Introduction: Current study was carried out as per the government of India and Himachal Pradesh guidelines to carry out a serosurvey to assess the extent of COVID-19 infection among health care professionals (HCPs) after 6 months of managing COVID-19 cases.

Methods: A hospital-based survey was carried out among 1279 conveniently selected HCPs from September 2020 to January 2021.

Results: The participants had a mean age of 38.3 (±10.4) years, and almost half (47.4%) were ≤35 years of age. A total of 29 (2.3%) were already tested positive for COVID-19 (RT-PCR: 22; Rapid Antigen Test: 7) before the survey, and the overall prevalence of IgG antibody was 12.7% among the participants (Male: 12.8%; Females: 12.5%). The odds were observed significantly high among administrative staff (aOR: 5.09; 95%CI: 1.27–20.33) and participants tested positive of COVID-19 previously (aOR: 28.41; 95%CI: 11.71–69.00).

Conclusion: HCPs were tested about 6 months after the initiation of the COVID-19 pandemic in the state and demonstrated a high and expected level of seroprevalence.

Keywords: Seroprevalence, COVID-19, hospital
indicating progression of infection in the college community. The current effort was carried out as per the government of India and Himachal Pradesh guidelines to carry out a serosurvey to assess the extent of COVID-19 infection among HCPs after 6 months of managing COVID-19 cases.

Material and Methods

A hospital-based survey was carried out to assess the seroprevalence of COVID-19 infection in HCPs from September 2020 to January 2021. The professionals were faculty members, resident doctors, medical officers/interns, nurses, laboratory personnel, administrative staff, and hospital support staff like ward attendants, hospitality, etc. An official circular was communicated to their concerned department and with a data collection form. It consists of basic information on identification, history of contact with a confirmed case of COVID-19, diagnosis for COVID-19, and current respiratory illness. Voluntarily, the participants were asked to fill the form in advance to report to the laboratory on a scheduled date. After filling of form, 3 mL blood sample was collected with universal precautions at the concerned department by the resident/nurse. The sample was labeled with department name, name of participant, date, and identification number. The filled forms and labeled samples were transported to the hospital laboratory with a sample transportation sheet. The collected blood, serum samples were tested for the presence of IgG antibodies for COVID-19. It was done by an anti-SARS-CoV-2 human IgG ELISA kit (COVID Kavach M/s Trivitron Health Care, Chennai, India). It detects IgG antibodies in serum/plasma, which bind with the whole antigen of the SARS-CoV-2 virus. The manufacturer of the kit reported no cross-reaction with other viruses in serum from RT-PCR confirmed cases of influenza A (H1N1, H3N2), rhinovirus, hepatitis virus (B and C), respiratory syncytial virus, human coronavirus OC43. It also reported no cross-reactivity for a serum with IgG antibodies against dengue and chikungunya. It has a sensitivity of 98.0% and a specificity of 100.0%.

A total of 29 (2.3%) were already tested positive for COVID-19 (RT-PCR: 22; Rapid Antigen Test: 7) before the survey, and the overall prevalence of IgG antibody was 12.7% among the participants (Male: 12.8%; Females: 12.5%) [Table 2]. It was observed to be highest among administrative staff (36.4%) and similar in other categories like medical officers (14.1%), residents (13.4%), hospital support staff (13.1%), and faculty (11.2%). Only 6 (8.8%) participants from the laboratory were tested positive for the antibody. Prevalence was reported to be high among participants who tested positive (75.9%) as compared to negative (11.2%) for COVID-19. Only one (12.5%) participant was seropositive of those who reported current respiratory symptoms [Table 3].

After adjustment, insignificantly high odds among antibody-positive participants was observed for age group 36–50 years (aOR: 95%CI: 0.71–1.69), hospital support staff (aOR: 1.34; 95%CI: 0.67–2.68), medical officers/interns (aOR: 1.10; 95%CI: 0.42–2.84), nurses (aOR: 1.02; 95%CI: 0.46–2.28), and faculty (aOR: 1.10; 95%CI: 0.44–2.27). Odds were observed significantly high among administrative staff (aOR: 5.09; 95%CI: 1.27–20.33) and participants tested positive of COVID-19 previously (aOR: 28.41; 95%CI: 11.71–69.00), but the number of positives was differentially less causing wide CI Table 4.

