

Original Article

Vaccination and Pandemic Control in Bangladesh: Post Vaccination COVID-19 Positive Cases among Health Care Providers

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Abstract

Vaccination was started on a trial basis in Bangladesh from 27th January, 2021 and started mass vaccination from 7th February, 2021. Since starting of mass vaccination it was noticed that, the health care providers (HCPs) who received two doses of Astra-Zeneca were then reported of being infected. This cross-sectional study was conducted during the period of July to December 2021 and data were collected from July to August 2021. The main objective was to measure the proportion of post vaccinated Corona Virus Disease-19 (COVID-19) positive cases among healthcare providers working in different healthcare facilities in Bangladesh and aimed to collect available evidence to characterize these infections and correlations with different co-morbidities. This study was carried out among 450 vaccinated HCPs who received 2 doses of vaccine at various health care facilities (HCFs) from 32 districts of Bangladesh. Data were collected from HCPs (Doctors, Nurses, Lab technician) who willing to participate irrespective of age and sex. Among the HCPs nearly three-fourth (71.6%) was doctors, 21.3% nurses and 7.1% were lab technologists. Here, most of the (88.0%) respondents were in age group 21 to 40 years and other 22.0% was in age

group 41 to 59 years. The number of Male-female respondents was equal and 77.8% of the respondents was Muslim followed by Hinduism (20.2%), Buddhist and Christian 2.0%. Study finds that 27.6% of the respondents was post vaccination COVID-19 positive (PVC-19+) (according to their rt-PCR test result). Less than one-fifth (18.7%) of the respondents had pre-existing co-morbidities among them 8.2% was suffering from hypertension (HTN), 6.0% asthma, 4% Diabetes Mellitus (DM), 2.0% Obesity, 1.1% ischemic heart disease (IHD) and 1.1% was others co-morbidities. Among the PVC-19+ cases most of them (84.6%) were in age group 21-40 years, male-female ratio was 1:0.9 and 81.5% was Muslim. More than three-fourth (77.4%) of positive cases were doctors, 17.7% nurses and 4.8% was lab technicians; among the PVC-19+ cases 87.9% was symptomatic. Three-fourth (75%) of the positive cases had fever, 51.6% had lost of smell and taste, 49.2% showed fatiguel or malaise, 48.4% dry cough, 43.5% headache, 26.6% runny nose, 25.8% felt muscle pain, 19.4% sore throat, 18.5% shortness of breathing, 14.5% experienced joint pain, 9.7% had productive cough and 32.3% complained for other symptoms and signs. Majority of the PVC+19+ cases (57.26%) developed complications; among them 71.8% had tiredness/ fatigue, 31% difficulty in thinking/ concentrating, 21.1% headache, 19.7% cough, 15.5% dizziness, 14.1% loss of smell or taste, 12.7% joint or muscle pain, 12.7% fast-beating or pounding heart, 11.3% shortness of breathing, 8.5% chest pain and 29.9% developed other complications. Pre-existing co-morbidity was found in 66.94% of positive cases, among those 41.5% HTN, 36.6% asthma, 14.6% DM, 14.6% obesity, 4.9% IHD and 9.8% had others co-morbidity. Chi-square test for independence with $\alpha = 0.05$ was done to assess association, hypertension ($P = 0.009$) and asthma ($P = 0.001$) with PVC-19+ cases was statistically significant. Hypertensive and asthmatic HCPs are more likely to be COVID-19 positive even after complete vaccination. Healthcare providers are at high risk for contracting COVID-19 and might become infected at home or nosocomially while caring for patients or interacting with other staff members. COVID-19 vaccination together with incessant use of personal protective equipment (PPE) might be recommended for HCPs to combat its pandemicity.

