


COVID-19 infection and seroconversion rates in healthcare workers in Lebanon

An observational study

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Abstract

Coronavirus disease 2019 (COVID-19) infection is a recent pandemic. Healthcare workers (HCW) are at high risk of acquiring the infection and transmitting it to others. Seroprevalence for COVID-19 among HCW varies between countries, hospitals in the same country and even among different departments in the same hospital. In this study, we aim to determine the prevalence of severe acute respiratory syndrome coronavirus 2 antibodies and the seroconversion among the HCW in our hospital. A total of 203 HCW were included. The rate of conversion to seropositive was 19.7% in total, with a rate of 13.4% in female versus 25% in male. The seropositivity in the House keeping group was 83%, followed by 45% in the COVID Floor while the seropositivity in the Anesthesia was 4% and the Infection Control 0%. The highest seropositivity rate in the COVID floor, and in the intensive care unit was explained by the long time spent with the patients. While in the inhalation team and the anesthesia, the lower rates of seropositivity was due to the N95 mask wearing the whole time. Seropositivity for COVID-19 in HCW is a major public health concern. Policies should be implemented to better protect HCWs.

Abbreviations: COVID-19 = coronavirus disease 2019, HCW = healthcare workers, PPE = personal protective equipment.

Keywords: COVID-19, healthcare workers, seroconversion, seropositivity

1. Introduction

Coronavirus disease 2019 (COVID-19) infection is a recent pandemic, known to cause severe respiratory illness, with more than 600 million people infected all over the world, and around 6.5 million people dead as of October, 2022.^[1] It has a wide clinical spectrum. COVID-19 patients can be asymptomatic. When symptoms are present, they range from minimal respiratory symptoms to life threatening respiratory failure.^[2] Health care setting transmission and infection remains is a major public health issue.^[3] Asymptomatic cases play a role in the silent transmission of COVID-19 and probably contributed to the start and perpetuation of the pandemic.^[4] Healthcare workers (HCW) are at high risk of acquiring the infection and transmitting it to others.^[3] In the era before vaccine or medications became available, reports of HCW infected with COVID-19 showed a prevalence of around 11% by polymerase chain reaction, and 7% by serology testing.^[5] Preexisting antibodies for COVID-19 affect the clinical

response during an infection.^[2] Antibody titers remain several months after an infection.^[6] COVID-19 produces detectable level of antibodies. However, it is not clear whether these levels can produce adequate immunity, to which extent, and for how long.^[1] In a study conducted in HCW in Oxford university hospitals, UK, the presence of IgG antibodies was associated with a reduced risk of COVID-19 reinfection in the following 6 months.^[1] Seroprevalence for COVID-19 among HCW range from 0% to 45.3%.^[6] This percentage is different across the countries and among different centers in the same country. Studies in the USA report the rate for prevalence among HCW to be between 6% and 35.8%.^[7–13] Percentages of seroprevalence are variable and depends on many factors. No study was conducted in the Lebanese hospitals on seroprevalence rates among the HCW. In this study, we report the prevalence of COVID-19 antibodies and the seroconversion rate among the HCW in different departments in the hospital in the beginning of the pandemic.

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2. Materials and Methods

The study was conducted in the year 2020 before any vaccination or established treatment for COVID-19 was available. The study was approved by the Lebanese American University Institutional Review Board IRB #: LAUMCRH.RH1.16/Apr/2020. This systematic study aimed to determine the prevalence of severe acute respiratory syndrome coronavirus 2 antibodies and the seroconversion among the HCW within our hospital. Participants included in the study were HCW at the Lebanese American University Medical Center, Beirut, Lebanon dealing with COVID-19 patients or working in COVID-19 units. All participants signed a consent form, and data was obtained anonymously. Two blood tests were performed for

the participants included, on the beginning of the study and 6 months later. Blood tests consisted of a serum anti severe acute respiratory syndrome coronavirus 2 antibodies levels using the Roche test. Data was collected and analyzed.

3. Results

A total of 203 HCW from different specialties were included in the study (Table 1 and Fig. 1). The majority were registered nurses, practical nurses or medical doctors.

