	12.2	10	14.3	3	3.2	20	22.5	

s=significant; ns= not significant; [a]p value reached from ANOVA test; [b]p value reached from Chi-square test

Regarding the demographic profile education was significantly (p<0.05) associated among vaccinated and non-vaccinated patients. But age, sex, occupation and socio-economic status were not significantly (p>0.05) associated among vaccinated and non-vaccinated patients.

Table II

Distribution of the study patients according to presenting symptoms (N=344)

Symptoms	Vaccinated (n=193)				Non-vaccinated (n=151)				P-value
	New COVID-19 (n=123)		Re-infection (n=70)		New COVID-19 (n=62)		Re-infection (n=89)		
	n	%	n	%	n	%	n	%	
Fever	85	69.1	40	57.1	51	82.3	74	83.1	0.001[s]
Cough	77	62.6	42	60.0	48	77.4	72	80.9	0.004[s]
Fatigue/Malaise	58	47.2	20	28.6	46	74.2	70	78.6	0.001[s]
Resp. distress	70	56.9	37	52.9	59	95.2	80	90.0	0.004[s]
Loss of taste	40	32.5	20	28.6	38	61.3	67	75.3	0.001[s]
Body ache/Joint pain	44	35.8	30	42.9	29	46.8	59	66.3	0.001[s]
Loss of smell	26	21.1	24	34.3	25	40.3	42	47.2	0.001[s]
Headache	22	17.9	25	35.7	19	30.6	37	41.6	0.001[s]
Diarrhea	20	16.3	23	32.8	13	21.0	36	40.4	0.001[s]
Sore throat	16	13.0	19	27.1	12	19.3	31	34.8	0.001[s]
Vomiting	20	16.3	16	22.9	12	19.3	24	27.0	0.280[ns]
Skin rash	8	6.5	10	14.3	10	16.1	16	18.0	0.063[ns]
Confusion	7	5.7	1	1.4	8	12.9	10	11.2	0.054[ns]

s=significant; ns= not significant; p value reached from Chi-square test

Regarding the presenting symptoms fever, cough, fatigue/malaise, respiratory distress, loss of taste, body ache/Joint pain, loss of smell, headache, diarrhea and sore throat were observed significantly (p<0.05) higher among non-vaccinated patients as compared to vaccinated people.

Table III

Distribution of the study patients according to co-morbidities (N=344)

Chronic condition	Vaccinated (n=193)				Non-vaccinated (n=151)				P-value
	New COVID-19 (n=123)		Re-infection (n=70)		New COVID-19 (n=62)		Re-infection (n=89)		
	n	%	n	%	n	%	n	%	
HTN	78	63.4	30	42.9	50	80.6	61	68.5	0.003[s]
DM	71	57.7	30	42.9	50	80.6	50	56.2	0.001[s]
IHD	28	22.8	10	14.3	18	29.0	31	34.8	0.021[s]
Bronchial asthma /COPD	24	19.5	10	14.3	13	21.0	32	36.0	0.006[s]
CKD	19	15.4	10	14.3	15	24.2	19	21.3	0.331[ns]
Stroke	6	4.9	5	7.1	6	9.7	10	11.2	0.355[ns]
CLD	2	1.6	0	0.0	2	3.2	4	4.5	0.313[ns]
Malignancy	1	0.8	0	0.0	0	0.0	2	2.2	0.374[ns]

s=significant; ns= not significant; p value reached from Chi-square test

Regarding chronic condition such as HTN, DM, IHD, bronchial asthma/COPD were found significantly (p<0.05) higher among non-vaccinated as compared to vaccinated patients.