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INTRODUCTION

COVID-19 pandemic was an alarming situation which affected the global community. In that crisis the frontline healthcare providers are playing the role of real-life heroes to combat this catastrophe. They are more prone to infection as they are in direct contact with COVID-19 patients during treatment procedures. The COVID-19 pandemic caused by Severe Acute Respiratory Syndrome-Corona Virus-2 (SARS-CoV-2) has challenged the health system of different countries all over the world.¹³ COVID-19 has been declared as pandemic by World Health Organization (WHO) on 11th March, 2020 and Bangladesh detected its first COVID-19 case on 8th March 2020.⁹ Vaccination was started on a trial basis in Bangladesh from 27th January, 2021 and started mass vaccination from 7th February, 2021 (Anon., December, 2021). As there are no clinically proven treatment options, the management of COVID-19 includes symptomatic management, infection prevention and control measures (e.g., social distancing and lockdown) which are effectively used to slow down the spread of the virus and flatten the epidemic curve.²⁸ Second or third wave of COVID-19 infections were often noticed following premature relaxation of such control measures in many countries (Shunqing Xu, 2020). Vaccination was considered to be one of the most efficient prophylactic interventions and its development, also deployment is therefore, promising strategies to reduce disease transmission.^{8,9} Healthcare providers (HCPs), being at the frontlines of the fight against the pandemic, had the highest risk of exposure to COVID-19 infection.²⁶ Thousands of healthcare workers have lost their lives being infected with COVID-19 during the pandemic.¹³ According to the Bangladesh Medical Association (Association, 2021), 129 medical doctors and 3 dental surgeons have died from COVID-19 in Bangladesh. The total infected cases and mortality among HCPs in Bangladesh were unfortunately higher than those of neighboring countries, including India, Pakistan and Nepal.²⁶ Government and non-government agencies and organizations have recommended that HCPs should be prioritized and offered a vaccine due to their higher risk of exposure and active participation in facing the COVID-19 pandemic.^{11, 18} Bangladesh Government had given priority to the healthcare providers for vaccination. They were at the frontline of the COVID-19 outbreak response and as such were exposed to hazards that put them at risk of infection even after full vaccination.¹³ Since 7th February when the mass vaccination for COVID-19 had been started in Bangladesh, it was noticed that, the health care providers who received two doses of Astra-Zeneca

were then reported of being infected after full vaccination.⁹ This study was conducted to measure the proportion of post vaccinated COVID-19 positive cases among HCPs working in different healthcare facilities in Bangladesh and aimed to collect available evidence to characterize these infections and correlations with different co-morbidities.

There were many relevant studies regarding post vaccination positive cases, though affirmations could not be made due to insufficient epidemiological data on healthcare professionals. It was also evident that those studies had lack of information about the relationship between socio-demographic characteristics with positive cases, co morbidities, severity in positive cases and so on. Some studies demonstrated the effectiveness of vaccines¹⁹ some studies provided data on postvaccinated skilled nurses.¹ Furthermore, similar studies had not been conducted in Bangladesh. This study provides information about socio-demographic characteristics; post vaccinated positive cases, clinical attributes, co-morbidities. This study reflects the disorder of health care workers after full dose of vaccination in Bangladesh and findings of this study would help the existing and future research work as well as would stand for a reference to compare the statuses of post vaccinated health care workers worldwide.

MATERIALS AND METHODS

This cross-sectional study was conducted during the period of July to December 2021 and data were collected from July to August 2021. The main objective was to measure the proportion of PVC-19+ cases among healthcare providers working in different healthcare facilities in Bangladesh. This study was carried out among 450 vaccinated HCPs who received 2 doses of vaccine at various HCFs from 32 districts of Bangladesh. Data were collected from HCPs (Doctors, Nurses, Lab technician) who willing to participate irrespective of age and sex, whereas HCPs of incomplete vaccination and severely ill HCPs were excluded from the study. Here 32 districts were randomly selected from 64 districts of Bangladesh then the name and telephone number of complete vaccinated HCPs were collected from Civil Surgeon Office and online interview and interview over telephone were done conveniently. Semi-structured pretested questionnaire and checklist were used for data collection. Collected data were checked and coded before analysis.

Data analysis: for descriptive statistics; frequency, percentage, mean, median, range and standard deviation (SD) was determined. Uni-variate, bi-variate analysis was done. For test of significance; chi-square test was done to assess the association and statistical significance. Data was analyzed by using statistical software (SPSS version 23) and calculations.

