





ORIGINAL ARTICLE

COVID-19 prevalence among health-care workers of Gastroenterology department: An audit from a tertiary-care hospital in India

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Key words

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Abstract

Background and Aim: In the present coronavirus disease-19 (COVID-19) era, health-care workers (HCWs) warrant special attention because of their higher risk and potential to transmit the disease. Gastroenterology services include emergency and critical care along with the endoscopy procedures, which have aerosol-generating potential. This study was aimed at auditing the COVID-19 impact on HCWs working in the Gastroenterology department of our hospital.

Methods: The COVID-19 status of 117 HCWs was collected using either polymerase chain reaction (PCR) or Immunoglobulin G (IgG) seroassay. COVID-19 positivity was correlated with demographic characteristics, job profile, area of work, and medical history.

Results: Thirty-eight HCWs (32.48%) showed evidence of COVID-19 using PCR (23.93%) or only IgG assay (8.55%). Endoscopy technicians (68.75%) exhibited significantly higher ($P = 0.003$) COVID-19 incidence compared to doctors (20.69%). Those working in the critical care units exhibited a trend toward higher COVID-19 incidence (42.86%). None of the six HCWs who received adequate hydroxychloroquine prophylaxis developed evidence of COVID-19. All the HCWs with COVID-19 disease recovered. However, there was a considerable loss of “man-days.”

Conclusions: In our setting, we observed a high COVID-19 risk for HCWs working in the Gastroenterology department, with the highest risk among the endoscopy technicians. A more stringent triaging and pretesting of patients, as well as HCWs, might decrease the risk of COVID-19. Further multicenter studies are needed to evaluate the risk and related parameters.

Introduction

India has become the epicenter of the coronavirus disease-2019 (COVID-19) outbreak, making it the second most affected country in the world.¹ Health-care workers (HCWs) constitute a special subgroup of the population, which is at a substantial risk of infection and is an important disease transmission source. Previous studies have reported COVID-19 seroprevalence rates of up to 17.4% among the HCWs.^{2–14} Moreover, an increasing number of reports have demonstrated that HCWs are affected by COVID-19 with significant morbidity and mortality.

Gastroenterology staff members are involved not only in outpatient care but also in emergencies, critical care, and endoscopy practice. Endoscopy procedures are generally considered aerosol-generating, with a potentially higher risk to the staff directly involved in such procedures.¹⁵ In our previous study, we

showed that HCWs working in the Gastroenterology department exhibited the highest seroprevalence rate for COVID-19.¹⁶ There is, however, scarcity of data on the burden of COVID-19 among HCWs in the Gastroenterology and Endoscopy services.^{17,18} We, therefore, conducted a prospective study in the Gastroenterology department of a large tertiary-care hospital in India to study the burden of COVID-19 among HCWs and its correlation with the demographic characteristics of HCWs, their job profiles, and nature of work.

Methods

Study population. This cross-sectional study was performed in August 2020. The department of Gastroenterology at the Apollo Gleneagles Hospitals, Kolkata, India, has 117 HCWs.

These include consultants, residents, technicians, nurses, executives, housekeeping staff, and dietitians. The department has 75 dedicated beds, including 20 in intensive care, 12 outpatient rooms, and six endoscopy suites with round-the-clock emergency services. All the 117 HCWs were requested to participate in the study and provided informed consent. The institutional ethics committee approved the study.

COVID policy of department. The policy of the department in terms of triaging, testing, and use of personal protective equipment (PPE) has been evolving. In the initial 2 months, we were triaging patients, and only those with symptoms suggestive of COVID 19 or a history of contact or travel to high prevalent areas were tested for COVID-19 with an reverse transcription-polymerase chain reaction (RT-PCR). However, in last 2 months, we followed a more stringent policy, insisting on RT-PCR testing for all patients except those undergoing emergency endoscopy. Our policy for admission has been the same as for endoscopy. For the outpatient clinic, however, we interviewed patients throughout this period and referred all suspected patients to hospital triage area. Others were allowed with precautions such as use of masks along with maintenance of social distancing. HCWs in the endoscopy and intensive units wear N-95 masks, surgical gowns, cap, gloves, and shoe cover, while those in the outpatient area and non-COVID ward wear N95 mask and surgical gowns with frequent hand washing.

