

## Seroprevalence of Apparently Healthy and Unvaccinated Healthcare Workers at the Ward of COVID Patients in a Referral Hospital, Dhaka, Bangladesh

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### Abstract

**Introduction:** In Bangladesh, when a SARS-CoV-2 infected person comes to close contact with another person, especially unvaccinated healthcare workers (HCWs) during staying at the hospital, the disease spreads among the other patients also. This study was carried out in the initial stage of the Corona virus disease 2019 (COVID-19) pandemic before the vaccination program had started. It was observed that among the HCWs some were infected by the virus while they take care of the infected patients and some suffered from subclinical infection without significant symptoms whereas some were not infected at all.

**Objective:** To observe the seroprevalence of SARS-CoV-2 antibodies in a specific group of people (HCWs) who were healthy and unvaccinated but exposed to the patients at the COVID ward in a referral hospital.

**Methods:** This study was carried out in Immunology and Virology Department, Armed Forces Institute of Pathology (AFIP), Dhaka Bangladesh from the date of 21st April, 2020 to 31st May, 2020. As this study was carried out in very early stage of the COVID-19 pandemic, samples were collected within a short period that is for forty days only. In this study, 294 samples were collected from apparently healthy and unvaccinated HCWs who work at the COVID wards in a referral hospital. To detect SARS-CoV-2 antibodies, Immunochromatographic (ICT) method was applied which is a well-accepted method worldwide.

**Results:** This study revealed that among 294 samples from healthcare workers, 36% (106) cases developed antibodies but 64% (188) cases didn't develop any type of antibody and 19.3(57) cases were PCR positive which might be possible due to their duties in COVID ward. Among 106 seroconvert cases, 16.98% (18) were positive for only IgM, 50.9% (54) were positive for only IgG and 34(32.07%) were positive for both IgG and IgM. Among 57 infected cases, 21.05% (12) were positive for only IgM, 45.61% (26) were positive for only

IgG and 33.33% (34) were for both IgG and IgM antibodies. The ratio between male and female in health-workers were 2.58:1 respectively.

**Conclusion:** This study revealed that the serological test of SARS-CoV-2 is useful for the identification of symptomatic, asymptomatic or subclinical infection among the persons who are the close contacts of COVID-19 patients; moreover, it will help to understand the disease outbreak, the contagiousness of SARS-CoV-2 and the immunity to SARS-CoV-2 in both the vulnerable and general populations.

**Key words:** SARS-CoV-2, COVID-19, Antibody, Serology.

### Introduction

Corona virus disease 2019 (COVID-19) caused by the SARS-CoV-2, a newly emergent coronavirus, that was first identified in Wuhan, Hubei, China in December 2019<sup>1</sup>. The clinical presentation is generally respiratory tract infection with a symptom ranging from a mild common flu-like illness to severe pneumonia leading to acute respiratory distress<sup>2</sup>. There are two types of COVID-19 tests that can identify the infected person. First, the gold standard test for current infection with SARS-CoV-2 uses real-time RT-PCR which detects the presence of viral RNA fragments in respiratory secretions which are collected from the nasopharynx, nose, or throat, even when they have no symptoms. Second, antibody tests, or serological tests are performed on a serum sample of a patient and detect antibodies produced by the virus<sup>3</sup>. Antibody detection is an effective adjunct to RNA analysis and an important tool for the occurrence, progression, prognosis, and outcome of COVID-19 and had an epidemiological importance<sup>3</sup>. In Bangladesh, healthcare workers (HCWs) are exposed to different occupational hazards while working in the hospitals because they closely and directly handle the patients. When HCWs especially unvaccinated, come to close contact with SARS-CoV-2 infected patients within hospitals, are at increased risk of being exposed to viruses and can also be the sources

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of transmission. Detection of circulating Immunoglobulin M(IgM) and Immunoglobulin G(IgG) in blood which is antigen-specific, serves as a conventional method to detect whether a person has been infected with that pathogen, either recently by IgM or more distantly by IgG<sup>3,4</sup>. For surveillance and screening, antibody testing would be very helpful and it could identify how many people have been exposed to this virus, even if they never had any symptoms. In early immune responses, IgM antibody production is pre-dominant with low quantity and short time. In contrast, IgG production is delayed, but its production is higher and will remain in the serum for a longer period of time and remain in the blood even after the infection is gone, due to immune memory. Detection of circulating IgM and IgG in the blood which is antigen-specific, serves as a conventional method to detect whether a person has been infected with that pathogen, either recently by IgM or more distantly by IgG<sup>5</sup>.