Operational definition:

- **Cases:** Cases refer to those healthcare providers, who were tested positive for COVID-19 by rt-PCR after complete vaccination.
- **Breakthrough infection:** A vaccine breakthrough infection is defined as the detection of SARS-CoV-2 RNA or antigen in a respiratory specimen collected from a person ≥14 days after they have completed all recommended doses of an authorized COVID-19 vaccine.
- **Duration of illness:** The duration in between onset of symptoms and symptoms remission.

RESULTS

This cross-sectional study was carried out among vaccinated HCPs (Doctors, Nurses, Lab-technician) at different HCFs [Sadar Hospitals and Upazila (Subdistrict) Health Complexes] from 32 Districts of Bangladesh. Among the HCPs from different HCFs, a total of 450 healthcare providers were included conveniently in this study.

Table I shows the distribution of the respondents according to their socio-demographic status; here 44.7% of the respondents were in age group 31-40 and others 43.3%, 9.1%, 2.7%, 0.2% were in age group 21-30, 41-50, 51-60 and 61-70 respectively. Male-female ratio of the respondents was equal that is 50% and 77.8% of the respondents was Muslim followed by Hinduism 20.2%, Buddhist 0.9% and Christian 1.1%.

Table- I: Distribution of the study population according to socio-demographic status (N=450)

Variables	Frequency	Percentage (%)
Age Group		
21-30	195	43.3
31-40	201	44.7
41-50	41	9.1
51-60	12	2.7
61-70	1	0.2
Sex		
Male	225	50
Female	225	50
Religion		
Islam	350	77.8
Hinduism	91	20.2
Buddhist	4	0.9
Christian	5	1.1

Table II shows the distribution of the respondents according to types of healthcare providers; where doctors were 71.6%, 21.3% nurses and 7.1% were lab technologists.

Table- II: Distribution of study population according to types of healthcare providers (N=450)

Types	Frequency	Percentage (%)
Doctor	322	71.6
Nurse	96	21.3
Lab technologist	32	7.1
Total	450	100

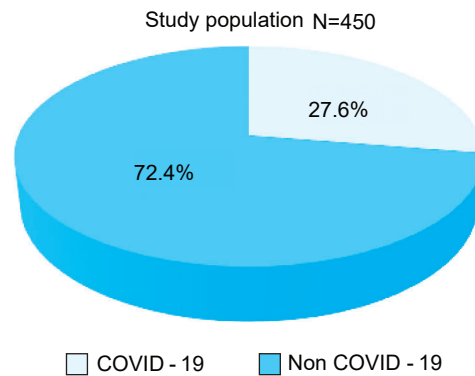


Figure- 1: Distribution of study population according to COVID-19 positive cases following vaccination

Figure 1 shows the distribution of respondents according to COVID-19 positive cases after vaccination; here 27.6% respondents were COVID-19 positives and others 72.4% were COVID-19 negatives (according to their rt-PCR test result)

Table III states the distribution of the respondents according to pre-existing co-morbidity; where 81.3% respondents not having co-morbidity, 18.7% having co-morbidity.

Table- III: Distribution of study population according to pre-existing co-morbidity (N=450)

Co-morbidity	Frequency	Percentage (%)
Yes	84	18.7
No	366	81.3
Total	450	100

Table IV shows the distribution of different co-morbidities among respondents; here 8.2% are suffering from HTN, 6% asthma, 4% DM, 9.2% obesity, 1.1% IHD and 1.1% are suffering from others co-morbidity.

Table- IV: Distribution of different co-morbidities among study population (Multiple response)

Co-morbidity	Frequency	Percentage (%)
HTN	37	8.2
Asthma	27	6
DM	18	4
Obesity	9	2
IHD	5	1.1
Others	5	1.1

Table V shows the distribution of the post vaccination positive cases according to their socio- demographic status. Among the COVID-19 positive cases 84.6% were found in age group of 21-40; others 12.1%, 3.2% were in age group 41-50 and 51-60 respectively. Mmale-female ratio was 1:0.9; 53.2% were Male and 46.8% female and most of the cases 81.5% were Muslim.

