

## COVID-19 and the risk to health care workers: Is it possible to prevent nosocomial transmission?

COVID-19 in healthcare workers

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### Abstract

**Aim:** Health employees are the key point in the struggle against the disease and in-hospital transmission during the 2019 coronavirus disease (COVID-19) pandemic. Hospital contamination poses a serious risk for both healthcare personnel and social transmission. In our study, we aimed to evaluate the COVID-19 positivity and prevention strategies in healthcare personnel.

**Materials and Methods:** The SARS-CoV-2 PCR results examined among health employees for all reasons were retrospectively collected. Combined nasopharyngeal and oropharyngeal swab samples were used. Real-time PCR was used for testing. With the epidemic, the pandemic preparation process started in our hospital. All in-hospital organization was prepared in steps. Training programs and practical applications were put into practice.

**Results:** Among 1054 active health personnel, 682 underwent 876 tests. Only 2 people (0.3%) were identified as positive for SARS-CoV-2 on PCR tests. In the total number of tests, the positivity rate was identified as 0.22%. In this period, no health employee developed severe disease, and no personnel died due to COVID-19.

**Discussion:** Creating effective health strategies with a preparation process, together with in-hospital organization and training, and the use of appropriate and sufficient personal protective equipment, are highly effective in protecting healthcare personnel and preventing hospital-borne transmission.

### Keywords

Coronavirus; Polymerase chain reaction; Healthcare workers

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## Introduction

Emerging in Wuhan city in China and following the recognition of pneumonia patients linked to the novel coronavirus (SARS-CoV-2), the disease rapidly spread and was declared a pandemic on 11 March 2020 by the World Health Organization. Currently, as of 12 June 2020, there are more than 7.5 million confirmed cases around the world and over 420 thousand deaths reported. Though the disease is generally known to be transmitted by droplets and contact, many studies have shown that droplets may travel long distances, even up to 8 m, in some situations, and may remain suspended in the air for up to 3 hours in situations involving aerosols [1]. Additionally, it is known that though a significant proportion of people may carry the virus and transmit the disease, they may not have any clinical symptoms [2]. This situation has caused many health personnel to catch the disease in hospital environments, where many medical procedures and interventions are performed in countries where patients infected with SARS-CoV-2 are intensely found.

In the period when people were recommended to stay at home with the aim of protecting themselves and preventing the spread of the disease, health employees were required to work in spite of all risks. During the pandemic, health employees caring for and treating patients with 2019 coronavirus disease (COVID-19) were at special risk. Personnel not working in pandemic clinics and wards were at risk due to the asymptomatic progression of the disease and a lack of COVID-19 diagnosis, patients with different diagnoses in the hospital, and work colleagues. Infected health employees could not work during the critical period due to the disease or may cause serious results due to being a source for the spread of the disease if not diagnosed. As a result, they were required to undergo screening when necessary with sensitive monitoring of symptoms. In fact, employees in some units undergo screening tests at certain periods, even if asymptomatic was debated [3]. In our study, we aimed to evaluate the results of the SARS-CoV-2 polymerase chain reaction (PCR) test applied to healthcare professionals in our hospital, nosocomial Covid-19 transmission and prevention strategies.

## Material and Methods

The study was planned observationally, retrospectively and cross-sectionally and was conducted between March and June 2020. Education and Research Hospital is a tertiary hospital with a total of 260-bed capacity, including 26 in intensive care units. The hospital has a total of 1054 active employees, including 167 doctors, 229 nurses, 133 midwives, 32 laboratory employees, 28 radiology unit employees, 91 administrative and technical personnel, 85 data entry personnel, 32 security guards, 119 cleaning personnel and 138 other personnel. The study included data for personnel in contact with patients and patient areas and excluded data from management and office staff. Personnel with symptoms suspected of being infected with COVID- had samples taken immediately, while personnel with risky contact with COVID-19 patients had samples taken when symptoms developed or on the seventh day after contact. In this process, the guideline instructions of the ministry of health were implemented. Additionally, from 1 May 2020 to 10 May 2020, samples were taken from