Table IV

Distribution of the study patients according to clinical status on enrolment (N=344)

Clinical status	Vaccinated (n=193)				Non-vaccinated (n=151)				P-value
	New COVID-19 (n=123)		Re-infection (n=70)		New COVID-19 (n=62)		Re-infection (n=89)		
	n	%	n	%	n	%	n	%	
Hospitalized with comorbidities but oxygen not required	45	36.6	25	35.7	3	4.8	8	9.0	
Hospitalized with supplemental oxygen with Mask/Cannula	46	37.4	25	35.7	13	21.0	47	52.8	0.001[s]
Hospitalized with supplemental oxygen with HFNC	32	26.0	20	28.6	42	67.7	34	38.2	
Hospitalized with supplemental oxygen by CPAP or BIPAP in ICU or HDU	0	0.0	0	0.0	4	6.4	8	9.0	

s=significant; p value reached from Chi-square test

Oxygen supplementation with a high-flow nasal cannula and CPAP or BIPAP was less required in vaccinated groups.

Table V

Distribution of the study patients according to severity (N=344)

Severity	Vaccinated (n=193)				Non-vaccinated (n=151)				P-value
	New COVID-19 (n=123)		Re-infection (n=70)		New COVID-19 (n=62)		Re-infection (n=89)		
	n	%	n	%	n	%	n	%	
Mild	53	43.1	25	35.7	3	4.8	8	9.0	
Moderate	40	32.5	10	14.3	10	16.1	10	11.2	0.001[s]
Severe	30	24.4	35	50.0	45	72.6	63	70.8	
Very Severe	0	0.0	0	0.0	4	6.5	8	9.0	

s=significant; p value reached from Chi-square test

Severe and very severe diseases were low among the vaccinated groups (vaccinated with new COVID-19 infection 24.4%, and with reinfection 50% vs. non-vaccinated with new COVID-19 infection 72.6% and with reinfection 70.8%).

Table VI

Distribution of the study patients according to outcome (N=344)

Outcome	Vaccinated (n=193)				Non-vaccinated (n=151)				P-value
	New COVID-19 (n=123)		Re-infection (n=70)		New COVID-19 (n=62)		Re-infection (n=89)		
	n	%	n	%	n	%	n	%	
Discharge from hospital with improvement	105	85.4	60	85.7	44	70.9	47	52.8	0.001[s]
Death	18	14.6	10	14.3	14	22.6	40	44.9	0.001[s]
Transfer to ICU for mechanical ventilation	5	4.1	0	0.0	4	6.5	14	15.7	0.001[s]
Still hospitalized with mask/cannula oxygen	0	0.0	0	0.0	3	4.8	2	2.2	0.042[s]
Still hospitalized due to co-morbidity	0	0.0	0	0.0	1	1.6	0	0.0	0.206[ns]

s=significant; ns= not significant; p value reached from Chi-square test

Regarding the outcome 85.4% of vaccinated and 70.9 % non-vaccinated was discharged from hospital with improvement; 14.6% of vaccinated and 22.6% of non-vaccinated died; 4.1% of vaccinated and 6.5% of non-vaccinated was transferred to ICU for mechanical ventilation.

Table VII

Distribution of the study patients according to duration of hospital stay (N=344)

Duration of hospital stay	Vaccinated (n=193)		Non-vaccinated (n=151)		P-value
	New COVID-19 (n=123)	Re-infection (n=70)	New COVID-19 (n=62)	Re-infection (n=89)	
Mean±SD	13.47±10.32	12.5±2.09	18.46±11.37	24.57±23.51	0.001[s]
Range (Min-Max)	3-74	10-15	4-60	5-90	

s=significant; p value reached from ANOVA test

The mean duration of hospital stay was 13.47±10.32 days in new COVID-19 affected and 12.5±2.09 days re-infection in vaccinated and in non-vaccinated 18.46±11.37 days in new COVID-19 affected and 24.57±23.51 day's re-infection. The mean duration of the hospital was significantly ($p<0.05$) less among the vaccinated group than among non-vaccinated patients.

Discussion:

The study revealed the beneficial effects of vaccination. Predominant presenting symptoms were less among the vaccinated group. Patients with different comorbidities were predominantly affected among the non-vaccinated groups. The vaccinated groups developed less severe illnesses, required less hospitalization, and mortality was low.

The age of the patient with COVID-19 was higher among the vaccinated groups, though it was insignificant. Initially we started vaccination to the elderly people first, this could explain this.