Table- V: Distribution of the PVC-19+ cases according to socio-demographic status (n=124)

Variables	Frequency	Percentage (%)
Age Group		
21-30	52	41.9
31-40	53	42.7
41-50	15	12.1
51-60	4	3.2
Sex		
Male	66	53.2
Female	58	46.8
Religion		
Islam	101	81.5
Hinduism	23	18.5

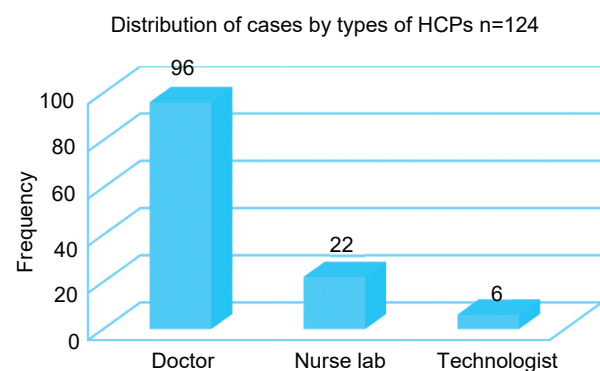


Figure- 2: Distribution of the PVC19+ cases according by types of healthcare providers

Figure 2 shows the distribution of the PVC-19+ cases according to types of healthcare providers; here 77.4% were doctors and others 17.7%, 4.8% were nurses and lab technologists

Table VI contains the distribution of the PVC-19+ cases according to their health condition after rt-PCR positive; where most of the cases had symptoms 87.9% and rest 12.1% were asymptomatic.

Table- VI: Distribution of the PVC-19+ cases according to their health condition after rt-PCR positive n=124

Health condition following vaccination	Frequency	Percentage (%)
Asymptomatic & tested rt-PCR positive	15	12.1
Symptomatic & tested rt-PCR positive	109	87.9
Total	124	100

Table VII shows the distribution of the PVC-19+ cases according to symptoms & signs of COVID-19; here 75% developed fever, 51.6% loss of sense of smell and taste, 49.2% fatigue/malaise, 48.4% dry cough, 43.5% headache, 26.6% runny nose, 25.8% muscle pain, 19.4% sore throat, 18.5% shortness of breathing, 14.5% joint pain, 9.7% productive cough and 32.3 were complaining about other symptoms and signs.

Table- VII: Distribution of the PVC-19+ cases according to symptoms & signs of COVID-19 n =124 (Multiple response)

Symptoms & signs	Frequency	Percentage (%)
Fever	93	75
Loss of sense of smell & taste	64	51.6
Fatigue/Malaise	61	49.2
Dry cough	60	48.4
Headache	54	43.5
Runny nose	33	26.6
Muscle pain	32	25.8
Sore throat	24	19.4
Shortness of breathing	23	18.5
Joint pain	18	14.5
Productive cough	12	9.7
Others	40	32.3

Distribution of cases by post COVID-19 complications (n=124)

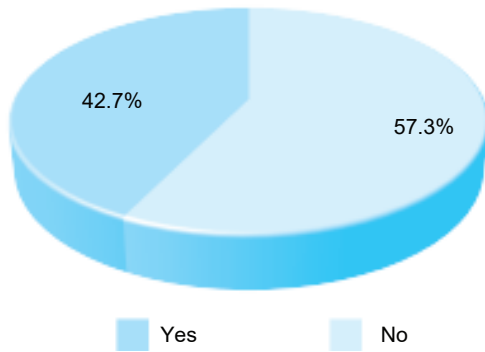


Figure- 3: Distribution of the PVC-19+ cases according to post COVID-19 complications

Figure 3 reflect the distribution of the PVC-19+ cases according to post COVID-19 complications; here 57.26% of cases developed post COVID-19 complications and rest 42.74% had no complications.

