Recent Advances in Pathology & Laboratory Medicine
Volume 6, Issue 3&4 - 2020, Pg. No. 10-16
Peer Reviewed & Open Access Journal

Research Article

Seroprevalence of COVID-19 Antibody among Health Care Workers in the Remote Andaman & Nicobar Islands, India

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DOI: https://doi.org/10.24321/2454.8642.202005

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How to cite this article:
Burma A, Kumar D, Mandal AK. Seroprevalence of COVID-19 Antibody among Health Care Workers in the Remote Andaman & Nicobar Islands, India. Rec Adv Path Lab Med. 2020;6(3&4):10-16.

Date of Submission: 2020-09-12

Date of Acceptance: 2020-10-25

A B S T R A C T

Introduction: Health Care Workers (HCW) are the frontline workforce and highly exposed to COVID-19 infection. There is no baseline line data available about seroprevalence of SARS-CoV-2 antibodies among different categories of HCWs in the isolated Andaman & Nicobar Island. Hence,a serosurvey was carried out to find out the type and mode of COVID-19 spread through estimation of SARS-CoV2 antibodies among health care workers across South Andaman district. Materials and Methods: A cross sectional study was conducted among the health care workers. A total of 1659 HCWs were selected randomly across all the categories of HCWs working in the island. Their venous blood samples were tested for COVID-19 IgG antibodies by using Erba Lisa ELISA-based kit.

Results: The overall seroprevalence was found to be 40.2 %. The highest prevalence was seen among health associate professionals (45.6%) followed by health support and management personnel (37.6%) & Health Professionals (32.6%) respectively.

Conclusion: From the present studywe draw an inference that SARS -CoV-2 IgG antibodies were comparatively higher among health care workers in South Andaman than other parts of the country. A large section of health care workers across South Andaman district are yet to develop antibodies and at higher risk of contracting COVID-19 infection.

Keywords: COVID-19, Health Care Worker, IgG antibody, Immunity

Introduction

Coronavirus disease 2019 (COVID-19) has emerged as a pandemic, and the infection due to SARS-CoV-2 has now spread to more than 200 countries.[1] Health Care Workers(HCWs) are the frontline workforce and more exposed to COVID-19 infection than other people in the general population.[2] COVID-19 infection in Health Care Workers are associated with morbidity, mental stress, disruption of patient care, risk of transmission to family members and mortality.[3]

Reported cases, however, do not reflect the true prevalence of SARS-CoV-2 infections, as an unknown proportion of cases are mild or asymptomatic, or they are otherwise not diagnosed or ascertained through passive public health reporting. Furthermore, viral testing has limited access and availability in many cities.

In addition, estimation of COVID19 antibodies in HCWs has been recommended by the Indian Council of Medical Research and other health agencies to study the epidemiology of the disease, effectiveness of infection control measures and identify candidates for donation of convalescent plasma.[3] There are very few studies and sparse data available about seroprevalence of SARS-COV 2 antibodies among HCWs, particularly in a far flung and cut off Island like Andaman & Nicobar. Thus, this study was undertaken to estimate the seroprevalence of COVID-19 antibodies among different categories of Health Care Workers across South Andaman district.

Materials and Methods

There are total three districts in Andaman and Nicobar Island. The South Andaman district is most developed district with highest population density in the island. The South Andaman district has the only tertiary care hospital of the entire archipelago known as Andaman and Nicobar Islands. Hence, a cross sectional study was conducted among the Health Care Workers (HCWs) of South Andaman district. Moreover, the HCWs of South Andaman district frequently visit other districts of the island to provide the specialized medical care. The HCWs of the other districts come to South Andaman district for various type of medical training. Thus, the seroprevelance among HCWs of South Andaman district could give us fare idea of the antibodies level among the HCWs of the whole Island.

The health care workers were classified into five categories based on WHO criteria.[4]

1. Health Professionals (General medical practitioner, Nursing professionals, Midwifery professionals, Dentist, Pharmacist, Physiotherapist, Dietician, audiologist).
2. Health Associate Professionals (Medical imaging & therapeutic equipment, Lab technician, Dental technician, Dental assistant & therapist, Community health workers, Medical record & health information technician, Community technician, Environment occupational health inspectors & associates).
3. Personal care workers in Health Services.
4. Health Management and Support Personnel (Non-Health professional not else were Classified, Clerical support workers, Elementary occupation).
5. Health service providers not elsewhere classified (Intern, Defense/Armed Forces personnel engaged in health).

