

## The Impact of the Protective Measures on Healthcare Workers During Covid-19 Pandemic in Tertiary University Hospital

Gul Cakmak<sup>1</sup>, Kemal Tolga Saracoğlu<sup>2</sup>, Selime Kahraman<sup>3</sup>, Berk Cimenoglu<sup>3</sup>, Ayten Saracoglu<sup>1</sup>, Nabil Abdelhamid Shallik<sup>4,5,6,7\*</sup> and Recep Demirhan<sup>3</sup>

<sup>1</sup>Clinic of Anesthesiology and Intensive Care, Marmara University Pendik Training and Research Hospital, Istanbul, Turkey

<sup>2</sup>Clinic of Anesthesiology and Intensive Care, Health Sciences University Kartal Dr. Lutfi Kirdar Training and Research Hospital, Istanbul, Turkey

<sup>3</sup>Clinic of Thoracic Surgery, Health Sciences University Kartal Dr. Lutfi Kirdar Training and Research Hospital, Istanbul, Turkey

<sup>4</sup>Tanta University, Tanta, Egypt

<sup>5</sup>Weill Cornell, Doha, Qatar

<sup>6</sup>Hamad Medical Corporation, Doha, Qatar

<sup>7</sup>Qatar University, Doha, Qatar

### \*Corresponding author

Nabil Abdelhamid Shallik, Tanta University, Tanta, Egypt

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### Abstract

**Background:** A novel coronavirus “SARS-CoV-2” causes the disease COVID-19. A high transmission rate within healthcare workers was reported. We aimed to determine effect of our protective measures on infection rate, related risk factors and measures that can be taken among healthcare professionals in our university hospital.

**Methods:** We conducted a retrospective cohort study to analyse the data of infected healthcare providers. Demographic data of the patients, computed tomography (CT) scan findings, laboratory parameters and any symptoms related with Covid-19 disease were recorded. The real-time reverse transcription Polymerase Chain Reaction (PCR) results were evaluated.

**Results:** The infection rate was 3.8% (143 of 3700 healthcare workers). Of 143 infected healthcare workers, 91 were female and 52 were male. Mean age of these patients was 32.5±8.6 years (Table 1). First PCR tests of 99 symptomatic healthcare staff were positive. Second tests of 84 of them were negative. The most common symptom was dry cough (47 patients, 32.8%). Treatment of 117 healthcare staff has been completed and they returned to work. Mortality or intensive care unit stay have not been observed.

**Conclusion:** The transmission rate was relatively low in our university hospital. Our protective measures of increased awareness of personal protection, adherence to algorithms, supportive attitudes of hospital management, proper preparation and intervention play a critical role in reducing infection risk for healthcare workers.

Public Interest Summary.

Corona Virus (COVID 19) pandemic may continue for more time. To prevent its spread within health workers personnel, should follow a strict preventive measure. Increased awareness of personal protection equipment, adherence to algorithms, supportive attitudes of hospital management, proper preparation and intervention play a critical role in reducing infection

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*risk for healthcare workers. Supportive behaviours of hospital administration and managers are essential to increase the enthusiasm of the staff. The Ministry of Health (MOH) should design a flexible working hours system and prevent long working hours under extreme pressure.*

*All meetings are better to be held with a teleconference to prevent face-to-face transmission.*

**Key words:** Protective measures, Covid-19, Hospital infection, Healthcare workers

## Introduction

In December 2019, a significant number of cases with pneumonia of unknown aetiology have been reported in Wuhan, the capital city of Hubei Province, China. A novel coronavirus “SARS-CoV-2” causes the disease COVID-19 [1]. The spread of COVID-19 in the world still appears inevitable. In March 11, 2020, World Health Organization (WHO) declared this disease as a pandemic [2]. There is strong evidence that indicates person-to-person transmission especially in hospital settings and within family [3,4]. A median incubation period of 4 days and a relatively low fatality rate have been reported [5]. A high transmission rate within healthcare staff is noticed even with taking strict preventive measures such as proper use of personal preventive equipment (PPE) [6]. According to an article published in Newsweek in 4 April, 2020, a total of 100 doctors and nurses lost their lives, half of them were from Italy [7]. Presumably, 1716 healthcare staff have been infected in China until 11 February 2020 and this number reached to 3000 by the end of February [8, 9]. Infection rate within healthcare workers in Spain and Italy were 14% and 9% respectively [10]. This rate alters within countries and hospitals.