Table VIII presents the distribution of the PVC-19+ cases according to post COVID-19 complications; here 71.8% developed tiredness or fatigue, 31% difficulty in thinking or concentrating, 21.1% headache, 19.7% cough, 15.5% dizziness, 14.1% loss of sense of smell or taste, 12.7% joint or muscle pain, 12.7% fast-beating or pounding heart, 11.3% shortness of breathing, 8.5% chest pain and 29.9% had developed other complications.

Table- VIII: Distribution of the PVC-19+ cases according to post COVID-19 complications (n =71) (Multiple response)

Post COVID-19 complications	Frequency	Percentage (%)
Tiredness or Fatigue	51	71.8
Difficulty in thinking or concentrating	22	31
Headache	15	21.1
Cough	14	19.7
Dizziness	11	15.5
Loss of sense of smell or taste	10	14.1
Joint or muscle pain	9	12.7
Fast-beating or pounding heart	9	12.7
Shortness of breathing	8	11.3
Others	23	32.4

Distribution of cases according to pre-existing co-morbidities (n=124)

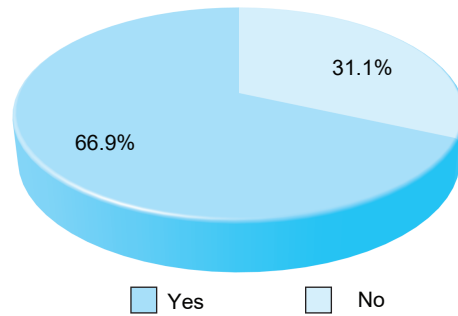


Figure- 4: Distribution of the PVC-19+ cases according to pre-existing co-morbidity

Figure 4 shows the distribution of the PVC-19+ cases according to pre-existing co-morbidity; here 66.94% of cases had no pre-existing co-morbidity and rest 33.06% had pre- existing of co-morbidity.

Table IX states the distribution of different co-morbidities among PVC-19+ cases; here 41.5% were suffering from HTN, 36.6% asthma, 6 (14.6%) DM, 14.6% obesity, 4.9% IHD and 9.8% were suffering from others co-morbidity.

Table- IX: Distribution of different co-morbidities among PVC-19+ cases (n =41) (Multiple response)

Co-morbidity	Frequency	Percentage (%)
HTN	17	41.5
Asthma	15	36.6
DM	6	14.6
Obesity	6	14.6
Others	6	14.6

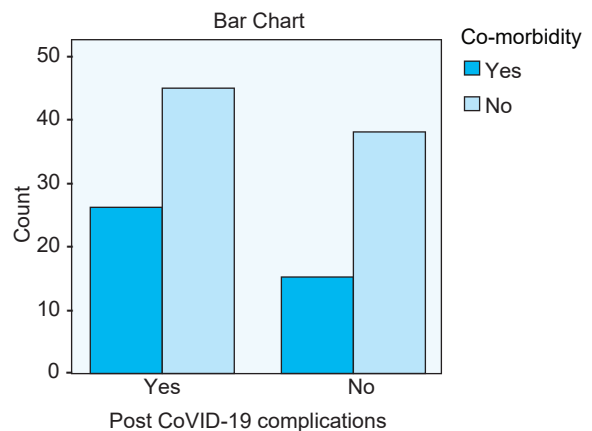


Figure- 5: Co-morbidity as related to post-covid complications (non-significant)

Association between post- COVID complications and co-morbidities:

Figure 5 shows chi-square test for independence with $\alpha = 0.05$ was used to assess whether co-morbidity was related to post-COVID-19 complications. The chi-square test result was statistically non-significant, $\chi^2 (1, N= 450) = 0.02, P = 0.89$, with Phi (ϕ) coefficient of 0.01. As seen in Figure 4, there is no association between post-covid complications and co-morbidities.