### Table 1: Basic profile of participants (1279) for hospital-based rapid antibody test for COVID-19, 2020

| Characteristics          | Value |
|--------------------------|-------|
| Mean age in years, ±SD   | 38.3, 10.4 |
| Age groups (n, %)        |       |
| ≤35                      | 606, 47.4 |
| 36–50                    | 485, 37.9 |
| ≥51                      | 188, 14.7 |
| Gender                   |       |
| Male (n, %)              | 639, 50.0 |
| Female (n, %)            | 640, 50.0 |
| Position (n, %)          |       |
| Faculty                  | 107, 8.4 |
| Residents                | 253, 19.8 |
| Medical officers/interns | 99, 7.7  |
| Nurses                   | 321, 25.1 |
| Administrative           | 11, 0.9   |
| Hospital support         | 420, 32.8 |
| Laboratory               | 68, 5.3    |
| Downloaded AarogyaSetu app (n, %) | 1028, 80.4 |
| History of contact with the confirmed case (n, %) | 199, 15.6 |

### Table 2: Laboratory profile of participants (1279) for hospital-based rapid antibody test for COVID-19, 2020

| Characteristics          | Value |
|--------------------------|-------|
| Previous positive for COVID-19 (n, %) | 29, 2.3 |
| RT-PCR                   | 22, 7.59 |
| Rapid antigen            | 7, 24.1  |
| IgG antibody positive (n, %) | 162, 12.7 |
Table 3: Prevalence of rapid antibody test for COVID-19 among various groups of the participants (1279) in a hospital, 2020

| Characteristics                        | Value (n, %)    |
|----------------------------------------|-----------------|
| Gender                                  |                 |
| Male                                    | 82, 12.8        |
| Female                                  | 80, 12.5        |
| Position                                |                 |
| Faculty                                 | 12, 11.2        |
| Residents                               | 34, 13.4        |
| Medical officers/interns                | 14, 14.1        |
| Nurses                                  | 37, 11.5        |
| Administrative                          | 4, 36.4         |
| Laboratory                              | 55, 13.1        |
| Hospital support                        | 6, 8.8          |
| Previous RT-PCR/Rapid antigen test      |                 |
| Positive                                | 22, 75.9        |
| Negative                                | 140, 11.2       |
| Previous RT-PCR test                    |                 |
| Positive                                | 18, 81.8        |
| Negative                                | 140, 11.2       |
| Current respiratory symptom             | 1, 12.5         |

Table 4: Logistic regression of positive rapid antibody test for COVID-19 on age, gender, and position among the participants (1279) in a hospital, 2020

| Characteristics                        | OR, 95% CI   | aOR 95% CI |
|----------------------------------------|--------------|------------|
| Age in years                           | 0.99, 0.97-1.00 |            |
| Age group                              |              |            |
| ≤ 35                                   | Reference    | Reference  |
| 36-50                                  | 1.04, 0.73-1.49 | 1.10, 0.71-1.69 |
| ≥ 51                                   | 0.86, 0.51-1.44 | 0.89, 0.48-1.62 |
| Gender                                 |              |            |
| Male                                   | 1.03, 0.74-1.43 | 0.97, 0.64-1.49 |
| Female                                 | Reference    | Reference  |
| Position                               |              |            |
| Faculty                                | Reference    | Reference  |
| Residents                              | 1.22, 0.61-2.47 | 1.01, 0.44-2.27 |
| Medical officers/interns               | 1.30, 0.57-2.97 | 1.10, 0.42-2.84 |
| Nurses                                 | 1.03, 0.51-2.05 | 1.02, 0.46-2.28 |
| Administrative                         | 4.52, 1.15-17.75 | 5.09, 1.27-20.33 |
| Hospital support                       | 1.19, 0.61-2.31 | 1.34, 0.67-2.68 |
| Laboratory                             | 0.76, 0.27-2.14 | 0.67, 0.22-2.06 |
| Previous RT-PCR positive test          | 24.91, 10.45-59.38 | 28.41, 11.71-69.00 |