symptom-free personnel for screening purposes. Samples were taken with a single sample stick from both the pharynx and the deep nasopharyngeal region. The fluids carrying the virus were sent to the laboratory in accordance with cold chain rules and tested with real-time reverse transcriptase PCR on the same day (Roche LightCycler® 480, Mannheim, Germany). One of the RT-PCR kits, the Bio-Speddy® (Bioeksan R&D Technologies Inc. COVID-19 RT-qPCR Detection Kit v2.0, Istanbul, Turkey), is determined valuable by the Turkish Ministry of Health and used throughout the COVID-19 pandemic).

All analyses were conducted using the statistical package program, the Statistical Package for Social Sciences (IBM SPSS for Windows, Ver.22) was used in the calculations. Means and standard deviations were obtained for continuous variables, while categorical variables were summarized using frequency and percentage. Student's t-test was applied to assess the differences between numerical variables. The chi-square test was used to compare categorical variables.

The study was approved by the Regional Ethics Committee (2020/143) and was conducted according to the Helsinki Declaration. In addition, permission was obtained from the Republic of Turkey Ministry of Health.

## Results

During the whole process, 682 health personnel underwent 876 PCR tests. Among these, 16 were symptomatic, 178 were contact screening (filiation) and 682 were in the planned screening week. Nonspecific ally, all symptomatic workers had mild symptoms such as sore throat and malaise. Among the total test count for health employees, the positivity rate was identified as 0.22%. The distribution and demographic data of tested personnel are presented in Table 1. Positive cases were in the symptomatic group, and their rate within the symptomatic group was 0.3%. One of the positive personnel had a history of out-of-hospital contact. In the other personnel, hospital infection could not be ruled out.

Among 178 contact histories, 26% (n = 46) had high, 46% (n = 81) had medium and 28% (n = 51) had low-risk contact. Chloroquine treatment was initiated in the high-risk group with a guide recommendation. No disease was detected in the cases that were followed up with contact. Routine testing was not performed for those in the low-risk group, and no disease developed during follow-up.

Since March 15, out of 207 patients admitted to the pandemic wards, 129 had COVID-19 diagnosis. Among COVID-19 diagnosed patients, 83 were PCR positive, and 46 had clinical and radiological compatibility. The internal capacity of the hospital decreased significantly due to decisions taken in the pandemic period (non-urgent surgeries were postponed, outpatient treatment was preferred except for mandatory cases, the number of outpatient clinic appointments was reduced). The workload for January and February and during the pandemic period is given in Table 2.

Additionally, in-service training beginning before the identification of COVID-19 cases in Turkey continued throughout the whole period. During this period, a total of 1653 participants attended 44 training sessions. Training topics were determined as Ministry of Health COVID-19 guidelines, hand hygiene,

isolation methods, use of personal protective equipment, sample taking and transport for SARS-CoV-2 PCR tests, waste management, hospital cleaning and disinfection, organizational action plan for the pandemic and infection control precautions in a variety of units. Sessions were performed for each topic at different times to encompass all personnel. Throughout the process, one-to-one trainings were carried out in clinics by paying attention to protective measures, and the continuity of the training was ensured.

From the beginning of March to the middle of June, 200 thousand medical masks, 17 thousand disposable aprons, more than 3 thousand disposable overalls and 12 thousand N95 masks were used. Total use exceeds these numbers because materials like washable aprons, glasses, and face shields were reused after appropriate cleaning and disinfection. Additionally, material donations were given to the hospital by other public and civil society organizations. There was no lack of personal protective equipment in clinics.

In order to quickly identify the personnel who have contact with the positive case and to take the necessary precautions, a team was formed under the presidency of an infection physician and a personnel health nurse. The phone number was announced to all staff and this team was accessible 24 hours a day. Contacts were recorded with the forms created. Active and rapid changes were made in the working order. Thus, the contagion was prevented, and the service was provided in this process.