Almost all endoscopic procedures were performed under propofol sedation. A few (approximately 20%) diagnostic upper gastrointestinal endoscopies, however, were performed with pharyngeal lignocaine application as desired by the patients.

Study design. A questionnaire in the form of a Google form was sent to all the participants either by email or to their registered phone numbers. This form included 26 multiple-choice questions with the options of selecting either one or more responses (Supplementary material). The survey questions were divided into three sections: demographic details; job profile with work details; and relevant medical history, including diagnosis of COVID-19 and its severity based on the Indian council of medical research (ICMR) guidelines.¹⁹ The HCWs were then categorized into two groups:

Category A: Those recently diagnosed with COVID-19 using RT-PCR analysis of nasopharyngeal/oropharyngeal swab. The test was performed either because of suggestive symptoms or close contact with a COVID-19 patient.

Category B: Those with no symptoms or mild nonspecific symptoms and were never tested using RT-PCR or were tested negative.

RT-PCR and COVID antibody testing. A total of 109 HCWs underwent RT-PCR testing. The test was performed in 34 HCWs due to their symptoms, which were suggestive of COVID-19, and in 75 because of close contact with a diagnosed case of COVID. RT-PCR was scheduled in symptomatic HCWs after the onset of symptoms. In HCWs with only contact with positive cases, the test was performed 5–7 days after the last close contact. The test was carried out using nasopharyngeal and oropharyngeal swabs that were collected in viral transport media and sent to the lab under cold chain. Detection was based on

real-time PCR using the 5' nuclease technique targeting the SARS-CoV-2-specific 148 bp N gene and 136 bp Rd Rp gene using the ARGENE *SARS-COV-2R-Gene* amplification kit by bioMerieux, France.

All 117 HCWs were tested for IgG antibody against COVID-19 using the enhanced chemiluminescence method (Vitros ECI, Ortho Clinical Diagnostics, New Jersey, USA). This assay is based on a recombinant form of the SARS-CoV-2 spike subunit 1 protein. This assay's results are determined by the sample's signal-to-cut-off (S/Co) ratio, with values of <1.0 and ≥1.00 corresponding to negative and positive results, respectively. For category B, IgG antibody testing was performed at any time during the study period. For category A, the serological test was conducted at least 3 weeks after the onset of symptoms or diagnosis of COVID-19 disease by RT-PCR.

Statistical analysis. All statistical analyses were performed using SPSS 20.0. Categorical variables were expressed as the number of patients and the percentage of patients and analyzed using Pearson's Chi-Square Test for Independence of Attributes or Fisher's Exact Test, as appropriate. We also conducted univariate and multivariate logistic regression analyses to determine associated factors. In all cases, a *P*-value of less than 0.05 was considered statistically significant.

Results

A total of 117 HCWs working in the Gastroenterology department were included in the study, of which 62 (53%) were males. The age range of the participants was 20–61 years. Fifty-seven (48.71%) HCWs belonged to ≤30 years age group. The demographic details and seropositivity of the HCWs involved in the study are given in Table 1. Twenty-eight (23.93%) participants were tested and found to be COVID-19 positive using PCR. These included 19 who were symptomatic for COVID and 9 who had history of contact with COVID-positive individuals but were asymptomatic. All these 28 RT-PCR-positive HCWs also tested positive for IgG antibody after 3 weeks of onset of disease. In addition, 10 (8.55%) HCWs tested positive for the COVID-19 IgG antibody but were never suspected of or diagnosed with COVID-19 using RT-PCR. Thus, the overall COVID-19 burden in our department was 32.48%. Figure 1 depicts the distribution of HCWs based on COVID-19 positivity.

Our cohort included 29 doctors, 43 nurses, 16 endoscopy technicians, 13 executives, 10 housekeeping staff, and 6 dietitians. Figure 2 shows the total number of participants along with the COVID-19 positivity rates in each of these categories. The highest prevalence for COVID-19 (RT-PCR or IgG positive) was observed for the endoscopy technicians (68.75%, *P* = 0.003), followed by executives (38.46%), nurses (34.88%), doctors (20.69%), and housekeeping staff (10%). None of the six dietitians were either PCR-positive or IgG-positive.