In this study, we observed the seroprevalence (SAR-CoV-2 antibodies) of a group of people those work as healthcare workers at COVID-ward in a referral hospital, Dhaka. As stay-at-home orders were lifted around the country and public life begins to return, health experts continue to emphasize the importance of testing for COVID-19 to prevent further and potentially worse wave of infections. Patients who have been infected with the corona virus once could be the key to fight against the disease.

### Material and Methods

This observational and perspective study was carried out in Immunology and Virology Department, AFIP from the date of 21st April, 2020 to 31st May, only for 41 days in the year of 2020. In this study, 294 samples were collected from apparently healthy HCWs who used to work at the wards where COVID patients were admitted. Now days, various laboratory methods are being developed to detect SARS-CoV-2 antibodies and these serologic tests has been designed and validated for surveillance and research purposes<sup>3</sup>. But before entering clinical application these methods need validation. In this study the tests were done by ICT method which is a well-accepted method worldwide. The kit used in this study is to detect the IgG and IgM antibodies qualitatively to SARS-CoV-2 in human serum, plasma or whole blood sample. The method applied for rapid serologic test is ICT assay which is available from April, 2020. This method is using lateral flow technique for rapid, qualitative detection of SARS-CoV-2 IgG/IgM antibody. The assay procedure was performed as described by the manufacturer. When the sample contains the IgM or IgG antibody, it forms a complex with the gold label antigen which is

SARS-CoV-2 recombinant antigen. The complex moves forward under the action of chromatography and combines with coated antibody to form a complex. The World Health Organization currently recommends that rapid serologic tests only be utilized for research purpose, not for clinical decision<sup>2</sup>.

### Results

A total of 294 healthcare workers were included in this study. The study revealed the seroprevalence of 294 healthcare workers who were suspected as either infected or carrier of SARS-CoV-2 virus during their duties in COVID-19 ward. The gold standard to diagnose SARS-CoV-2 virus is RT-PCR, and to detect previous infections in people who had few or no symptoms, serological test is recommended, so we performed both RT-PCR and ICT as well. In this study, Table-I presents the main result of 294 samples of which antibodies developed in 36% (106) cases and 64% (188) cases didn't develop any type of antibody even in cases of their exposure to infected patients.

**Table-I:** Seroprevalence among health-workers (n=294)

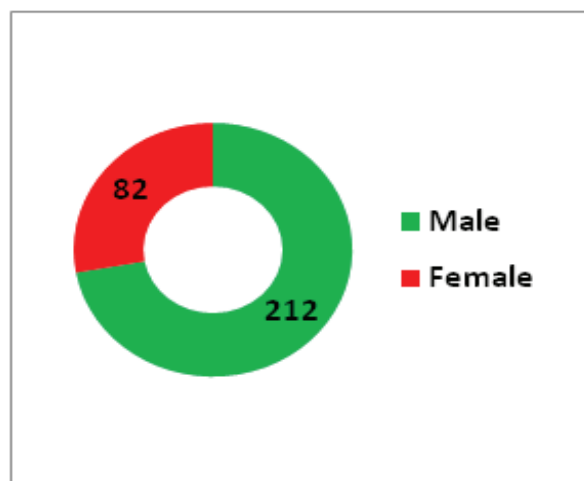
| Health workers | Antibody positive cases | Antibody negative cases |
|----------------|-------------------------|-------------------------|
| 294            | 106 (36%)               | 188 (64%)               |

In Table-II, we observed that among 294 samples, 57 (19.3%) samples were RT-PCR positive and 237 (80.61%) cases were RT-PCR negative.

**Table-II:** RT-PCR positive cases in healthcare workers (n=294)

| Total number of HCWs | RT-PCR positive HCWs | RT-PCR negative HCWs |
|----------------------|----------------------|----------------------|
| 294                  | 57(19.3%)            | 237(80.61%)          |

Among 294 HCWs, the numbers of males are 212 (72.2%) and females are 82(27.8%). The ratio is 2.58:1 (Figure-1).



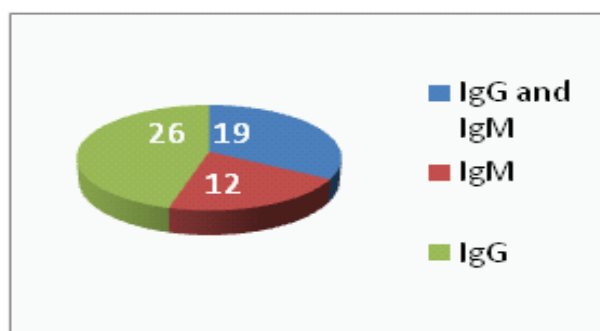
**Figure-1:** Ratio of male and female health-workers (n=294)

Table-III shows, the presence of antibodies in male and female group. Among 106 health-workers 84% (89) males and 16% (17) female developed antibodies. Among 89 males, 15.7% (14) developed IgM, 52.8% (47) developed IgG and 31.4% (28) developed both IgG and IgM. Among 17 females, 23.5% (04) developed IgM, 41.1% (07) developed IgG and 35.2% (06) developed both IgG and IgM.