**Table 1.** Distribution and demographic information for tested personnel

Sex	Number (%)
Female	467 (68.5%) median age: 38 (19-61)
Male	215 (31.5%) median age: 37 (19-61)
Total	682 median age: 37 (19-61)

  

Occupation	Number (%)
Doctor	78 (11.4)
Nurse	219 (32.1)
Midwife	108 (15.8)
Laboratory personnel Health technicians	71 (10.4)
Security personnel	21 (3)
Data personnel	55 (8)
Cleaning personnel	98 (14.3)
Other*	32 (4.6)
Total	682

\*Pharmacist, officials, technical services, drivers, caregiver

**Table 2.** Hospital workload before and during the pandemic

	January 2020	February 2020	Before screening*	After screening**
Patient numbers in emergency service	27354	19491	12915	10523
Patient numbers in other clinics	40717	35240	18772	18337
Surgery	1154	1137	608	711
Intensive care	278	263	410	368
Admission to normal wards	1698	1590	1694	1510

\* 50 days from 15 March 2020 – 4 May 2020 \*\* 40 days from 4 May 2020 – 12 June 2020

**Discussion**

COVID-19 was detected in two of 1054 healthcare workers from the beginning of the outbreak until June 2020. One of these staff members tested due to being symptomatic was a radiography technician. After the SARS-CoV-2 PCR test was positive, all of their colleagues were screened and monitored for symptoms. None of them developed the disease or tested positive. Nosocomial infection was not considered due to a lack of hospital-acquired focus and a history of out-of-hospital contact. The other personnel identified positive for SARS-CoV-2 on PCR was a nurse responsible for the gynecology and obstetrics clinic. She had suspicious contact with a patient who was followed up for pregnancy on the 5th day of her hospitalization and was diagnosed with COVID-19, and she had mild symptoms. All other personnel in contact with the same patient were screened and all tested negative. The nurse who was positive had not had long-duration or high-risk contact with the patient, but had performed an intravaginal application. Our nurse developed very mild symptoms lasting only one day. Both personnel did not have pneumonia findings identified on tomography, and both were isolated and administered 5-day hydroxychloroquine treatment.

The other 14 people who were tested for symptoms were negative and their symptoms did not persist. Therefore, tomography evaluation was not required.

Since the beginning of the pandemic, studies have reported about infected health personnel. These rates display differences between countries and health facilities. A study in China reported that 3.5% of total patient numbers were health employees, while another study reported 3.8% were health employees [4,5]. In the United States of America, 3% of 315,531 patients confirmed as for 9 April were health workers [6]. However, this publication noted that there were serious deficiencies in the reporting forms as to whether confirmed cases were health workers or not. A screening study of 1032 asymptomatic health workers in England obtained 3% positive PCR test results [7]. A study of 1666 PCR test results from 1654 symptomatic personnel again in England identified 240 (14%) health workers were positive for SARS-CoV-2 [8]. One of the countries most affected by the pandemic was Italy that reported nearly 20% of health workers in a center were infected [9].

Strict implementation of infection control measures is essential both to reduce the risk of nosocomial infections of healthcare professionals and not to be a source of contamination [10].

If hospitals, which are diagnosis and treatment centers, do not take the necessary precautions, they may become a focus for disease transmission. Early diagnosis in health workers is very important from this aspect, though periodic screening of select groups is debated. Thus, symptomatic personnel may avoid unnecessary quarantine, and loss of labor and transmission by atypical, mild and asymptomatic cases may be prevented [11]. In the 2.5-month period from the moment the disease first emerged in China on December 31, 2019 until the moment it was first identified in our country on March 11, Turkey monitored the progression of the pandemic and new scientific data, and made preparations in light of experiences in other countries. As a result of precautions taken, the virus entered our country late, which provided significant advantages. The low

number of infected health employees in our hospital was our priority target during preparation for the pandemic. There were three main factors in this situation, which can be qualified as a success.

