

**Impact of vaccination on COVID-19 infection among resident doctors of tertiary care teaching hospital. -A cross sectional study**

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**Abstract**

**Introduction:** Large-scale vaccination is the single most effective public health measure for mitigation of the coronavirus disease (COVID -19) pandemic in absence of definitive treatment. Vaccination drive against COVID-19 is going on across the globe that prioritized health care workers. Data regarding effectiveness of the vaccine to prevent COVID-19 infection in healthcare workers in Indian set up remains unavailable. Hence present study was sought to evaluate the impact of vaccine on prevention and treatment outcome in COVID-19 infection amongst resident doctors.<sup>3</sup>

**Methodology:** A cross -sectional, questionnaire-based study was conducted amongst resident doctors at tertiary care teaching hospital over a period of 2 months. Questionnaire comprising of 16 questions was sent through electronic media to study population. Data of demographic details, Vaccination and postvaccination COVID-19 infection of participants were analysed.

Severity of post –vaccination COVID-19 infection was analysed as per RTPCR (reverse transcription polymerase chain reaction) score and need of hospitalization while treatment outcome was analysed based on recovery period.

**Results:** Out of 459 vaccinated participants, 103(22.44%) participants had received single dose, while 356(77.56%) had received both doses of vaccine. Among vaccinated, 365(79.53%) participants were remained infection-free, including 56(54.37%) recipient of single dose and 309(86.79%) recipients of both doses. Out of 94 (20.47%, n=459) participants who got COVID-19 infection, out of which 57 participants (55.34%, n=103) had received only single dose while 37 participants (10.39%, n=356) had received both doses of vaccine. Out of 94 patients only 10(10.64%) patients had severe infection as per RTPCR score (<23) and also required hospitalization. Mean recovery period of

11.23+3.04 days was observed in postvaccination infected participants.

**Conclusion:** Vaccination is found effective to prevent COVID-19 infection in health care workers, reduces severity of infection during post-vaccination period and shortens the recovery period.

**Keywords:** Post-vaccination COVID-19, Resident doctors, High-risk group

### Introduction

COVID-19 (SARS-CoV-2) infection started from last month of 2019 and first notified from Wuhan China<sup>[1]</sup>, later it spread all over the world within few months and WHO declared it as pandemic in March 2020<sup>[2]</sup>.

Since its emergence no specific treatment is available for patients with COVID-19 infection. Numerous potential therapies, including supportive intervention, immunomodulatory agents, antiviral therapy, and convalescent plasma transfusion, have been used in clinical practice.<sup>[3]</sup>

As of now in absence of definitive treatment, vaccination is one of the important measures amongst different available options for prevention. Hence large-scale vaccination of risk groups and later the general population is the single most effective public health measure for mitigation of the coronavirus disease (COVID-19) pandemic<sup>[4]</sup>. While studies demonstrated that 2-dose schedules of both the Pfizer-BioNTech BNT162b2 and the Moderna mRNA-1273 vaccine had more than 90% effectiveness for preventing symptomatic COVID-19 infections-a breakthrough infections due to the Delta variant of SARS-CoV-2<sup>[5]</sup>.

Despite the global push for vaccination, vaccine hesitancy among healthcare workers (HCWs) is common with acceptance rates from 27.7% to 77.3%. Demographic variables such as men, older age and physicians were positive predictive factors, whereas

concerns for safety, efficacy and effectiveness and distrust of the government were barriers<sup>[6]</sup>

National COVID-19 vaccination programs started during December 2020 in several countries and prioritized HCWs<sup>[4]</sup>. In India, on 16<sup>th</sup> Jan 2021 first phase of vaccination was started for health care workers. HCWs remain on the front line of the battle against SARS-CoV-2 infection, and through interactions in the workplace related to care and proximity to patients, in addition to household and community interactions, they are among the groups at highest risk of infection during this raging pandemic<sup>[6]</sup>. Reports were also found that in spite of taking both doses of vaccine several healthcare workers acquired COVID-19 infection during the second wave, out of them some had moderate to severe disease requiring hospital /ICU admission. In trial conducted by AstraZeneca, vaccine was very effective in preventing symptomatic infection, hospital/ICU admissions and offered 100% protection from death. The real-world experience of the vaccine is quite different than the trial population<sup>[7]</sup>.