Figure 3 shows the COVID-19 positivity rate based on the area of work. The HCWs working in the critical care unit exhibited the highest COVID-19 positivity rate of 42.86% (15/35), followed by those who worked in the gastroenterology ward (29.17%, 7/24), endoscopy unit (28.26%, 13/46), and outpatient care (25%, 3/12). The difference was, however, was not statistically significant. Of the 28 HCWs who tested positive

Table 1 Demography of study group and seropositivity rate

Sl no	Parameter	Group	Total number	Either PCR- or IgG-Positive HCW		P value
				Number	%	
1	Gender	Female	55	15	27.27	0.211
		Male	62	23	37.10	
2	Age	≤30 years	57	21	36.84	0.532
		31–40 years	35	10	28.57	
		41–50 years	19	5	26.32	
		>50 years	6	2	33.33	
3	Diet	Nonvegetarian	109	35	32.11	0.473
		Vegetarian	8	3	37.50	
4	Job profile	Dietician	6	0	0.00	<0.0001
		Executives	13	5	38.46	
		Housekeeping staff	10	1	10.00	
		Nurse	43	15	34.88	
		Technician	16	11	68.75	
		Doctor	29	6	20.69	
5	Working department	Endoscopy	46	13	28.26	0.086
		Gastro critical care	35	15	42.86	
		Gastro OPD	12	3	25.00	
		Gastro Wards	24	7	39.17	
6	Time spent in hospital in a week	Up to 48 h	69	19	27.54	0.146
		>48 h	48	19	39.58	
7	Blood group	A	20	6	30.00	0.705
		Others	97	32	32.99	
8	Mode of transport	By walk	3	1	33.33	0.204
		Personal vehicle	42	10	23.81	
		Public transport	72	27	37.50	
9	Number of persons in room	1–2	60	19	31.67	0.99
		3–5	48	16	33.33	
		More than 5	9	3	33.33	
10	BCG vaccination	No	29	10	34.48	0.714
		Yes	88	28	31.82	
11	MMR vaccination	No	65	18	27.69	0.179
		Yes	52	20	38.46	
12	Comorbidity	With comorbidities	16	6	37.50	0.473
		Without comorbidities	101	32	31.68	
13	Intake of immune boosters	No	82	29	35.37	0.249
		Yes	35	9	25.71	
14	HCQ prophylaxis	Adequate dose	6	0	0.00	—
		Inadequate dose or none	111	38	34.23	
15	Area of your residence	Metropolitan	50	11	22.00	0.022
		Outside	67	27	40.30	
16	Containment zone	Maybe	27	8	29.63	0.751
		No	59	19	32.20	
		Yes	31	11	35.48	

BCG, bacille Calmette-Guerin; HCQ, hydroxychloroquine; HCW, health-care worker; MMR, measles, mumps, rubella; OPD, out patient department; PCR, polymerase chain reaction.

through RT-PCR, 9 (32.14%) were asymptomatic, 15 (53.57%) had mild disease, 3 (10.71%) had moderate disease, and 1 (3.57%) had severe disease. All COVID-19 PCR-positive participants required quarantine either at their home or in the hospital's quarantine facility; however, only one required hospitalization and oxygenation. None of the HCWs required antiviral medications, high-flow nasal oxygen, or mechanical ventilation. None of the participants died due to COVID-19. The quarantine/leave period for HCWs varied from 7 to 40 days. This

amounted to a “man-day lost” of 524 days. We also interviewed all HCWs with positive PCR or IgG for their family history and noted that eight HCWs had family members also diagnosed with COVID. In only one case, a family member was affected before the HCW, and the remaining seven had family members diagnosed almost simultaneously or a few days later.