Table 2 shows the distribution of the HCW among different areas in the hospital, with the highest numbers being in the Emergency Room or in the Operating Room.

The rate of conversion to seropositive was 19.7% in total, with a rate of 13.4 % in female versus 25% in male (Table 3).

Seropositive rate is variable from 1 area to another in the hospital. For example, the seropositivity in the House keeping group was 83%, followed by 45 % in the COVID Floor compared to the seropositivity in the Anesthesia and Infection Control (4% and 0%) (Table 4). If we exclude the housekeeping staff, the prevalence rate become 17.7%.

4. Discussion

As we have obtained from our data, 19.7% of our HCW converted to seropositive. These rates varied with gender and job location and position. The highest rates were in the housekeeping division and the COVID Floor staff.

Many studies were conducted worldwide to evaluate the seroconversion rate of the HCW for COVID-19. Table 5 summarizes all studies with the different rates of seropositivity among HCW.^[1,3, 6–13, 17–31, 45–66]

A recent meta-analysis of seroprevalence in HCWs collected 127480 HCW from 49 studies.^[14] The overall seroprevalence rate was estimated at 8.7%. Many factors were associated with seropositivity as male gender, race, working in a COVID-19 unit, and working in areas with a shortage of personal protective equipment (PPE). Another meta-analysis including 25 studies found an average seroprevalence of 8%.^[15] Similarly, studies found a significant higher probability of positive antibody tests in HCW working in a COVID unit.^[16–18]

Our study showed an average rate of seroprevalence of 19.7 % which is higher than the rates found in the 2 meta-analysis. This was mainly due to the outbreak in the house keeping department with a rate of 84% in the housekeeping. To note here that the housekeeping team live in the same house, so the outbreak might be community related more than hospital acquired.

If we remove the outbreak in the housekeeping division, the total prevalence in our study will drop to 17.7% and will be the highest in the COVID floor, and in the intensive care unit. This result is similar to other studies like in Denmark, the highest rate of seropositivity was among frontline care workers.^[16] In another study, the highest rate was among patient care support.^[17] One of the factors that can interfere with the rate of conversion is the time spend with the patient, this is why the rate is higher in departments where there is prolonged duration of contact with the patient, and possible respiratory procedures creating contagious aerosols.

Men are more commonly seropositive than female, 25% versus 13.4%. Other studies found that COVID antibodies are more frequently detectable in male gender.^[9,16,19] This could be explained by the difference in behavior, the higher ACE 2 receptors, and hormonal differences as reported in the literature.^[9,16,19]

Other factors reported in the literature to be associated with seropositivity were black, Asian and Hispanic, healthcare assistants and shortage of PPEs. A study conducted in Egypt, showed more than 50% of the HCW had occupational safety concern at

Registered nurse	90
Practical nurse	43
Laboratory technician	9
Infection control	1
Medical doctor	37
Transporter	13
Secretary	4
House keeper	6
Total	203

Gender distribution

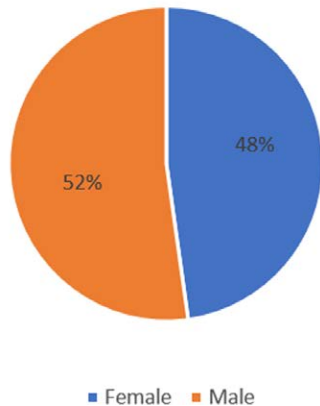


Figure 1. Gender Distribution for Healthcare Workers.

COVID floor	20
Laboratory	11
Infection control	1
Emergency	41
Inhalation	10
Anesthesia	26
Intensive care unit	26
Operation room	39
Dialysis	11
COVID floor physicians	12
House keeper	6
Total	203

Table 3

Rate of conversion to seropositive by gender.

Gender	Number	Converted to seropositive (Number)	Percentage
Female	97	13	13.40%
Male	106	27	25%
Total	203	40	19.70%

Table 4

Rate of seropositivity per different areas in the hospital.