The sample size was calculated by Epi Info 2000 software. The mean prevalence of COVID -19 antibodies from various studies across India was 23.5%. For 95% confidence interval and 2.0% absolute precision, the sample size was calculated as 1697. However, non-response rate was 1.5% (27 participants). Thus, total sample size was 1670, which was representative of health care workers of entire archipelago of Andaman and Nicobar Island. These health care workers were selected by simple random sampling through computer-generated numbers.

Sample Collection

A pre-structured questionnaire consisting of demographic details, details about nature of work and risk assessment and other relevant medical history was used to collect the data and 3-5 ml blood was drawn from each participant for antibody testing.

COVID-19 Antibody Detection

Detection of SARS-CoV-2-specific IgG antibodies was performed using Erba Lisa ELISA-based kit. Antibody index was calculated by dividing each sample OD by cut off value. The interpretation of the antibody index depicts that:

- <0.9: No detectable IgG antibody to COVID-19
- <0.9-1.1: Borderline positive for COVID-19
- >1.1: Detectable IgG antibody to COVID-19

However, borderline positive results were combined with the positive case for statistical analysis because the antibody index of 0.9-1.1 was an indication that there was considerable amount of immune response in the participants against COVID-19 and thus showed past episode of COVID-19 infection.

Erba Lisa ELISA-based test kit is based on principle of indirect ELISA using recombinant Spike subunit antigen. It has sensitivity of 99.12% and specificity of 99.33%.

Statistical Analysis

Data was entered in MS- Excel and were analysed in SPSS version-20. Descriptive analysis (percentage, mean, standard deviation) was done for the socio demographic variables. Chi - square test was used to find the association between the categorical variables. P value of <0.05 was considered as statistically significant.

The study was approved by institutional ethical committee.

Results

A total of 1670 Health Care workers were sampled who constituted 61% of the total HCWs working in South Andaman(n=2717). Among these, 40.2% of HCWs were found positive and 59.8% were negative for COVID-19 antibody (Table 1).

A significant association was found between category of HCW and COVID-19 antibody level wherein, seropositivity

ISSN: 2454-8642
DOI: https://doi.org/10.24321/2454.8642.202005

was highest among the health associate professionals (45.6%) then health management and support personnel (37.6%) followed by health professionals (32.6%). (Table 2).

Table1.Prevalence of COVID-19 Antibodies among Health Care Workers

COVID-19 Antibody result	Frequency	Percent
Positive	672	40.2
Negative	998	59.8
Total	1670	100.0

A significant association exists between category of health care workers and their involvement in COVID-19 diagnosis/ treatment and aerosol procedure. Out of 1670 health care workers, 171 were involved in COVID-19 diagnosis/ treatment. Among the health care workers who were involved in COVID-19 diagnosis/treatment, 51.5% belonged to health professionals' category and 32.7% belonged to health associate professional category(Table 3). 99 health care workers were involved in aerosol generating procedure. Among the health care workers who were involved in aerosol generating procedure, 60.6 % were health professionals and 20.2 % were health associate professionals.

A significant association was seen between different category of HCWs and their socio demographic characteristics. There appears to be a significant difference in age, place of residence, gender and poverty line among different category of HCW(P value=0.0001)(Table 4). Among the age group of 18-40 years, health associate professionals were 43.6 % and health professionals were 27.7%. Similarly, health associate professionals were in higher proportion (57.4%) in 41-60 year age group whereas health professionals were in highest proportion (61.3%) in the age group above 60 years. Among the urban residents, majority were health associates professionals (45.4%). Similarly, in rural areas, 70.4% of residents were Health associate professionals. In the gender wise distribution, majority of females (59.8%) were health associate professional and 52.2% of males were Health support and management personnel. Among the participants above poverty line (APL),49.2% were Health Associates whereas among those below poverty line 72.9% belonged to health associate category.

