Original Research Article

Exploring the Factors associated changes in the personal habits of frontline healthcare workers during COVID-19 pandemic

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Abstract

Introduction: The World Health Organization (WHO) announced on 11 March 2020, that the SARS-CoV2 outbreak that started in December 2019 became a pandemic. Reported illnesses have ranged from very mild to severe (from progressive respiratory failure to death). Clinical symptoms caused by the virus include loss of taste and smell, fever, malaise, dry cough, shortness of breath, and respiratory distress. **Material & Methods:** This prospective cross-sectional observational seroprevalence study is conducted at Tertiary care teaching Hospital. Various groups of participants in the study - Seroprevalence of SARS -CoV-2 IgG in health care professionals at tertiary care teaching medical institutions in RR district, Telangana. A serum bank covering all regions was constituted by collecting residual sera from various diagnostic laboratories in region. Large laboratories were engaged, with high daily throughput covering primary care and all kinds of ambulatory specialist care outside hospital. **Result:** In our study, total of 53.04% were symptomatic and 46.95% were asymptomatic. Exposed staff were 30% and unexposed staff were 70%. In addition, Travel history were 19.13% and Family history 14.34%. BCG vaccinated were 85.21%. On the other hand, Symptomatic staff mean of over all Antibody titer 11.56+16.36, Antibody titer in vaccinated group 25.30+18.01 and Antibody titer in not vaccinated group 2.95+6.43.**Conclusion:** The job satisfaction of frontline medical staff by developing specific policies for medical staff in similar public health emergencies. The form of participation, prioritizing the self-fulfillment needs of medical staff with high education levels and strengthening the emergency response and practical operation training of junior staff.

Keywords: Coronavirus, IgG, SARS-CoV2, Seroprevalence.

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Introduction

The World Health Organization (WHO) announced on 11 March 2020, that the SARS-CoV2 outbreak that started in December 2019 became a pandemic. Reported illnesses have ranged from very mild to severe (from progressive respiratory failure to death). [1] Clinical symptoms caused by the virus include loss of taste and smell, fever, malaise, dry cough, shortness of breath, and respiratory distress. [2] In addition, increasing age, male sex, smoking, and comorbidities such as cardiovascular diseases and diabetes have been identified as risk factors for developing severe illness. By mid July 2020, over 12 million confirmed cases in 216 countries were reported to be infected by SARS-CoV-2 causing coronavirus disease 2019 (COVID-19). [3]

Currently, there is no vaccine or effective cure available to protect against or treat COVID-19. Therefore, unprecedented measures such as physical distancing, large-scale isolation and closure of borders, schools and workplaces were considered in many countries to mitigate the spread of the disease and to reduce the corresponding pressure on the respective healthcare systems. [4]

These needs were translated into the following research objectives: to constitute a national serum bank on a periodic basis (cross-sectional study design) in order to estimate the seroprevalence and seroincidence in India and to follow-up trends herein over time and to estimate the age-specific prevalence of SARS-CoV-2 antibodies in order to identify age groups that have been infected versus those that are still susceptible as a function of time. [5, 6] The current nationwide study presents background seropositivity (overall, by age category, sex) in the Indian population using serial serological survey data. [7]

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Material & Methods

This is a prospective, cross-sectional, observational and seroprevalence study is conducted. Various groups of participants in the study - Seroprevalence of SARS -CoV-2 IgG in health care professionals at tertiary care teaching medical institutions in RR district, Telangana. A serum bank covering all regions was constituted by collecting residual sera from various diagnostic laboratories in region. Large laboratories were engaged, with high daily throughput covering primary care and all kinds of ambulatory specialist care outside hospital. Each laboratory was allocated a fixed number of samples per age group.

A frontline medical staff was then enrolled in the study. The inclusion criteria were as follows: (1) Medical staff who directly participated in the fight against COVID-19 by "contacting confirmed/suspected COVID-19 cases or their specimens," and (2) Those who voluntarily participated in the study and provided their informed consent. The exclusion criteria were as follows: (1) Non-frontline medical staff, and (2) Those who could not complete the questionnaire.