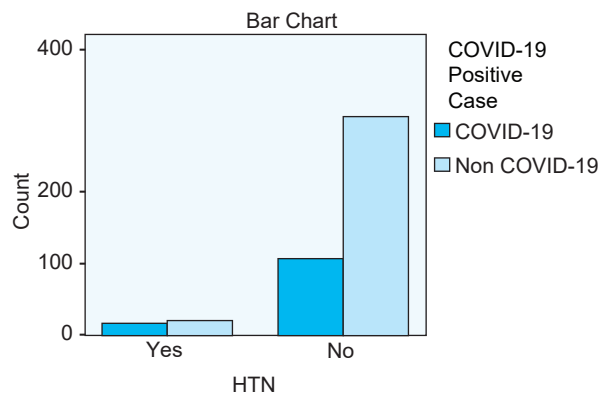


Figure- 6: Hypertension as related to post vaccinated COVID-19 positive cases

Association between cases and hypertension:

Figure 6 illustrates A chi-square test for independence with $\alpha = 0.05$ was used to assess whether Hypertension was related to post vaccinated covid-19 positive cases. The chi-square test result was statistically significant, $\chi^2 (1, N= 450) = 6.83, P = 0.009$, with Phi (ϕ) coefficient of 0.12, indicating a small relationship. As seen in Figure 6, Hypertensive healthcare providers are more likely to be covid-19 positive even after complete vaccination.

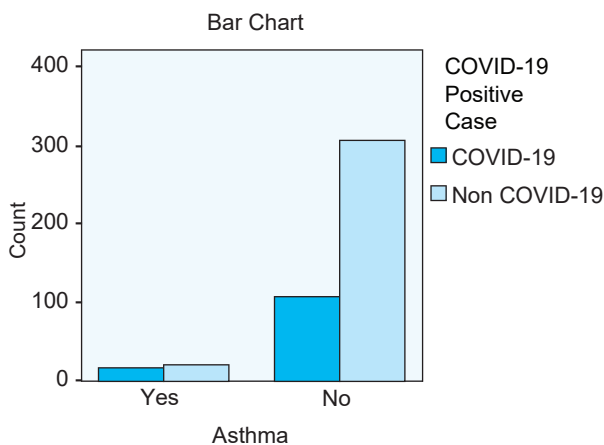


Figure- 7: Asthma as related to post vaccinated COVID-19 positive cases

Association between PVC-19+cases and asthma:

Figure 7 shows a chi-square test for independence with $\alpha = 0.05$ was used to assess whether asthma was related to post vaccinated covid-19 positive cases. The chi-square test result was statistically significant, $\chi^2 (1, N= 450) = 11.28, P = 0.001$, with Phi (ϕ) coefficient of 0.16, indicating a small relationship. As seen in Figure 7, Asthmatic healthcare providers are more likely to be covid-19 positive even after complete vaccination.

DISCUSSION

A total of 450 vaccinated HCPs based on complete vaccination of COVID-19 after 14 days were included in the study. Among them, 27.56% COVID-19 positive cases after vaccination were detected according to their rt-PCR test results and were mostly younger in age and the median age of the participants was 32 years (IQR: 28–36) and 84.7% were between 21–40 years age group. Our survey findings are consistent with another study conducted among HCPs in California, they found 20.6% COVID-19 positive cases and the median age was 38 years (IQR: 32–48) after complete vaccination.¹⁵ Males represented 53.2% of the cases, with a male to female sex-ratio of 1.14, 81.5% cases were Muslim and 77.4% HCPs were doctors and others 17.7%, 4.8% were nurses and lab technologists respectively. According to Bangladesh Bureau of Statistics (BBS) 2018; male-female ratio in our country was 1.002:1, majority of the population was Muslim (88.4%) and according to Health Bulletin 2019; the ratio of Doctor, Nurse and Lab technologist is 11:5:1 which is very similar to this study population (10:3:1).²⁵

Among the vaccinated HCPs who tested positive for COVID-19, 87.9% had symptoms and 12.1% were asymptomatic and had history of exposure to confirmed or suspected COVID-19 cases upon questioning. In the previously mentioned study conducted in California; 83.1% experienced COVID-19 symptoms and rest were asymptomatic which is similar to this study.¹⁵