Ayoubkhani *et al.,*[14] reported that the mean age of participants was 46 years, and male (61.0%) showed significantly more infection rate in comparison to female (39.0%) in both the groups (vaccinated and non-vaccinated). They also emphasized that heterogeneity was not found in association between vaccination and long COVID-19 by sociodemographic characteristics, health status, hospital admission with acute COVID-19, vaccine type (adenovirus vector or mRNA), or duration from SARS-CoV-2 infection to vaccination. According to a survey finding, Shammi *et al.,*[15] reported that the ratio of male to female participants was 3 :1.

In our study, regarding the socio-economic status, most patients were from middle class. In accordance with our study, Akter *et al.,*[16] also reported that the major challenges faced by middle class people of Dhaka city in COVID-19 pandemic period.

In this study, the distribution of the study patients according to presenting symptoms showed that fever, cough, fatigue/malaise, respiratory distress, loss of appetite, body ache/joint pain, loss of smell, headache, diarrhea and sore throat were observed significantly higher among non-vaccinated patients as compared to vaccinated people.

In a study, Larsen *et al.,*[17] observed that the common symptoms of acute COVID-19 are fever, fatigue, diarrhea, and respiratory symptoms such as cough, sore throat, and shortness of breath. However, some patients develop neurological manifestations ranging from mild symptoms such as anosmia, dizziness, and headache to more severe cerebrovascular disease, seizures, encephalitis, or the Guillain–Barré syndrome.[18] Other extrapulmonary manifestations of COVID-19 include acute kidney injury, hyperglycemia, thrombotic complications, myocardial dysfunction and arrhythmia, acute coronary syndromes, and hepatocellular injury.[19-20]

In a study, Selvaraj *et al.,*[21] reported that among vaccinated 26% turned out to be COVID-19 positive and 44.5% non-vaccinated got infected which agrees with our study. They also emphasized that odds of infection among non-vaccinated individuals were 2.27 times higher than vaccinated individuals. Individuals who encountered the viral antigen for the second time experienced either through vaccination or infection demonstrated exaggerated inflammatory response which is explained by the antibody-dependent enhancement phenomenon without life-threatening complications.

In our study, the distribution of the study patients according to chronic condition such as HTN, DM, IHD, bronchial asthma/COPD, stroke, malignancy was found significantly higher among non-vaccinated as compared to vaccinated patients. In their study, Lee *et al.,*[22] observed that the underlying health conditions were also assessed including hypertension, diabetes, chronic lung disease, immuno-suppression and transplantation which keep well with present study.

In this study, the distribution of the study patients according to the smoking history showed that COVID-19 infection was higher among non-smoker compared to the smokers regardless of their vaccination status. It is still controversial concerning the relationship between smoking and COVID-19.

Some research works supported that smoking in patients with COVID-19 had greater severity of illness.[23-25] However, others suggested that the risk of infection was lower among smokers for the reason of nicotine.[26] Panigrahi *et al.,*[27] pointed out that nicotine might have protective effect against acute inflammatory lung injury caused by cholinergic mediated COVID-19. Lippi and Henry[28] even claimed that active smoking had no relationship with the severity of COVID-19. Subsequently, Gallus *et al.,*[29] argued that there were several mistakes in the study and concluded that smoking did play a role in the severity of COVID-19. Ismail *et al.,*[30] emphasized that in terms of disease outcomes, there were no differences between the two groups (smokers and non-smokers).

In our study, the distribution of the study patients according to clinical status on enrolment, statistically significant differences between vaccinated and non-vaccinated groups were only observed among patients who were enrolled with clinical status of hospitalized with supplemental oxygen with mask/cannula. Regarding severity of the disease, the patients with moderate, severe and very severe disease category showed statistically significant difference between the vaccinated and non-vaccinated groups.