Sample preparation & Analysis

After centrifugation of blood samples, selected residual sera (minimum 0·5 mL) were kept in the fridge (4-8°C) for a maximum of 14 days and finally stored at -20°C. Serology results were obtained through a semi-quantitative test kit, measuring IgG antibodies against S1 proteins of SARS-CoV-2 in serum (ELISA). The test was performed as previously described by Lassaunière *et al.* The Dutch

Taskforce Serology has compared all available data using the EuroImmun ELISA and determined a specificity of 99·2% and sensitivity ranging from 64·5% to 87·8% in pauci-symptomatic patients and patients with severe disease, respectively, using samples from patients >14 days after onset of disease symptoms. Presence of detectable IgG antibodies indicates prior exposure to SARS-CoV-2, an infection which may be resolved or is still resolving, and possibly protection against reinfection.

Data Management

Data collected for each sample include: unique sample code, sample date, age (in years), sex, and postal code of the place of residence. From the second collection period onwards, for each sample it was recorded whether or not a COVID-19 diagnostic (PCR) test was requested at the collecting laboratories. Samples were delivered anonymously to the investigators. Triage and check for duplicates were done in the collecting laboratories before anonymization.

Each collection period, data were checked for completeness (based on age, sex, and postal code).

Serological results (SARS-CoV-2 antibodies) were linked to the database based on the sample code. All files were kept on a secured server with restricted access.

Result

In our study, total of 53.04% were symptomatic and 46.95% were asymptomatic. Exposed staff were 30% and unexposed staff were 70%. In addition, Travel history were 19.13% and Family history 14.34%. BCG vaccinated were 85.21%.

Table 1: Figures & Percentages of various groups of participants in the study - Seroprevalence of SARS -CoV-2 IgG in health care professionals

S. No	Variables	Overall Seropositive [no. & %]	Overall Seronegative [no. & %]	Vaccinated Seropositive [no. & %]	Vaccinated Seronegative [no. & %]	Not vaccinated Seropositive [no. & %]	Not vaccinated Seronegative [no. & %]
1	Symptomatic staff [122] 53.04	65/122 53.27	57/122 46.72	43/47 91.48	4/47 8.51	22/75 29.33	53/75 70.66
2	Asymptomatic staff [108] 46.95	60/108 55.55	48/108 44.44	31/39 79.48	8/39 20.51	29/69 42.02	40/69 57.97
3	Exposed staff 69/230 30.00	35/69 50.72	34/69 49.27	26/31 83.70	5/31 16.12	9/38 23.68	29/38 76.31
4	Unexposed staff 161/230 70.00	88/161 54.65	73/161 45.34	48/54 88.88	6/54 11.11	40/107 37.38	67/107 62.61
5	Comorbid conditions 56/230 24.34	33/56 58.92	22/56 39.28	26/31 83.87	5/31 16.12	7/25 28.00	18/25 72.00
6	Vaccinated 86/230 37.39	-	-	74/86 86.04	12/86 13.95	-	-
7	Not vaccinated 144/230 62.60	-	-	50/144 34.72	94/144 65.27	-	-
8	Travel history 44/230 19.13	22/44 50.00	22/44 50.00	20/24 83.33	4/24 16.66	2/20 10.00	18/20 90.00
9	Family history 33/230 14.34	19/33 57.57	14/33 42.42	12/13 92.30	1/13 7.69	7/20 35.00	13/20 65.00
10	BCG vaccination 196/230 85.21	112/196 57.14	84/196 42.85	71/83 85.54	12/83 14.45	41/113 36.28	72/113 63.71
11	Doctors 123/230 53.47	64/123 52.03	59/123 47.96	49/60 81.66	11/60 18.33	15/63 23.80	48/63 76.19
12	Nursing staff 22/230 9.56	16/22 72.72	6/22 27.27	12/12 100.00	0/12 0.00	4/10 40.00	6/12 60.00
13	Administrative staff 30/230 13.04	13/30 43.33	17/30 56.66	7/8 87.50	1/8 12.50	6/22 27.27	16/22 72.72
14	Laboratory staff 37/230 16.08	21/37 56.75	16/37 43.24	2/3 66.66	1/3 33.33	19/34 55.88	15/34 44.11
15	House keeping staff 18/230 7.82	11/18 61.11	07/18 38.88	020/2 100.00	00/18 0.000	09/16 56.25	07/16 43.75
16	High risk group 115/230 50.00	69/115 60.00	46/115 40.00	46/50 92.00	4/50 8.00	23/65 35.38	42/65 64.61
17	Intermediate risk group 65/230	40/65 61.53	25/65 38.46	25/65 68.00	40/65 32.00	17/40 42.50	23/40 57.50