While the daily number of new COVID-19 cases remains high, and data regarding effectiveness of the vaccine to prevent COVID-19 infection in healthcare workers remain unavailable. Hence, the present study was aimed to evaluate the impact of vaccine on prevention of COVID-19 infection and its effect on severity of infection and treatment outcome in affected resident doctors.

### Materials & methods

This cross-sectional, questionnaire-based study was conducted among the postgraduate resident doctors of tertiary care teaching hospital situated in western region of India over a period of 2 months. Study was conducted after taking approval from Institutional ethics

committee. The questionnaire was constructed through google form and was circulated among resident doctors through electronic media. The questionnaire was formed after discussion with educators and validated. The google form contained 16 questions in three divided sections. Section 1 contained 5 questions (3 close ended, 2 open ended) regarding personal data like name, academic year, demographics, consent to participate in the study and vaccination status of participants, where it ended up for non-vaccinated participants after the question regarding vaccination status while for vaccinated participants it continues with further sections. Section 2 contained 3 questions which are dichotomous closed ended type and section 3 contained 8 questions, 7 closed ended and 1 open ended question. Section 2 and 3 contained questions regarding post vaccination COVID-19 infection. Questionnaire was ended up-Questionnaire was sent to all postgraduate resident doctors. Two weeks were provided to send their responses. One reminder was sent after fifteen days to those participants who have not submitted their responses. By the end of 2 months all the responses obtained were analysed.

**Statistical analysis**

The data analysis was conducted using Microsoft excel 2019. Descriptive statistics (mean± standard deviation) were used to describe continuous variables like age, recovery period for COVID illness. Frequency statistics (absolute number and percentage) were used to describe categorical variables like gender, vaccination status, RTPCR score, hospitalization status.

**Results**

Investigator sent questionnaire to a total of 830 post graduate resident doctors through electronic media. Out of these, total of 578(69.64%) participants responded to questionnaires and among them 563 participants were

included for analysis as they completed form, while 15 participants were excluded from analysis due to inadequate information. Out of a total 563 residents, 279(49.55%) participants were male while 284(50.44%) were female with mean age of 26.39±1.37 years.

Out of 563 participants, 459(82%) had received vaccine, while 104(18%) had not received any dose of vaccine. Out of 459 vaccinated participants, 103(22.44%) participants had received only single dose of vaccine (partially vaccinated) till the end of study period. while 356 (77.56%) had received two doses of vaccine (fully vaccinated) (Table 1).

Out of 459 vaccinated participants, 365(79.53%) participants were remained infection-free while 94(20.4%, n=459) participants got COVID-19 infection. Out of 365, 56 had received single dose while 309 participants had received both doses, out of 94 COVID-19 infected participants 57 had received only single dose while 37 participants had received both doses of vaccine (Table 1). As shown in table 1, out of 103 partially vaccinated participants, 57 (55.34%) participants got COVID-19 infection and 56 (54.37%) participants remained infection free during the postvaccination period, while out of 356 fully vaccinated participants, only 37 (10.39%) participants got COVID-19 infection while 309 participants (86.79%) remained infection free during post-vaccination period.

Vaccine (Dose)	Number of vaccinated participants (%)	Number of participants got post-vaccination infection (%)	Number of Participants remains infection-free (%)
Only single dose	103 (22.44%)	57 (55.34%,	56(54.37 %, n=103)

(partially vaccinated)		n=103)	
Both doses (fully vaccinated)	356 (77.56%)	37 (10.39%, n=356)	309(86.79 %, n=356)
Total	459	94 (20.47% n= 459)	365(79.53 %)

Table 1: Distribution of post-vaccination COVID-19 infection among participants

Among 57 infected participants who had taken single dose of vaccine, majority of participants (40; 70.2%) received COVID-19 infection within first two months of post-vaccination period while 12 participants (21%) got COVID-19 infection during the third month and 5 participants infected after 3 months of vaccination. Similarly, out of 37 infected participants who had taken both doses of vaccine, 24 participants (64.9%) acquired COVID-19 infection within first two months of post-vaccination period while 9 participants (24.3%) received COVID-19 infection during the third month and 4 participants got infection after 3 months of (Table 2).