Healthcare workers	Number	Seropositive converted	Percentage
COVID floor	20	9	45%
Laboratory	11	1	9%
Infection control	1	0	0%
Emergency	41	8	19%
Inhalation	10	1	10%
Anesthesia	26	1	4%
Intensive care unit	26	6	23%
Operation room	39	5	13%
Dialysis	11	2	18%
COVID floor physicians	12	2	17%
House keeper	6	5	83%
Total	203	40	19.70%

Table 5

Rate of seropositivity among Healthcare workers in different countries worldwide.

Study	City/Country	Year of data collection	Sample size (N)	Setting	Seropositive rate (%)
Moscoda et al, 2020 ^[12]	New York, USA	2020	40329	Primary care facilities and hospitals	13.7
Jeremias et al, 2020 ^[7]	New York/USA	2020	1699	Hospitals	9.8
Houlihan et al, 2020 ^[3]	London/UK	2020	181	Hospitals	45
Poulikakos et al, 2020 ^[20]	England/UK	2020	281	Hospitals	6
Steensels et al, 2020 ^[21]	Genk/Belgium	2020	3056	Hospitals	6
Blairon et al, 2020 ^[22]	Brussels/Belgium	2020	1485	Hospitals	14.6
Pallett et al, 2020 ^[23]	London/UK	2020	6440	Hospitals	18
Korth et al, 2020 ^[24]	Essen/Germany	2020	316	Hospitals	1.6
Martin et al, 2020 ^[25]	Brussels/Belgium	2020	326	Hospitals	11
Amendola et al, 2020 ^[26]	Milan/Italy	2020	547	Hospitals	5
Self et al, 2020 ^[9]	USA	2020	3248	Hospitals	6
Grant et al, 2020 ^[17]	London/UK	2020	2004	Primary care facilities and hospitals	31
Mughal et al, 2020 ^[8]	New Jersey/USA	2020	121	Hospitals	8
Hunter et al, 2020 ^[27]	Indiana/USA	2020	690	Hospitals	1.4
Plebani et al, 2020 ^[28]	Veneto Region/ Italy	2020	8285	Primary care facilities and hospitals	4.6
Mansour et al, 2020 ^[11]	New York/ USA	2020	285	Hospitals	35
Sotgiu et al, 2020 ^[19]	Milan/Italy	2020	202	Hospitals	14
Garcia-Basteiro et al, 2020 ^[29]	Barcelona/Spain	2020	578	Hospitals	9
Sydney et al, 2020 ^[13]	New York/USA	2020	1700	Hospitals	19
Khalil et al, 2020 ^[30]	London/UK	2020	190	Hospitals	21
Stubblefield et al, 2021 ^[10]	Tennessee/USA	2020	249	Hospitals	7.6
Lackermair et al, 2020	Bavaria/Germany	2020	151	Primary care facilities	2.6
Paderno et al, 2020 ^[32]	Brescia/Italy	2020	58	Hospitals	8.6
Kassem et al, 2020 ^[33]	Cairo/Egypt	2020	74	Hospitals	12
Olalla et al, 2020 ^[34]	Marbella/Spain	2020	498	Hospitals	1.8
Iversen et al, 2020 ^[16]	Denmark	2020	28792	Hospitals	4
Hains et al, 2020 ^[35]	Indiana/USA	2020	25	Hospitals	44
Solodky et al, 2020 ^[36]	Lyon/France	2020	244	Hospitals	5
Behrens et al, 2020 ^[37]	Hannover/Germany	2020	217	Hospitals	1.4
Brandstetter et al, 2020 ^[38]	Regensburg/Germany	2020	201	Hospitals	10.9
Fusco et al, 2020 ^[39]	Naples/Italy	2020	115	Hospitals	0.9
Lahner et al, 2020 ^[40]	Rome/Italy	2020	2115	Hospitals	0.4
Schmidt et al, 2020 ^[41]	Hessisch Oldendorf/ Germany	2020	406	Hospitals	2.9
Xu et al, 2020 ^[42]	China	2020	4384	Hospitals	1.8
Zhao et al, 2020 ^[43]	Beijing/China	2020	276	Hospitals	10
Barallat et al, 2020 ^[44]	Barcelona/ Spain	2020	7563	Primary care facilities and hospitals	10