In this retrospective study, we determined the infection rate within healthcare professionals in a university hospital throughout the outbreak. It is aimed to determine the effect of our hospital protective measures on infection rate and the risk factors related to the transmission of the Covid-19 virus and other logistics measures.

## Material and Methods

### Participants

The data of infected healthcare providers in our hospital between March 11, 2020 and eleventh of May 2020 with positive Covid-19 test were analysed. Respiratory symptoms were listed as fever, dry cough, fatigue, sore throat, chest distress, headache, shortness of breath, nausea, runny nose, haemoptysis and loss of taste or smell. Diarrhoea, skin rash, backache and conjunctivitis were also questioned.

Demographic data of the patients, computed tomography (CT) scan findings, symptoms and presence of anaemia were recorded. Laboratory parameters including electrolytes, acute phase reactants and hepatic and kidney functions were evaluated. Healthcare staff who received inpatient and outpatient treatment were recorded. Diagnostic procedure for healthcare staff was held by following guidelines of WHO. Patients with positive Polymerase Chain Reaction (PCR) test were treated according to the algorithms of National Ministry of Health [11]. Throat swab specimens were collected from the upper respiratory tract and processed using real-time reverse transcription Polymerase Chain Reaction (RT-PCR) to perform target gene analysis [12].

Criteria for recovery and eligibility for labour are remission in symptoms, regression in CT findings and achieving negative test results in 2 consecutive PCR tests taken 24 hours apart.

## Hospital Organization

Our institution is a university hospital that has 1100 beds including 210 beds in intensive care unit (ICU) and employs 3700 healthcare staff. It has been assigned as a pandemic hospital by the Ministry of Health on March 11, 2020. From that day forth, all non-urgent patients were discharged in order to provide beds for Covid-19 patients.

To hospitalize patients diagnosed with Covid-19, 500 pandemic patient beds were arranged at 31 clinics. Special radiology and tomography units were spared. Specific elevators and corridors were reserved for pandemic patients. Ten coronavirus outpatient clinics were opened so that patients could quickly be examined.

## Hospital Protective Measures and Regulations include the Following

Increased awareness of using personal protection equipment (PPE) and its importance, adherence to national and international guidelines, proper preparation, and intervention.

Supportive behaviours of hospital administration and managers were aimed to increase the enthusiasm of the staff.

Infectious Diseases Department created a task force and well-educated hospital staff about infection prevention and control procedures. In addition, operating room or ICU staff who could not attend these sessions due to their workload requested repetition of these educational programs at their workplaces.

Since the first day, the pandemic scientific committee has been established to discuss up-to-date articles, updated guides, and treatment algorithms.

Ministry of Health (MOH) designed a flexible working hours system and prevented long working hours under extreme pressure.

The hospital engineering established a new ICU with negative pressure rooms quickly.

All meetings were held with a teleconference to prevent face-to-face transmission.

## Statistical Analysis

Mean, standard deviation, median, lowest, highest, frequency and ratio analysis were used in the descriptive statistics of the data. Kolmogorov test was used for the distribution of variables, and

SPSS 26.0 version was used in the statistical analysis. Continuous variables were described as mean with standard deviation and median with interquartile range. Categorical variables were presented as counts (frequency or percentages).