All of these 28 HCWs who were tested and found to be COVID-19-positive through PCR subsequently tested positive for IgG based on an S/Co ratio varying between 1.13 and 29.20,

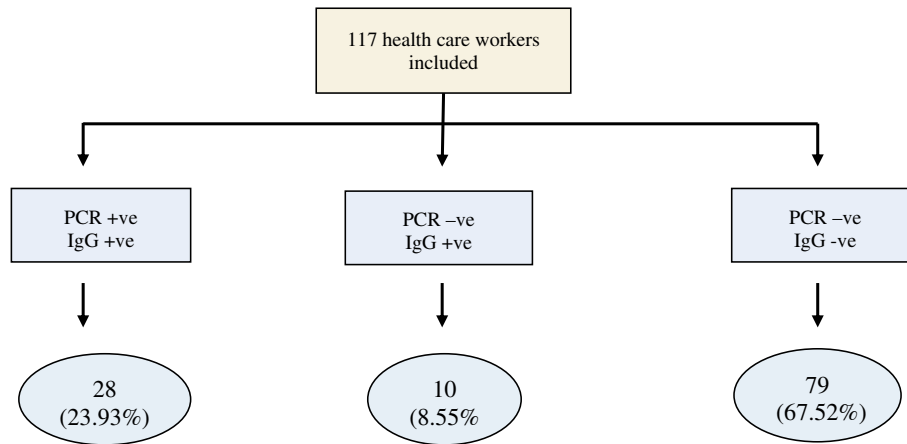


Figure 1 Polymerase chain reaction (PCR) and IgG positivity among health-care workers in the study.

with a median of 8.46 and mean (\pm SD) of 10.57 (\pm 7.02). Of the 10 HCWs who only tested positive for IgG, the S/Co ratio ranged between 2.48 and 9.1, with a median of 8.46 and mean (\pm SD) of 6.21 (\pm 2.41). Thus, there was a higher IgG S/Co ratio among PCR-positive HCWs compared to only IgG-positive HCWs. This difference, however, as shown in Figure 4, was not statistically significant ($P = 0.056$).

Univariate and multivariate analysis. Univariate analysis showed that the age group, working department, time spent in hospital, blood group, mode of transport, number of persons in a room, bacilli Calmette-Geurin (BCG) vaccination, measles, mumps and rubella (MMR) vaccination, comorbidity, intake of immune boosters, and residence in the containment zone for IgG- or PCR-positive group were not significantly different compared to that of the negative group. However, the job of

endoscopy technician and the area of residence outside the metropolitan area were associated with significantly higher COVID-19 positivity (Table 2). On multivariate analysis, none of these parameters reached statistical significance (Table 3).

Discussion

This study was conducted to assess the COVID-19 prevalence among the HCWs working in the Gastroenterology department. Our results showed an overall COVID-19 prevalence of 32.48% in our study sample. In an earlier study of ours, which was aimed to assess the seroprevalence of COVID-19 in various clinical departments, we found a high prevalence of COVID-19 among HCWs working in the Gastroenterology department.¹⁶ This could possibly be attributed to the regular performance of gastrointestinal endoscopies, which are considered to be aerosol-generating

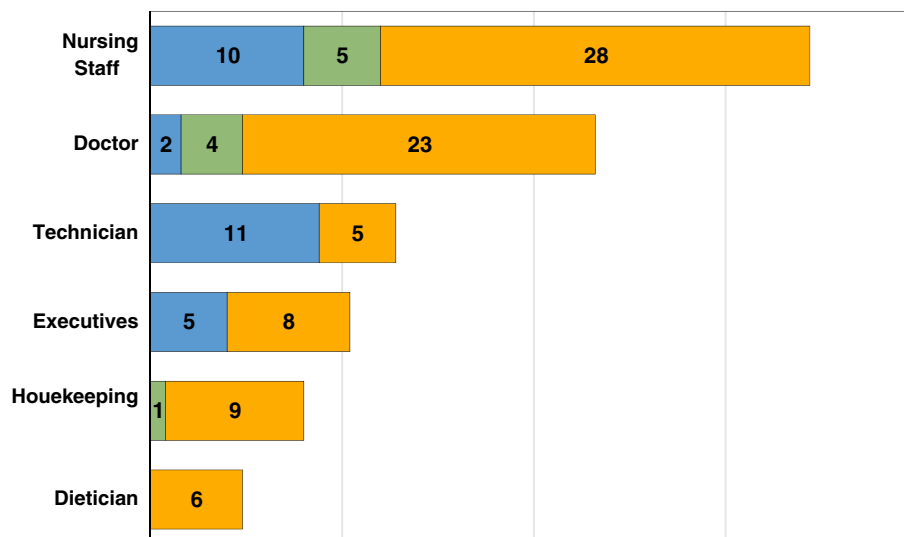


Figure 2 Bar diagram depicting the job profile and evidence of COVID-19 (polymerase chain reaction [PCR] or IgG positive). (■), PCR and IgG positive; (■), only IgG positive; (■), PCR and IgG non-reactive.