	28.26						
18	Low risk group 50/230 21.73	21/50 42.00	29/50 58.00	11/11 100.00	0/11 0.000	10/39 25.64	29/39 74.35
19	21-30yrs 61/230 26.56	31/61 50.81	30/61 49.18	11/11 100.00	0/11 0.00	20/50 40.00	30/50 60.00
20	31-40yrs 68/230 29.56	35/68 51.47	33/68 48.52	27/30 90.00	3/30 10.00	08/38 21.05	30/38 78.94
21	41-50yrs 38/230 16.52	22/38 57.89	16/38 42.10	07/08 87.50	01/08 12.50	15/30 50.00	15/30 50.00
22	51-60yrs 23/230 10.00	15/23 65.21	08/23 34.78	08/10 80.00	2/10 20.00	07/13 53.84	06/13 46.15
23	61-70yrs 32/230 13.9	20/32 62.50	12/32 37.50	19/22 86.36	3/22 13.63	1/10 10.00	9/10 90.00
24	71-80yrs 08/230 3.47	05/08 62.50	3/08 37.50	03/05 60.00	02/05 40.00	00/03 0.000	03/03 100.00
25	Red zone 49/230 21.30	27/49 55.10	22/49 44.89	17/19 89.47	02/19 10.52	10/30 33.33	20/30 66.66
26	Green zone 155/230 67.39	86/155 55.48	69/155 44.51	53/63 84.12	10/63 15.87	33/92 35.86	59/92 64.13
27	Orange zone 26/230 11.30	13/26 50.00	13/26 50.00	04/04 100.00	00/04 0.00	9/22 40.90	13/22 59.09
29	Male 121/230 52.60	63/121 52.06	58/121 47.93	34/42 80.95	08/42 19.04	29/79 36.70	50/79 63.29
30	Female 109/230 47.39	52/109 47.70	57/109 52.29	40/44 90.90	04/44 9.09	12/42 28.57	30/42 71.42