Table 2.Association between Category of Health Care Workers and COVID-19 Antibody

Category	COVID 19 Antibody Result		Total	P value
	Positive	Negative		
Health professionals	32.6%	67.4%	439	
Health associate professionals	45.6%	54.4%	844	0.0
Health management and support personnel	37.6%	62.4%	378	
Health care workers not elsewhere classified	22.2%	77.8%	9	001

Table 3.Association between Category of HCWs and their Work Profile

	Health professional	Health associate professional	Health management and support personnel	Health workers not elsewhere classified	Total	P value
Involved in COVID diagnosis treatment	51.5%	32.7%	11.7%	4.1%	171	0.0001
Not involved in COVID diagnosis treatment	23.4%	52.6%	23.9%	0.1%	1499	
Involved in aerosol generating procedure	60.6%	20.2%	14.1%	5.1%	99	0.0001
Not involved in aerosol generating procedure	24.1%	52.5%	23.2%	0.3%	1571	

ISSN: 2454-8642
DOI: https://doi.org/10.24321/2454.8642.202005

Table 4.Association between Category of HCWs and their Sociodemographic Characteristics

		Health professional	Health associate professional	Health management and support personnel	Health workers not elsewhere classified	Total	P value
Age	18-40 y	27.7%	43.6%	27.5%	1.1%	793	0.0001
	41-60 y	23.6%	57.4%	18.9%	0.0%	846	
	>60 y	61.3%	38.7%	0.0%	0.0%	31	
Residence	Rural	16.7%	70.4%	12.9%	0.0%	341	0.0001
	Urban	28.7%	45.4%	25.1%	0.7%	1329	
Gender	Female	25.2%	59.8%	14.4%	0.6%	1306	0.0001
	Male	30.2%	17.3%	52.2%	0.3%	364	
Poverty line	APL*	27.4%	49.2%	22.8%	0.6%	1574	0.0001
	BPL**	7.3%	72.9%	19.8%	0.0%	96	

*APL-Above Poverty Line, **BPL-Below Poverty Line.

Table 5.Association Between Different Category of HCWs and Duty Hours

		Health professional	Health associate professional	Health management and support personnel	Health workers not elsewhere classified	Total	P value
Working hours per day	<6 hours	4.3%	94.9%	0.8%	0.0%	372	0.0001
	6-8 hours	31.0%	39.3%	29.4%	0.2%	1209	
	>8 hours	53.9%	18.0%	21.3%	6.7%	89	

A significant association between the category of HCW and their duration of duty hours was seen (Table 5). Higher exposure (more than 8 hours) was reported by majority of Health professionals (53.9%). On the other hand, less than 6 hours of exposure was reported mostly among Health associate professionals (94.9%).

Discussion

This study was confined to the South Andaman district because it is a well-defined and confined geographical area. The South Andaman district is most developed district with highest population density in the island.[7] South Andaman district has the only tertiary care hospital of the island and the HCWs from this district are often sent for providing specialised health service to other districts (North and Middle Andaman district, Nicobar district).Similarly, the HCWs of the other districts also travel to South Andaman district for various type of medical training and upgradation of skills. Thus, the seroprevelance among HCWs of South Andaman district could give us fare idea regarding the antibodies among the HCWs of the entire archipelago.

Five broad groupings/categories of HCWs were sero surveyed. These groups/categories were as defined by WHO.[4]The stakeholder population were the health care workers who had long working hours and exposure during COVID-19 patient diagnosis, treatment, care and support, whichmade them more vulnerable to COVID-19 infection.

The overall sero prevalence of COVID-19 antibodies among Health Care Workers was found to be 40.2%, which is a cumulative percentage of HCWs who tested positive along with those who tested borderline positive for COVID-19 antibody. In rest of India the sero prevalence from a tertiary care hospital at Kolkata was 11.94%[2] and at Southern Rajasthan 16%.[5]These were only hospital based studies, whereas our study reflects the majority of HCWs population of the most populated district of Andaman & Nicobar.A National survey conducted by Indian Council of Medical Research (ICMR) found the sero prevalence to be 25.7%[6] out of a survey population of 7385 and did not cover Andaman & Nicobar group of Islands. The reason for the difference in the result could be due to the fact that these surveys were performed at the initial stage of COVID-19 surge wherein the number of individuals among HCWs who got infected and recovered were fewer in count as compared to the time when we performed the survey 4 months after 1st wave during which the count of HCWs exposed and subsequent antibody formation had risen significantly. The higher percentage of seroprevalence in our study may also

ISSN: 2454-8642
DOI: https://doi.org/10.24321/2454.8642.202005

be due to the social, cultural and educational differences, which might have been the cause of low rate of awareness and following of Covid appropriate behaviour.