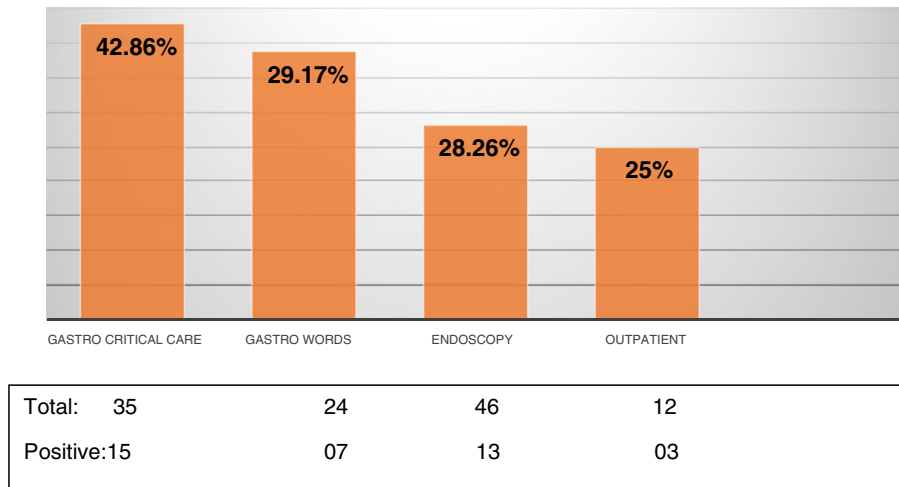


Figure 3 Bar diagram depicting the percentage of health-care workers with evidence of COVID-19 (polymerase chain reaction or IgG positive) in relation to working area. (■), Working department.

procedures.¹⁵ Gastroenterology and endoscopy practice in our country has gone through three phases in the current pandemic. In the first 2 months of nationwide lockdown, that is, mid-March to mid-May 2020, there was a significant decrease (by almost 10% compared to that in the pre-COVID-19 era) in the frequency of endoscopy all over the country, as shown by our nationwide survey.²⁰ During the gradual “unlocking” procedure, that is, later part of May to mid-July, most of the endoscopy services were triaging the patients on the basis of suspicion of COVID-19, with those having relevant symptoms or history of contact with individuals subjected to PCR testing. This could have resulted in asymptomatic individuals evading the diagnosis and being admitted or undergoing endoscopy and, subsequently, infecting HCWs.^{10,21} As mentioned above, in the last 2 months, with increasing availability of COVID-19 testing facilities, most of the centers, including ours, have now made COVID-19 testing

mandatory before any endoscopic procedure or admission in the gastroenterology wards. However, till date, emergency endoscopies have been performed without excluding COVID-19 cases, and the safety of HCW in the emergency units depends only on the use of personal protective equipment (PPE) and other safety measures.²² We ensured that PPE used by each HCW included an N-95 mask, full gown, shoe cover, cap, and gloves.

Several studies have reported 0–17.4% COVID-19 prevalence among HCWs.^{2–14} However, very few have evaluated the impact of COVID-19 on specific medical departments.^{17,18} Repici *et al.*, in a multicenter study from Italy, reported a very low risk of COVID-19 among HCWs in the gastrointestinal endoscopy units.^{17,18} They reported that 42 (4.3%) endoscopy unit HCWs developed COVID-19 during the study period. However, their study was retrospective in nature and was conducted in March 2020, when the COVID-19 pandemic was still in its initial stages. In contrast to our study, the Italian study reported that a higher proportion of physicians (7.1%) was affected by COVID-19 compared to endoscopy unit nurses (3.2%) or health-care assistants (2.0%).^{17,18}

In the present study, of 38 HCWs exhibiting evidence of COVID, the diagnosis of 28 HCWs was confirmed by PCR. The diagnosis of the remaining 10 HCWs was confirmed by only serological analysis, which indicated recent asymptomatic infection. These HCWs, before seroconversion, could be responsible for spreading the disease not only to the patients but also to their fellow departmental staff.²¹ This raises a question of periodic surveillance of HCWs in medical departments, such as gastroenterology, using RT-PCR to diagnose active asymptomatic infections.