(Continued)

Table 5
(Continued)

Study	City/Country	Year of data collection	Sample size (N)	Setting	Seropositive rate (%)
Kammon et al, 2020 ^[45]	Alzintan/Libya	2020	77	Hospitals	0.6
Xiong et al, 2020 ^[46]	Wuhan, China	2020	797	Hospitals	4.4
Galán et al, 2020 ^[47]	Madrid/Spain	2020	2590	Hospitals	31.6
Nakamura et al, 2021 ^[48]	Iwate/Japan	2020	1000	Hospitals	0.4
Psychogiou et al, 2020 ^[49]	Athens/Greece	2020	1495	Hospitals	1
Chibwana et al, 2020 ^[50]	Blantyre/Malawi	2020	500	Hospitals	16.8
Tosato et al, 2020 ^[51]	Padova/Italy	2020	133	Hospitals	4.5
Paradiso et al, 2021 ^[52]	Bari/Italy	2020	606	Hospitals	1.2
Fujita et al, 2020 ^[53]	Kyoto/Japan	2020	92	Hospitals	5.4
Sikora et al, 2020 ^[54]	UK	2020	161	Cancer centers	7.5
Rudberg et al, 2020 ^[18]	Stockholm/Sweden	2020	410	Hospitals	19
Shields et al, 2020 ^[55]	Birmingham/UK	2020	516	Hospitals	24
Takita et al, 2020 ^[56]	Tokyo/Japan	2020	55	Primary care facilities	9
Eyre et al, 2020 ^[57]	UK	2020	9958		10.7
Lidstrom et al, 2020 ^[58]	Sweden	2020	8679		6.6
Jones et al, 2021 ^[59]	UK	2020	6858		9.3
Calcagno et al, 2021 ^[60]	Italy	2020	5444		6.9
Delmas et al, 2021 ^[61]	France	2020	4600		11.5
De Carlo et al, 2020 ^[4]	Italy	2020	3242		1.9
Brant-Zawadzki et al, 2020 ^[62]	USA	2020	2932		1.1
Racine-Brzostek et al, 2020 ^[63]	USA	2020	2274		35.4
Dimcheff et al, 2020 ^[64]	USA	2020	1476		4.9
Papasavas et al, 2021 ^[6]	Connecticut/USA	2020	6863		6.3
Mostafa et al, 2021 ^[65]	Cairo/Egypt	2020	4040	University healthcare facilities	4.4
Nicholson et al, 2021 ^[66]	San Diego/USA	2020	11993	Hospitals	0.94
Lumley et al, 2021 ^[1]	UK	2020	12541	Hospitals	10

their workplace, and around 60% of them were not compliant with the PPE use.^[67]

With the financial crisis in our country, hospitals in Lebanon suffered huge shortage in the medical supplies and in particular the PPEs. However, our hospital used strict Infection Control policies, PPEs were available to all. Negative pressure rooms were created at the beginning of the COVID pandemic with frequent education sessions and audits. Therefore, it is clear that personal effort of each healthcare worker to comply with the policies will protect him in the setting of a pandemic.

The inhalation team (respiratory therapist) and the anesthesia had the lower rates of seropositivity. This is possibly because these were the only teams provided N95 Masks at all times since the beginning of the pandemic, being the group at the highest risk of exposure.

These infection control measures are of major importance to prevent the infection of HCW, and their possible need of hospitalization and treatment.^[68]

The study was conducted in 1 hospital in Lebanon, which makes the data limited. However, the importance of this data remains for infection control purposes among the hospital, and this is of major importance during the COVID-19 pandemic.

Another limitation is the period of time of the study, which is before the era of the vaccination. However, data is still important since we witness actually variants of the virus, that makes the vaccine efficacy questionable.

5. Conclusion

Seropositivity for COVID-19 in HCW is a major public health concern. Policies should be implemented to better protect HCWs. In addition, HCW surveillance is of major importance in a hospital setting to protect both HCW and patients from nosocomial transmission.

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