The COVID-19 vaccines are extremely effective at preventing serious illness, hospitalization, and death. No vaccine is 100 percent effective, and as such we have found some fully vaccinated people tested positive for COVID-19. Breakthrough cases typically report mild illness or no symptoms.^{3,4} In this study, those who have recovered and suffering from COVID-19 (98.3%); tended to show a higher frequency of symptoms where 75% developed fever, 51.6% loss of sense of smell and taste, 49.2% fatigue/malaise, 48.4% dry cough, 43.5% headache, 26.6% runny nose, 25.8% muscle pain, 19.4%

sore throat, 18.5% shortness of breathing, 14.5% joint pain, 9.7% productive cough and 32.3% were complaining about other symptoms and signs and only 6.5% were hospitalized and rest, 93.5% took home isolation. Compared to this survey, a recent study at Washington State of COVID-19 breakthrough cases shows symptomatic COVID-19 and hospitalization rate were 78% and 10% respectively.²⁸ Most of the cases in our study presented with fever, anosmia, lethargy, dry cough, headache at initial presentation of the disease which is very similar to a systematic review and meta-analysis of 148 studies from 9 countries.¹⁷ The median (IQR) for the duration of illness was 10–16 days, which is consistent with a prospective cohort study conducted in a tertiary care center of Bangladesh.²²

More than half of positive cases had developed post COVID-19 complications; where 71.8% developed tiredness or fatigue, 31% difficulty in thinking or concentrating, 21.1% headache, 19.7% cough, 15.5% dizziness, 14.1% loss of sense of smell or taste, 12.7% joint or muscle pain, 12.7% fast-beating or pounding heart, 11.3% shortness of breathing, 8.5% chest pain and 29.9% had developed other complications. Various post-COVID-19 symptoms have been reported in different studies. Post-COVID-19 symptoms can develop even in mild cases.² Most studies have reported fatigue, cough, respiratory distress, and headache as (the) dominant features.⁷ In our study, tiredness or fatigue, difficulty in thinking or concentrating, headache, cough, dizziness was observed in 71.8%, 31%, 21.1%, 19.7%, 15.5% cases, respectively.

One-third of the cases had comorbidities existing prior to COVID-19 infection of which the most prevalent were HTN (41.5%) and asthma (36.6%). The relationship between co-morbidity with post COVID-19 complications were found non-significant. But the relationship between post-vaccinated positive cases with hypertension and asthma were found statistically significant.

Limitations:

Non-probable convenient sampling was done. Data collection was done over telephone and online interview due to current COVID-19 situation. Study was done on people who received Astra-Zeneca vaccine only.

Ethical consideration:

Ethical permission from IRB of NIPSOM was taken before data collection. Verbal consent was taken from each and every participant over telephone. Privacy and confidentiality were maintained strictly. Participants had all

rights to withdraw from the study anytime during tele-conversation. Information obtained were published for research and technical purpose without mentioning the name and address of the respondents.

CONCLUSIONS

Study finds that post vaccinated healthcare providers at high risk for contracting symptomatic and asymptomatic COVID-19 and might become infected at home or nosocomially while caring for patients or interacting with other staff members. More than one-third of the post vaccinated COVID-19 HCPs were being infected again among them more than three-fourth were doctors. Most of the post vaccinated HCPs had symptoms, where fever, loss of smell and taste, fatigue were predominant. Majority of the HCPs developed complication, among those tiredness/fatigue, difficulty in thinking/concentration, headache, cough, dizziness were common. One-third of the HCPs had comorbidities and significant association was found with asthma and HTN. Hypertensive and asthmatic HCPs are more likely to be COVID-19 positive even after complete vaccination. No death was traced among PVC-19+ HCPs.

Recommendations:

There should establish and follow an efficient triage system to assess patients with flu like symptoms at all healthcare facility levels in addition they need proper training based on appropriate IPC practices, lab safety protocols. Maintaining respiratory/ cough etiquette and hand hygiene practices should be continued even after vaccination. To administer booster dose is required for frontline healthcare providers to give more protection.

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