An interesting observation in the present study was relatively high IgG levels in terms of the signal-to-cutoff ratio among PCR-positive HCWs compared to those with only serological positivity. This difference in the two groups was, however, not statistically significant, which might be attributed to a small sample size. Higher IgG levels among HCWs with PCR positivity might reflect a higher immunological response in patients with clinical manifestation of

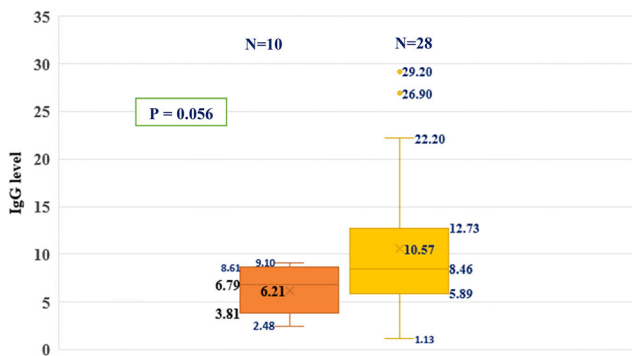


Figure 4 Box-whisker plot showing COVID IgG S/co ratio among health-care workers as per COVID reverse transcription-polymerase chain reaction (RT-PCR) status. The median (range) IgG signal to cut-off ratio in those who were negative for COVID RT-PCR was 6.79 (2.48–9.10), while it was 8.46 (5.89–12.73) for those positive for COVID RT-PCR. (■), RT-PCR non reactive; (■), RT-PCR reactive.

Table 2 Univariate analysis

Variable		Total	IGG or PCR positive	IGG or PCR positive %	OR	95% confidence interval		P value
						Lower bound	Upper bound	
Age group	≤30 years	57	21	36.84	1.17	0.19	6.92	0.865
	31–40 years	35	10	28.57	0.80	0.13	5.08	0.813
	41–50 years	19	5	26.32	0.71	0.01	5.18	0.739
	>50 years	6	2	33.33				
Job profile	Dietician	6	0	0.00	0	0	0	
	Executives	13	5	38.46	2.39	0.57	10.05	0.232
	Housekeeping	10	1	10.00	0.43	0.06	4.053	0.458
	Nurse	43	15	34.88	2.05	0.69	6.14	0.198
	Technician	16	11	68.75	8.43	2.10	33.77	0.003
Working department	Doctor	29	6	20.69				
	Endoscopy	46	13	28.26	0.95	0.32	2.84	0.937
	Critical care	35	15	42.86	1.82	0.60	5.50	0.288
	Gastro OPD	12	3	25.00	0.81	0.17	3.91	0.793
Working hours/week in hospital	Gastro wards	24	7	29.17				
	>48 h	48	19	39.58	1.72	0.79	3.77	0.173
	Up to 48 h	69	19	27.54				
Blood group	A	20	6	30.00	0.87	0.31	2.48	0.795
	Others	97	32	32.99				
Mode of transport	By walk	3	1	33.33	0.83	0.07	9.63	0.884
	Personal vehicle†	42	10	23.81	0.52	0.22	1.22	0.135
	Public transport‡	72	27	37.50				
No of members sharing a common room	1–2	60	19	31.67	0.93	0.21	4.11	0.92
	3–5	48	16	33.33	1	0.22	4.53	1
	More than 5	9	3	33.33				
BCG vaccination in childhood	No	29	10	34.48	1.13	0.46	2.74	0.791
	Yes	88	28	31.82				
MMR vaccination	No	65	18	27.69	0.61	0.28	1.34	0.218
	Yes	52	20	38.46				
Comorbidity	With comorbidities	16	6	37.50	1.29	0.43	3.87	0.645
	Without comorbidities	101	32	31.68				
Intake of immune boosters	No	82	29	35.37	1.58	0.65	3.82	0.309
	Yes	35	9	25.71				
HCQ prophylaxis	Adequate dose	6	0	0.00	0	0	0	
	Inadequate dose or take nothing	111	38	34.23				
Area of residence	Metropolitan	50	11	22.00	0.41	0.18	0.96	0.039
	Outside	67	27	40.30				
Containment zone	Maybe	27	8	29.63	0.77	0.25	2.31	0.636
	No	59	19	32.20	0.86	0.34	2.16	0.754
	Yes	31	11	35.48				

BCG, bacille Calmette-Guerin; HCQ, hydroxychloroquine; IgG, immunoglobulin G; MMR, measles, mumps and rubella; OPD, outpatient department; OR, odds ratio; PCR, polymerase chain reaction.