Table 2: Mean antibody titer of various groups in the study

S. No	Variables	Over all Antibody titer	Antibody titer in vaccinated group	Antibody titer in not vaccinated group
1	Symptomatic staff [122/230] 53.04	11.56 ± 16.36	25.30 ± 18.01	2.95 ± 6.43
2	Asymptomatic staff [108/230] 46.95	9.16 ± 14.27	20.19 ± 17.47	3.06 ± 6.42
3	Exposed staff 69/230 30.00	9.30 ± 14.26	18.97 ± 16.55	1.87 ± 4.93
4	Unexposed staff 161/230 70.00	10.97 ± 15.90	25.13 ± 18.28	3.42 ± 6.84
5	Comorbid conditions 56/230 24.34	14.01 ± 18.02	21.29 ± 18.93	4.98 ± 11.66
6	Vaccinated 86/230 37.39	22.87 ± 17.73	-	-
7	Not vaccinated 144/230 62.60	3.00 ± 6.38	-	-
8	Travel history 44/230 19.13	13.87 ± 17.70	24.49 ± 17.80	1.16 ± 3.49
9	Family history 33/230 14.34	11.28 ± 15.06	23.69 ± 16.18	3.21 ± 6.56
10	BCG vaccination 196/230 85.21	11.36 ± 15.88	22.44 ± 17.90	3.22 ± 6.85
	BCG No information 34/230 14.78	5.34 ± 11.24	37.86 ± 7.74	2.20 ± 4.39
11	Doctors 123/230 53.47	11.05 ± 15.34	20. 01 ± 16.96	2.19 ± 5.29
12	Nursing staff 22/230 9.56	16.53 ± 16.81	28.92 ± 13.30	1.67 ± 2.21
13	Administrative staff 30/230 13.04	8.38 ± 15.51	25.21 ± 20.96	2.26 ± 5.28
14	Laboratory staff 37/230 16.08	7.29 ± 12.60	29.57 ± 25.62	5.32 ± 9.18
15	House keeping staff 18/230 7.82	8.57 ± 16.92	52.94 ± 2.05	3.02 ± 5.37
16	High risk group 115/230 50.00	13.17 ± 16.28	25.77 ± 16.11	3.47 ± 7.34
17	Intermediate risk group 65/230 28.26	7.76 ± 13.20	14.62 ± 17.95	3.35 ± 6.13
18	Low risk group 50/230 21.73	7.90 ± 15.24	29.29 ± 20.15	1.87 ± 4.82
19	21-30yrs 61/230 26.56	7.51 ± 13.69	28.85 ± 19.34	2.82 ± 5.34
20	31-40yrs 68/230 29.56	11.01 ± 16.06	23.48 ± 17.12	1.16 ± 3.41

21	41-50yrs 38/230 16.52	8.94 ± 14.02	28.75 ± 19.27	3.66 ± 4.92
22	51-60yrs 23/230 10.00	13.47 ± 16.43	18.81 ± 18.39	9.37 ± 14.13
23	61-70yrs 32/230 13.9	15.37 ± 17.20	21.65 ± 17.16	1.55 ± 4.82
24	71-80yrs 08/230 3.47	7.52 ± 16.91	12.03 ± 19. 66	0.006 ± 0.011
25	Red zone 49/230 21.30	8.42 ± 13.27	17.79 ± 16.91	2.48 ± 4.47
26	Green zone 155/230 67.39	24.55 ± 18.13	11.84 ± 16.51	3.14 ± 6.98
27	Orange zone 26/230 11.30	6.90 ± 11.21	22.83 ± 17.00	4.01 ± 7.16
29	Male 121/230 52.60	9.28 ± 14.51	20.34 ± 17.84	3.42 ± 7.37
30	Female 109/230 47.39	11.77 ± 16.27	25.31 ± 17.27	2.48 ± 4.88

In table 2, Symptomatic staff mean of over all Antibody titer 11.56 ± 16.36, Antibody titer in vaccinated group 25.30 ± 18.01 and Antibody titer in not vaccinated group 2.95 ± 6.43.

Discussion

General immune response after any viral infection has already been documented. However, as Covid19 isa novel viral infection, the immune response during and after covid19 infection is still largely evolving. [8] The present study on the seropositivity among cases is among the few serological studies from India, exclusively covering the cases of covid-19 cases with a large sample. Seropositive covid19 cases are the laboratory confirmed cases, who demonstrate IgG antibodies after the infection. This is direct evidence of immune response as a result of their infection. While seropositive cases directly indicate proportion of cases who have acquired immune response, the seronegative cases indicate the proportion of cases who did not demonstrate IgG antibodies inspite of having a confirmed infection status in the past. [9] "What are the factors affecting this seropositivity?" is the real question which the experts are trying to answer with scientific evidences. The present study also tries to highlight the proportion of cases with IgG antibodies and its correlation with the duration, severity and time-gap since diagnosis, if any.