According to protocol formulated by National Health Commission of China,[31] COVID-19 patients were categorized by clinical symptoms as asymptomatic, mild, moderate, serious, or severe. In a study, Moghadas *et al.,*[6] reported that vaccination markedly reduced adverse outcomes with non-ICU hospitalizations, ICU hospitalizations and deaths across the same period. Their data indicate that vaccination can have a great breakthrough in reduction of COVID-19 outbreaks. On a similar note, Lee *et al.,*[22] reported that although vaccination reduces the severity of illness, clinical and imaging data of COVID-19 breakthrough infections have yet to be detailed. Li *et al.,*[32] observed the efficacy of wide array of vaccination to prevent severity of COVID-19 infection by comparing the odds of vaccination in different outcomes.

Yang *et al.,*[33] reported that the serious issue of respiratory failure secondary to COVID-19 has appeared as burden on the intensive care unit resources throughout the world including a shortage of ventilators. It is worth noting that during the early phase of COVID-19, management by intubation were advised to decrease the risk of aerosol-generating procedures and meet the rising oxygen requirement and decline in respiratory status.[34]

In this study, the distribution of the study patients according to CRP and D-Dimer revealed that the CRP level was significantly higher among vaccinated as compared to non-vaccinated patients whereas D-Dimer was higher in non-vaccinated patients (94.11±609.18) in comparison to vaccinated (49.74±248.83) patients. Wang *et al.,*[35] reported that CRP could be a valuable marker to anticipate the possibility of aggravation of non-severe adult COVID-19 patients, with an optimal threshold value of 26.9 mg/L. Huang *et al.,*[36] reported that D-dimer has the highest C-index to predict in-hospital mortality, and patients with D-dimer levels e”0.5 mg/L had a higher incidence of mortality (Hazard Ratio: 4.39, P<0.01). Their study suggested D-dimer could be a potent marker to predict the mortality of COVID-19, which may be helpful for the management of patients.

In this study, regarding the distribution of the study patients according to outcome revealed that more favourable outcome are significantly more in vaccinated group. In a study, Whittaker *et al.,*[37] reported that out of 716 fully vaccinated patients (admitted to ICU: 103 (14%); in-hospital death: 86 (13%)) and 2487 unvaccinated patients (admitted to ICU: 480 (19%); in-hospital death: 102 (4%).

In the present study, regarding the distribution of the study patients according to duration or length of hospital stay (LOS), it was less among vaccinated group as compared to non-vaccinated patients.

In accordance with our study, Bernal *et al.,*[38] observed that COVID-19 vaccination programs have substantially reduced the turnover of patients with COVID-19-related hospitalizations

and deaths. Olson *et al.,*[39] reported that among 179 COVID-19 patients, six (3%) were vaccinated and 173 (97%) were unvaccinated. Overall, 77 (43%) patients were admitted to an intensive care unit and 29 (16%) critically ill patients received life support during hospitalization, including invasive mechanical ventilation, vasoactive infusions, or extracorporeal membrane oxygenation. In another study, Whittaker *et al.,*[37] in Norway found that fully vaccinated patients hospitalized with COVID-19 have a shorter LOS and lower risk of ICU admission than unvaccinated patients which correlates well with our study.

Conclusion:

The study found that vaccination against COVID-19 is associated with a decrease in the incidence and prolong COVID-19 symptoms in adults aged more than 18 years and this appeared to be sustained after a vaccine. Re-infection rate is lower in vaccinated patients. The results also suggests that vaccination of people with previously infected may be associated with a reduction in the burden of prolong COVID-19 symptom at least in the first few months after vaccination. It can be inferred that a higher incidence of COVID-19 among those unvaccinated versus vaccinated. Therefore, at least during times and locations of a COVID-19 pandemic, vaccinations may be beneficial for patients against COVID-19.

Limitation:

It is a single-center study with relatively few numbers of participants. We did not stratify the population according to the duration and the number of vaccinations. The researchers were aware of the patient's vaccination status, which could create a potential bias.

Recommendation:

Further multi-center research works with large number of study patients are required to evaluate the long-term relationship between vaccination with the presentation and outcome of COVID-19. Studies are also needed to understand the biological mechanisms underpinning any improvements in symptoms after vaccination, which may contribute to the development of therapeutics for COVID-19. In addition, more prospective analysis, including patients' risk factors, COVID-19 variants and the utilized treatment strategies would be appeared warranted.

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