Duration between vaccination and COVID-19 infection	Number of COVID-19 positive participants	
	After 1 <sup>st</sup> dose (Partially vaccinated) (n= 57)	After 2 <sup>nd</sup> dose (Fully vaccinated) (n= 37)
<1 month	21 (36.84%)	11(29.73%)
1-2 months	19 (33.33%)	13 (35.14%)
2-3 months	12 (21.05%)	9 (24.32%)
>3 months	5 (8.77%)	4 (10.8%)

Table 2: Time relationship between vaccination and post-vaccination COVID-19 infection

Severity of post-vaccination COVID-19 infection was analysed in terms of RTPCR score, need for hospitalization and requirement of oxygenation or intensive care therapy. As per the RTPCR score COVID-19 infection was considered as mild [32-35], moderate [24-31] and severe [ $\leq 23$ ]. As shown in figure 1, out of 94 infected participants, 49 (52.13%) participants had mild, 35 participants (37.2%) had moderate and only 10 participants (10.64%) had severe infection. severity of post vaccination infection was also analysed in relation to number of doses received by infected participants. It was found that majority of infected participants had mild to moderate infection like cases 87.7% participants who received only one dose which is further increased up to 89.3 % participants who received both doses of vaccine.

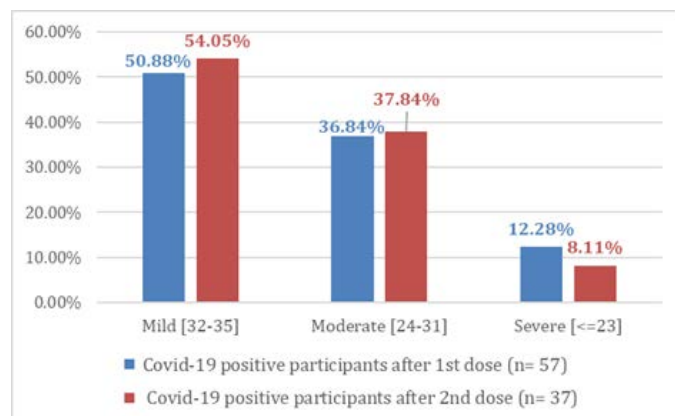


Figure 1: Severity of postvaccination infection as per RTPCR score of among the infected participants  
Severity of COVID-19 infection was further analysed in terms of requirement of hospitalization in infected participants. Out of 94 COVID-19 positive participants, 84(89.36%) participants were treated in home quarantine, while only 10(10.64%) participants required hospitalization, among the hospitalised patient no one require oxygen administration and admission in intensive care unit. Out of total 57 partially vaccinated infected participants only 7 (12.28%) required

hospitalization while out of total 37 fully vaccinated only 3 (8.11%) participants required hospitalization.

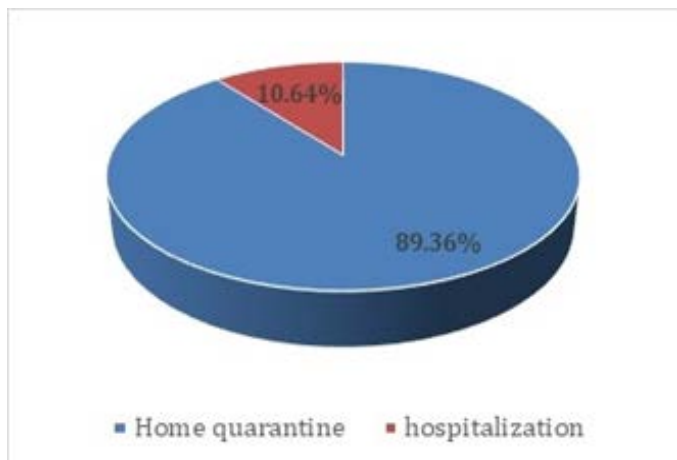


Figure 2: Hospitalization among infected participants

Recovery period for postvaccination infection was also analysed. All the infected participants were recovered between 5-15 days with mean recovery period of  $11.23 \pm 3.04$  days. Among 57 infected participants who had taken single dose of vaccine, majority of participants (33; 58%) were recovered between 7-10 days while 42% were recovered between 11-15 days. While out of 37 infected participants who had taken both doses of vaccine, majority of participants (27; 72%) were recovered between 7-10 days while 34% were recovered between 11-15 days.