It is quite obvious that one would expect all the confirmed cases of Covid19 to IgG antibodies against the disease agent, SARS-CoV2. However, based on our findings with an average seropositivity of 54.51% [95%CI 52.14-56.86%] among cases, it can be said that majority of the cases demonstrate presence of IgG antibodies after the with SARS-CoV2. [10] However, it also implies that the remaining 45.49% have either not developed the antibodies, have antibodies but in undetectable proportion or the antibodies have disappeared, after their development, during the post-covid period. The reasons for seronegative cases require further in-depth scientific research to identify the factors affecting immunity and to uncover the reasons behind the same. [11]

Among the cases, females have higher positivity as compared to males but the difference was statistically not significant (Z=0.19, P=0.84). This finding signifies that the difference is by chance and the factors affecting immunity seems to be affecting both the biological groups equally. Similar is the finding by other studies, where the difference between the two sex groups is statistically not significant. [12]

Since size was calculated on the population (independent the cases recorded from each UPHC/Ward), the proportion of seropositive cases should not differ much. Although most zones have seropositive proportion between 51.88-58.55%, the for low seropositivity in West Zone (40.15%) and high seropositivity in Zone (71.67%) are not clear. [13] This may indicate that there may be multiple other factors affecting positivity in covid19 cases & require further analysis for other factors affecting seropositivity. Contrary to the general belief that any case of viral disease will have antibodies virus in the immediate post-infection period, as per our study the seropositivity among covid19 cases was not 100%. So, it was important to identify the reasons for the same and analyse data to identify the relationship of the factors affecting the seropositivity. There are already documented evidences that the severity of the clinical symptoms affects the immune response. Duration of hospital stay, need for Oxygen /Bipap / Ventilator as part of case management as well as place of case management (home / Covid Care Centre (CCC) / hospitalization) are all directly related to the severity of clinical symptoms. We tried to analyse available details of the covid19 cases on these parameters to check this association. [14]

Looking at the age-group wise seropositivity, children adolescent have the higher seropositivity. Most children and young are more to have mild clinical illness which may be due to their strong immune response which to development of IgG antibodies in the immediate post-covid period. [15] On the other hand, the seropositivity of about 40% in 20-29 years age group adults indicate that less than half from the young adult age group demonstrate IgG antibodies in the post-covid period. It also shows that the positivity has increasing trend as the age group increases from young adults to elderly. [16] There are also scientific evidences which show that elderly people are more likely have symptoms, have more severe symptoms and their period of clinical symptoms stays for longer duration as compared to the young adults. These differences in the clinical symptoms may be the reason behind the higher seropositivity among elderly as compared to the young adults. [17]

Available evidences suggest that the percent seroconversion in asymptomatic cases is low. On verifying this fact with our data, it was found that those requiring hospital admission demonstrated higher seropositivitythan those cases who were isolated at home. [18] The patient management principle required for these cases also showed that as the severity of case increase (from not requiring oxygen, requiring oxygen, Bipap to ventilator) the proportion of seropositive cases increases. Even the duration of hospitalization showed that as the duration of hospitalization increases the proportion of seropositive cases increase and all cases requiring hospital admission beyond 3 weeks were seropositive. [19]

It has been documented that onset of symptoms should be preferred rather than the date of diagnosis for consideration of this time-gap. However, due to higher reliability of data, we preferred comparing the date of diagnosis over the onset of symptoms. Comparing the proportion of seropositive cases with time since diagnosis (in months), we observed that the seropositivity stays between 50-55% during the first 4 months of time since diagnosis. The higher seropositivity for 5 & 6 months from diagnosis coincides with the first peak of cases in the city. The relationship of seropositivity with the time since diagnosis is not very clear and require detailed scientific inquiry to understand the dynamics of immune reaction in the post covid period. [20]

Conclusion

The job satisfaction of frontline medical staff by developing specific policies for medical staff in similar public health emergencies. The form of participation, prioritizing the self-fulfillment needs of medical staff with high education levels and strengthening the emergency response and practical operation training of junior staff. Meanwhile, efforts should be made to provide medical staff with psychological interventions ensure their normal sleep and rest times, meet their reasonable demands, and so on.

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