†Employees commuting in their own vehicle.

‡Employees commuting in public transport bus, local train or hospital van.

the disease. Fortunately, none of our HCWs exhibited any fatality. An additional observation was the considerable loss of human resources for the department in terms of loss of man-days.

In the present study, endoscopy technicians exhibited high odds ratios compared to doctors in both univariate (odds ratio [OR]: 8.43, $P = 0.003$) and multivariate analyses (OR: 2.27, $P = 0.609$). This finding, if validated in a larger study, could be attributed to their close association with endoscopic procedures, cleaning of endoscopes, and reprocessing of accessories. We also

noted a trend toward higher COVID-19 prevalence in HCWs in the critical care area. This finding could again be attributed to a greater interaction with the critical patients admitted and the performance of various life-saving and invasive procedures. However, we observed that HCWs working in our department were often noted to be having their meal and snacks together, obviously sitting closely and without any mask. It is not possible to attribute high COVID-19 risk solely to the professional environment. A transmission in the household cannot be ruled out,

Table 3 Multivariate analysis

Variable		Total	IgG or PCR Positive	IGG or PCR Positive %	OR	95% confidence interval		P value
						Lower bound	Upper bound	
Job profileh	Dietician	6	0	0	0	0	0	
	Executives	13	5	38.46	0.04	0.001	2.26	0.116
	Housekeeping staff	10	1	10	0.83	0.05	12.61	0.895
	Nurse	43	15	34.88	1.81	0.31	10.68	0.511
	Technician	16	11	68.75	2.3	0.09	52.55	0.609
	Doctor	29	6	20.69				
Working department	Endoscopy	46	13	28.26	0.34	0.04	2.64	0.3
	Gastro critical care	35	15	42.86	1.22	0.17	8.69	0.837
	Gastro OPD	12	3	25	1.30	0.09	19.25	0.847
	Gastro Wards	24	7	29.17				
Area of residence	Metropolitan	50	11	22	0.48	0.11	2.15	0.35
	Outside	67	27	40.30				

IgG, immunoglobulin G; OPD, out patient department; OR, odds ratio; PCR, polymerase chain reaction.

although only one HCW had a prior history of a family member having a confirmed diagnosis of COVID-19. The role of hydroxychloroquine (HCQ) prophylaxis for preventing COVID-19 is still debatable, with previous reports demonstrating both favorable and unfavorable outcomes.^{23,24} In the present study, none of the six HCWs who received adequate HCQ prophylaxis suffered from COVID-19. However, no conclusion could be drawn in this respect due to a small sample size. There is no guideline issued by our hospital regarding the use of any prophylactic pharmacological agent.

This study had a few limitations. First, the total number of HCWs was only 117. A broader range of data from larger gastroenterology units or a multicenter study is needed not only to comprehensively assess the overall COVID-19 prevalence but also to quantify the risk according to the job profile, area of work, and other parameters. Second, we did not perform IgM assay, which might have led to missing some of the recent COVID-19-positive cases. However, IgM assay has low sensitivity and specificity, as well as considerable heterogeneity.² The IgG assay used in this study targets the S1 spike protein, which is more specific to COVID-19 compared to the nucleocapsid protein-based IgG assay.^{25,26} Third, we did not compare the COVID-19 prevalence with other medical departments. In our earlier study, however, we did find higher COVID-19 prevalence in the gastroenterology department compared to other departments, such as oncology, pathology, critical care, and emergency.¹⁶

In conclusion, our study showed a high prevalence of COVID-19 in Gastroenterology HCWs with a higher incidence in endoscopy technicians. Such prevalence might reflect the disease burden in the general population, volume of endoscopy work, and—most significantly—hospital policy in terms of patient testing and use of PPE. A more stringent policy for triaging and testing, along with careful use of PPE and maintenance of social distancing, is recommended.

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