Days for recovery	Number of infected participants		
	After 1 <sup>st</sup> dose (n=57) (Partially vaccinated)	After 2 <sup>nd</sup> dose (n=37) (Fully vaccinated)	Total (n=94)
7 days	5 (8.77%)	13(35.14%)	18(19.15%)
8-10 days	28(49.12%)	14(37.83%)	42(44.68%)
11-15days	24(42.11%)	10(27.03%)	34(36.17%)

Table 3: Duration of COVID-19 illness among infected participants

## Discussion

COVID pandemic has caused high morbidity, mortality and global economic recession. As of now, 12<sup>th</sup> feb 2022, total 42 million cases were reported in India with around 5 lakhs deaths due to COVID-19 infection [8]. These multiple waves of transmission represent as a major health challenge during COVID-19 pandemic. This SARS-CoV-2 virus found to be different from other viruses due to multiple mutations on the sites of non-structural proteins (NSP) 2 and 3, and also varying nature of virulence observed between different persons. [9]

Several studies emphasized that newer SARS-CoV2 variants have increased infectivity, modest decrease in neutralizing activity, and may impact vaccine effectiveness via escape from vaccine-induced immunity, specifically by mutations in the spike protein [10]. But in the absence of an effective antiviral therapy, vaccination remains the only strategy to mitigate the ongoing SARS-CoV-2 pandemic [11].

In our study, it was observed that majority of respondents (82%) were found vaccinated. Our study sample was postgraduate resident doctors who are well aware of vulnerability and risk exposure to COVID-19 infection. Among the vaccinated participants, majority of them (78%) received both doses, higher vaccination rate might be due to the fact that participants were health care personal knowing about safety and efficacy of vaccine at the same time they also knew that vaccination is the only preventive measure.

It was further observed that vaccine was found effective to keep participants infection free as 54% of partially vaccinated participants remained infection free which is increased up to 87% of fully vaccinated participant who remained infection free in our study. Findings in our



study was found higher than other Indian case control study conducted by thiruvengadem study in Faridabad in which reported effectiveness of vaccine found to be 46.2% in partially vaccinated and 63.1% in fully vaccinated participants <sup>[11]</sup>. Lower effectiveness of vaccine found in the later study might be due to inclusion of cases and controls of COVID-19 infection that compared the vaccinated and unvaccinated population, while our is cross-sectional study involving self-administered questionnaire.

It was also observed that among infected participants 70.2% partially vaccinated and 64.9% fully vaccinated received COVID-19 infection within 1-2 months of post-vaccination duration. The frequency of acquiring infection was less after 2 months of vaccination. Reason for risk of acquiring infection was less as postvaccination duration increases may be due to immunity development and increase antibody titre <sup>[12]</sup>.

It was observed that around 87% infected participants among partially vaccinated and 92% among fully vaccinated show mild to moderate COVID-19 infection as per RTPCR score. Thiruvengadem et al study shows, around 95% participants among unvaccinated, 1.2% among fully vaccinated, 4.6% among partially vaccinated had moderate to severe COVID-19 infection <sup>[11]</sup>. This significant difference may be due to thiruvengadem study was case control type and also involve the comparison of vaccinated with unvaccinated participants.

Vaccination reduces requirement of hospitalization as it is observed in our study that only 12% partially vaccinated and 8% of fully vaccinated participants required hospitalization, which is almost similar to previous study conducted by Griffin et al <sup>[13]</sup>.

Vaccination not only reduces hospitalization rate but

also decreases requirement of oxygen therapy and /or intensive therapy, this fact is supported by results of our study where not a single participant required oxygen therapy or intensive care which is similar to study done by Griffin et al showing only 1.5% patients required intensive care treatment while only 0.5% patients required oxygen therapy.

Recommended duration of isolation and precautions period as per CDC guidelines for people who are severely ill (i.e., requiring hospitalization, intensive care, or ventilation support) is at least 10 days and up to 20 days after symptom onset, and after fever ends (without the use of fever-reducing medication) and symptoms are improving <sup>[14]</sup>. In our study recovery period for postvaccination infection was found to be less than 15 days, while majority of participants (58% among partially vaccinated and 72% among fully vaccinated) were recovered within 7-10 days.

Health care workers as study population is the strength of our study considering the fact that HCWs are among the group at the highest risk of getting COVID-19 infection as they are the most exposed and vulnerable population. However cross-sectional self-administered questionnaire-based study and not involving unvaccinated HCWs for comparison are the limitations of present study.

### **Conclusion**

Our study concludes that Vaccination is found effective to prevent COVID-19 infection in health care workers. It also reduces severity of infection if it occurs during post-vaccination period and shortens the recovery period. We further recommend large scale study involving general population with aim to compare vaccinated and unvaccinated participants.

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