**Table-III:** The seroprevalence of anti-SARS-CoV-2 IgM and IgG antibodies according to the characteristics of the study population is shown with percentiles in male and female(n=106)

| Variable             | IgM (%)    | IgG (%)   | IgG & IgM (%) | Total cases (%) |
|----------------------|------------|-----------|---------------|-----------------|
| Male                 | 14(15.7%)  | 47(52.8%) | 28(31.4%)     | 89(84%)         |
| Female               | 04(23.5%)  | 07(41.1%) | 06(35.2%)     | 17(16%)         |
| No of seroprevalence | 18(16.98%) | 54(50.9%) | 34(32.07%)    | 106             |

In this study, Figure-2 shows the seroprevalence of anti-SARS-CoV-2 antibody among 57 RT-PCR positive cases. Here presence of IgM is 21.05% (12), IgG is 45.61% (26) and both IgG and IgM are 33.33% (19).



**Figure-2:** Seroprevalence among RT-PCR positive cases (n=57)

## Discussion

In this study, we tried to focus on the seroprevalence of doctors, nurses and healthcare workers who have been on the frontline for fighting this COVID-19 pandemic, and placed themselves at high risk of catching COVID-19<sup>3</sup>. Hundreds of doctors and HCWs have been infected with corona virus in Bangladesh, making up 11% of the total infections reported in the country<sup>4</sup>. In the UK, 14% of healthcare workers, in the Netherlands, 6% of healthcare workers and in China, 1% to 4% of the healthcare workers who were tested positive for SARS- CoV-2. One analysis indicated 17.1% of asymptomatic or subclinical infection in health workers of SARS- CoV-2 in hospital setting<sup>3</sup>. In this study, we found 19.3% (57) of the HCWs were RT-PCR positive which correlates with these studies. In one study from China by Xin X and et al, most people of COVID-19 patients produced antibodies that prevent the virus from infecting new cells<sup>6</sup>. The antibodies developed about 70% around 10 days after symptoms begin among 175

patients with mild symptoms, but in this study, we found that 36% cases in 294 health-workers developed antibodies after 14 days of exposure. Among 294 health-workers, 36% (106) developed antibodies, but 64% (188) of them did not have any kind of antibody. In this study, highest numbers in seropositivity of IgG was observed and there were also individuals with IgM alone and both IgG and IgM positivity. Islam MK et al revealed that among the total positive cases in Bangladesh, 68% were male and 32% were female patients<sup>7</sup>. In England, one study of 1,591 cases of ill people who were admitted into hospitals showed that about 82% of them were men<sup>8</sup>. We observed significant differences in seropositive rates between genders (84% in males and 16% in females) in the entire study population. This study revealed that among all 294 samples the seropositivity of anti-SARS-CoV-2 was 36% (106) and IgG was highest that is, 45.61% (26), IgM was 21.05% (12), and both IgG and IgM are 33.33% (19). Heyder A. Balou and et al revealed that 33.3% of IgG, 5.6% of IgM and 39% of both IgG and IgM are present among 503 samples<sup>9</sup>. Javed et al stated that among 3120 samples 4.6% of IgG, 4.1% of IgM and 8.3% of both IgG and IgM<sup>10</sup>. In another study, Dr David M Reese states that B cells that produce “neutralizing antibodies” most effective in binding to the virus and preventing it from infecting other cells and serologic test will be able to find out who’s been exposed and who has antibodies and hence who has a certain level of immunity to this virus<sup>11</sup>. The limitations of this study are that it may yield a “positive” result even if a person has never been infected with the targeted pathogen. Because a person may possess antibodies directed against one microbe, but that cross-react in the laboratory during serologic tests for different pathogens (for instance, related microbes). The sequences of patient’s variant and healthcare worker’s variant was not detected, so there might be differences among those. Though direct transmission in the hospitals cannot be ruled out, our data do not support widespread nosocomial transmission as the source of infection in patients or HCWs<sup>12</sup>.

## Conclusion

This study revealed that the serological test is useful for the identification of symptomatic, asymptomatic or sub-clinical infection of SARS-CoV-2 among close contacts with COVID-19 patients especially in case of HCWs. The people who carry antibodies specific to the novel coronavirus, called SARS-CoV-2, have been infected previously, even if they didn’t know it. The health workers at the front lines of COVID-19 pandemic outbreak, they put themselves at risk of infection and health hazards by treating the infected patients. This study proved that the serological testing is very useful

screening test for the identification of asymptomatic or sub-clinical infection of SARS-CoV-2 among health workers with COVID-19 patients.

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