## Results

In our hospital, 41771 clinical examinations were conducted for Covid-19 until 11 May 2020. A total of 34060 PCR tests were performed and 3974 of them were positive. The mean age of adult patients was 58 years, our youngest patient was a 22-day-old baby. The oldest patient was 101 years old. The mean age of the patients in intensive care unit (ICU) was 68 years. The mean age of the patients who died in the intensive care unit was found to be 70 years. The overall in-hospital mortality rate due to Coronavirus infection was 1.96%.

A total of 143 healthcare workers were infected with Covid-19 (3.8%). Mean age of these patients was  $32.5 \pm 8.6$  years (Table I). First tests of 99 symptomatic healthcare staff were positive. Second tests of 84 of them were negative.

Symptoms were listed as cough in 47 (32.8%) patients, fever in 18 (12.5%) patients, fatigue in 18 (12.5%) patients, sore throat in 15 (10.4%) patients, chest distress in 14 (9.7%) patients, shortness of breath in 9 (6.2%) patients, headache in 7 (4.8%) patients, runny nose in 7 (4.8%) patients, diarrhoea in 5 (3.4%) patients, loss in taste and smell in 4 (2.7%) patients, nausea in 4 (2.7%) patients, anxiety in 2 (1.3%) patients and backache in 1 (0.6%) patient. Forty-two patients were asymptomatic. Neither haemoptysis nor conjunctivitis was present.

Of 143 infected healthcare workers, 91 were female and 52 were male. Treatment of 117 of our staff has been completed and they returned to work. Remaining 26 were isolated and treated at home. Mortality has not been observed in our hospital staff. Of these 26 patients, 11 were male and 15 were female. On the other hand, of 117 recovered patients 41 were male, 76 were female and 46 of them were physicians including 21 residents. There were 39 nurses and 6 midwives.

Other infected staff ( $n=51$ ) included nurse anaesthetists, radiology technicians, health technicians, cleaning staff, janitors, secretaries and computing staff.

While 109 patients underwent CT imaging, in 34 patients this was not necessary. Sixty-six patients did not have any CT finding, 21 patients had mild and 17 patients had moderate-severe CT findings. (Table II) displays mean laboratory values of the patients.

## Discussion

In this retrospective cohort study, the infection rate in hospital staff was determined to be 3.8%. Mean age of the infected staff was 32.5 years. Mostly females were infected and the most frequent symptom was cough. Among those infected, 29% were asymptomatic.

Reporting the infected staff was found to be efficient in the control of the outbreak [13]. WHO-China Joint Mission reported 2055 Covid -19 cases among healthcare workers, 22 (1.1%) of which

passed away [14]. However, there are some controversies in the data from China. Another study from China reports 2.7% of healthcare workers were infected by COVID-19 [15]. In 11 February 2020, deputy director of the National Health Commission declared that there were 1716 confirmed cases of Covid-19 in medical staff across the country [12]. Based on this information, infection rate of hospital staff was 3.8%. Moreover, there were 6 reported deaths among those 1716 infected which is significantly low compared with ICU mortality of 13.53% in SARS [16]. Similar with above mentioned studies, this rate in our hospital was found to be 3.83%. In contrast, there were no deaths among our medical staff. Until that day, 81.8% of the staff have been completely recovered and are back to work. Rapid PCR tests which result in 15 minutes, low dose chest CT scan in symptomatic patients and timely initiation of the treatment seems to be effective in achieving this successful outcome.

Ran et al. reported that 3 most common symptoms are fever (85.71%), cough (60.71%) and brachypnea (7.14%) [8]. In a study conducted by Chu et al [12], the most common symptom was fever as well (81.8%). However, in our study, the most common symptom was dry cough with a rate of 32.8% while fever was observed in 12.5% of the patients.

Primary transmission occurs via direct or indirect exposure to respiratory particles [17]. In our hospital, frontline healthcare workers could accomplish self-protection using personal protective equipment (PPE). However, even with appropriate PPE, Coronavirus transmissions can be observed [18]. Staff working in non-Covid wards, polyclinics and operating rooms could only reach surgical mask, which creates a deficiency in preventive measures. Furthermore, Coronavirus is also transmissible during the incubation period [19].