Another significant reason for HCWs antibody level being high in South Andaman is because the sole medical college(ANIIMS) is the only tertiary care hospital in this entire archipelago catering to 3.80 lakh inhabitants.[7] Other tertiary care centre are located in the mainland and are approachable via air/sea route only. Hence, the general population is completely dependent on this centre leading to high rate of exposure to HCWs causing high percentage of seropositivity.

Similar studies performed across other countries among HCWs show variable results such as 0 % in Malaysia[8],4 % in Denmark[9], 1-14% in US[10, 11], 6.5% in Belgium[12],11.2% in Spain[13] and 10% in United Kingdom[14, 15] and 9.4 % in Southern Switzerland.[16] The lower prevalence may be attributed to adoption of robust containment measures, contact tracing, rapid detection of cases through improved access to testing, isolation of positive case, picking up clusters and "break the chain measures". Moreover, the density of population is much lower in these countries as compared to South Andaman district leading to lesser spread of infection and a lower sero prevalence. Maintenance of covid appropriate behaviour due to better education and awareness about the virus may also have played a contributory role in low seropositivity.

Our study also revealed that higher number of HCWs were of the age group 41-60 years. The finding is consistent with a study performed in Bhubaneswar(an eastern city of India)[17] across different Hospitals among HCWs. Amongst the workers in this age group, majority were Health Associate Professionals which included technicians, therapist and community health workers whose superannuation age as per the administration recruitment rules was 60 years. Hence, most of the working population of health associate professionals were in the age group of 41-60 years. In the age group above 60 years, majority were health professionals.

Higher number of females were working in the health facilities across the South Andaman district and this finding was statistically significant. Especially, the community health workers like Anganwadi Workers(AWWs), Accredited Social Health Activists (ASHAs) and Auxiliary Nursing Midwives (ANMs) were all females. The study consisted of 645 AWWs, 68 ASHAs and 76 ANMs.

The present study revealed a significant association between the category of HCW and their place of residence. Majority of the health workers (1329) resided in urban area which can be attributed to the fact that the majority of health infrastructure and tertiary care setup is confined to urban part of the district due to which majority of the health workers shift their residence to stay near their place of work.

The seropositivity was found to be significantly higher among health associate professionals(community health workers, laboratory technicians, dental technicians, radiographers etc.). This category of HCWs such as lab technicians were involved in sample collection procedures, dental technicians and assistants were also exposed to aerosol generating procedures such as dental x-ray, tooth scaling, polishing and extraction etc. and AWWs, ASHA were involved in door to door surveillance activities. There might also be a breech in infection control practices and non-adherence to covid protocols among these HCWs. In comparison, the seropositivity among health professionals was less, showing that a better knowledge, awareness and understanding of covid appropriate behaviour and protocol could prevent the infection.The antibody positivity among health management and support personnel(clerk, accountant, office supervisor, cook etc.) was also less in comparison to health associates, as they were not much exposed to COVID-19 patients due to their nature of work, whichdid not involve close contact with patients, as they were mostly concerned with administration.

Significant difference was observed in the seropositivity based on working hour among different categories of HCWs. The health professionals like physicians, nursing staff, ANMs and pharmacists had on an average eight hours of duty. Among them the doctors and nurses were also posted on emergency duties. On an average six hours of exposure was seen among community health workers (AWWs, ASHAs), technicians, health inspectors and associates, which can be ascribed to their placement of work in non-emergency area. Hence, the hours of exposure varied among different categories as per their place and area of work.

Strength

The present study was performed in a well-defined cohort(Health Care Workers). Thus, it reflects the seroprevalence in the population of HCWs of the Andaman and Nicobar Island and its variation not only in its different categories but also in different socio demographics revealing the method of COVID-19 virus spread .Thus, it may help in framing a policy and finding a method to protect the vulnerable category.

Limitation

The current study is only a cross-sectional study, it tells us only about the point prevalence of COVID-19 antibodies among HCWs in South Andaman district, and it does not reveal the longitudinal trend of COVID-19 antibody. It also does not reflect the post vaccination status.

ISSN: 2454-8642
DOI: https://doi.org/10.24321/2454.8642.202005

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

- Declaration of Competing Interest
- The authors declare no conflict of interest

Acknowledgement

We would like to acknowledge Andaman and Nicobar administration for their necessary support and help. We would also like to acknowledge Mr. Vidhu Joshy for providing assistance in statistical analysis.

Conflict of Interest: None

Source of Funding: None

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ISSN: 2454-8642
DOI: https://doi.org/10.24321/2454.8642.202005