Discussion

The medical college is comprised of a hospital and college arm to deliver medical teaching and training services. The COVID-19 pandemic has resulted in the conversion of medical college to COVID-19 management center. HCPs like doctors, nurses, laboratory, support, and administrative staff worked proximally and distally to manage and create enabling environment for patient care. The survey among HCPs of medical college suggested seroprevalence of 12.7% similar among males and females. Although administrative staff appeared to have a high proportion, they were low in number respectively. Apart from it, the prevalence was observed to be high among medical officers/interns and residents, and hospital support staff, whereas faculty members and nurses had similar prevalence. Laboratory staff had the lowest prevalence possibly due to adherence to universal precautions while handling and managing specimens. As expected, antibody prevalence was high among participants who tested positive for COVID-19 previously. The presence of antibodies among administrative staff indicates infection transmission from hospital settings of the medical college. Their exposure is most likely due to a breach of public health measures while dealing with the hospital staff.

A seroprevalence was observed to be 9.5% among randomly selected 578 health care workers recruited over 13 days in Spain. It was considered to be the lowest prevalence during the peak of the COVID-19 pandemic. Over 3 months, samples from 3,248 front line health workers were conveniently collected from 13 academic medical centers of the United States, and 6.0% samples (ranged from 0.8-31.2%) were tested for COVID-19 antibodies. Serosurvey among 500 asymptomatic health workers of Malawi recruited over 2 months was observed with the adjusted prevalence of 12.3 and concluded to be high. Seroprevalence was reported to be high (27.0%) among 500 health care workers of New York City with community exposure of 34.0% at the epicenter of the pandemic. Evidence from a metropolitan city of India reported a prevalence of 11.9% among 1122 health care workers of large tertiary care hospital. Like the current study, a high prevalence was also observed among support staff and assistants. Concurrently, a high prevalence was reported among previously COVID-19 cases (100.0%) than asymptomatic health care workers (58.0%). Seroprevalence is observed to be low (1.6%) among professionals dealing directly with COVID-19 patients. The current study also observed low prevalence among laboratory staff who dealt specimens for COVID-19 testing. Evidence suggested that working in the COVID-19 management unit is not associated with high seropositivity due to higher risk perception for better adherence to universal precautions.

The odds of being seropositive were observed to be highest among participants who reported previous COVID-19 infection (aOR: 28.41) and being working in administration (aOR: 5.09) but with a wide confidence interval. Confirmed COVID-19 infection or symptoms expected to increase the likelihood of seropositivity. It is reported to be high in the case of anosmia and ageusia-quiet specific for COVID-19. Specific symptomology was not observed in the current study, but seropositivity was observed to be 12.5% among the participants with current respiratory symptoms. A limited number of participants in categories hindered a valid measurement of associations between professional categories and risk of infection.

Current findings can be subjected to certain limitations. First, risk of selection bias as professionals with high or low risk for infection might have participated less or more likely. Second, the
timing of the survey could have underestimated the antibody response due to early or late sampling since infection. Third, as adherence to universal precautions and public health measures have modified the exposure risk and so as antibody response, this information was not collected during the current study. Last, it is difficult to determine the place of infection exposure (hospital or community) as such information was not collected.

**Conclusion**

HCPs were tested about 6 months after initiation of the COVID-19 pandemic in the state and demonstrated a high and expected level of seroprevalence. It was similar across gender and high among the previously confirmed case of COVID-19. Exposure was demonstrated among treating doctors, nurses, and support staff. The presence of antibodies among administrative staff personnel confirms transmission of infection from hospital frontline workers to distant workers. It could have caused infection among family members of HCPs living inside the campus of medical college, but they were not assessed. As HCPs and other staff of the college is part of the community, so a combination of health care and community exposure could have contributed to the seroprevalence. The study has implications for all the health care professionals and more so for those delivering point of care health services like primary care physicians (PCP) who continue to be involved in patient care during this pandemic.

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**Conflicts of interest**

There are no conflicts of interest.

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