We had sufficient amount of PPE and did not experience any shortage since the beginning of the pandemic. From the beginning of the first week, a task force was created by Infectious Diseases Department and hospital staff was well educated about infection prevention and control procedures. Operating room or ICU staff who could not attend these sessions due to their workload, requested repetition of these educational programs at their own work places. In addition, since the first day, the pandemic scientific committee has been established to discuss, up-to-date articles, updated guides and treatment algorithms.

Being exposed to numerous infected patients for a long time directly increases the risk of infection in healthcare workers. In addition, heavy workload and long hours without rest makes staff more susceptible to infection. One of the most crucial factors determining infection rate within healthcare staff is being compelled to work for long hours under extreme pressure. The reason why we could achieve lower infection rate among healthcare staff is implementing a working schedule that helps staff avoid viral load as much as possible and allows them to have adequate resting time. We believe that "flexible working hours system" designed by Ministry of Health is efficient in this regard. Another measure taken in our hospital is quickly establishing a new ICU with negative pressure rooms. Although the number of patients increased, the safety of employees was ensured as negative pressure systems were active

in both ICU and operating rooms.

In a study by Nava et al., mean age of the colleagues who died during outbreak varied between 60 and 70 years [20]. This number is  $32.5 \pm 8.6$  years in our staff. This age difference is thought to play an important role in avoiding mortality. Besides, there was also no need for ICU.

According to a Cochrane review, unnecessary changes in local guidelines would exhaust healthcare workers [21]. In our country, guidelines have been published for healthcare professionals to help them comply with the rules and to provide proper self-protection. These guidelines do not welcome nonessential revisions and clarify treatment plans for healthcare workers who were exposed to the virus [22]. We believe that avoiding frequent alterations in guidelines is associated with favourable outcome.

Supportive behaviours of hospital administration and managers seem to be beneficial by increasing enthusiasm of the staff [23]. Likewise, administration and managers of our institution was helpful in any means to contribute this successful outcome.

Similar to our study, Heinzerling et al., reported that 84% of infected staff were female and 51% were registered nurses [24]. However main drawback of this study is having only 43 patients. Having small patient population may cause unsatisfactory results.

Number and rate of asymptomatic patients are crucial. In a study about symptomatology of Covid-19, of 634 confirmed cases, 328 (51.7%) were asymptomatic [25]. In another study, which is from New York, 33 out of 215 pregnant women were positive and 29 (87.9%) were asymptomatic [26]. On the other hand, China National Health Commission states that 130 out of 166 cases (78%) are asymptomatic in 1 April 2020 [27]. In our study, 29% of infected healthcare workers were asymptomatic. We believe that those who were symptomatic had the opportunity to receive timely treatment, thus there was no mortality or requirement for intensive care.

Finally, since the beginning of the pandemic, all meetings were held with teleconference. In our opinion, this also has a positive impact in outcome.

One of the study's limitations was the short duration of the study (only three months), and with the extended period, might be changed the expected results. Also, this single-centre study and will be better to include other centres with different protective measures inside and outside the country.

## Conclusion

Covid-19 pandemic may continue for a while. In order to prevent its spread within health workers, meticulous preventive measures should be adopted. Increased awareness of personal protection, adherence to algorithms, supportive attitudes of hospital management, proper preparation and intervention play a critical role in reducing infection risk for healthcare workers.

## Author Contributions

Selime Kahraman, Kemal T. Saracoglu, Berk Cimenoglu, Ayten

Saracoglu, Nabil A. Shallik, and Recep Demirhan contributed to all aspects of this manuscript, including study conception and design; acquisition, analysis, and interpretation of data; drafting the article and revision.

## Declaration of Interest

No conflict of interest for the authors and coauthors regarding this study.

## Consent to Participate

Written informed consent was obtained from all subjects participating in the trial

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