1. Organization: Firstly, a pandemic committee chaired by hospital management (chief physician and assistants) was created. The committee included infectious disease experts, emergency medicine experts, chest diseases experts, intensive care experts, microbiology expert, head of nursing services and infection control nurses, and the administrative financial services manager. During this process, all decisions were made by this committee and published in written form. With no COVID-19 patients in our country or city, hospital departments, triage areas, wards and clinic areas were defined. Plans were prepared in three stages according to the pandemic level, and the transition from the first stage to the second and third stage implementations occurred according to patient numbers over time. Additionally, personnel who would work in COVID-19 wards, clinics and in shifts were determined. Apart from infectious diseases and chest diseases experts, all other internal medicine and surgical branch doctors were included in the process, and responsibilities were shared to prevent some doctors from being overloaded. Hospital cleaning procedures were reviewed and reorganized. Radiography, tomography, laboratory processes, surgeries and intensive care units were organized. All non-emergency surgeries and interventional procedures were postponed. The number accepted for clinical appointments was reduced and health personnel began to work on a rotational basis. The number of patient caregivers and visitors in the hospital was limited. In this process, the decrease in the number of non-COVID patients enabled more effective service to the COVID patient group and healthcare personnel to work more carefully (Table 2). Also, an additional service building was created separately from the main building to monitor COVID-19 diagnosed or suspected patients. Apart from pandemic wards, patients admitted for diagnoses other than COVID-19 and caregiving personnel were reorganized. All patients and health workers were made to use masks, personnel used gloves, and meticulous hand hygiene was ensured.

2. Training: The Turkish Ministry of Health has published guidelines for the diagnosis, treatment and prevention of COVID-19 for health workers. Based on the Ministry of Health guidebook, theoretical training on the clinical and laboratory features of the disease, transmission and protection routes and applied training on protective equipment and use was completed to encompass all personnel.

3. Use of personal protective equipment: The indispensable and most important point in the protection of health personnel dealing with patients with COVID-19 diagnosis or suspicion is the use of protective equipment. In the pandemic preparation stage, the organization reviewed personal protective material stocks and purchases were completed according to the third stage of the pandemic action plan. Interventions ensured that no protective material deficiency was experienced by personnel in any period. At the same time, unnecessary consumption caused by panic was prevented during a period when the number of patients had not increased yet.

It was determined which protective material was to be used

in which way during which medical applications. The use of an N95 mask is recommended for aerosol-generating procedures such as bronchoscopy, endotracheal aspiration and taking nasopharyngeal swabs [12]. The use of medical masks by patients has been shown to reduce the spread of coronavirus and other respiratory tract viruses [13]. Additionally, a meta-analysis observed that the use of medical masks during routine patient procedures, which do not create aerosols was not different from N95 masks in terms of protection [14]. We made it mandatory for all personnel, patients and visitors in all hospital areas to wear medical masks.

When creating health strategies, ensuring effective infection control plays a key role in situations with epidemic disease, especially [15]. During the severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and Ebola epidemics, countries in Asia and West Africa had weak strategies for infection control in health facilities, and as a result, they experienced multiple cross-contamination, death and financial losses. These strategy deficiencies were identified as case identification, training inadequacy, isolation deficiency, communication deficiency, limited personnel policies and delayed response to the epidemic [16].

The limitations of the study are sensitivity problems in identifying SARS-CoV-2 on the PCR test, which may vary according to the region the sample was taken from, sampling technique and period of the disease. Apart from personnel with symptoms and continuing complaints, only one sample was used, despite negative tests. Additionally, antibody tests could not be used.

#### Conclusion

In conclusion, health employees are important for the struggle with COVID-19, while at the same time they are under serious risk. Additionally, they play a key role in in-hospital transmission. Considering the frequency of asymptomatic cases, periodic screening may come to the agenda wherever possible. In this process, we experienced the importance of determining organizational pandemic strategies before the pandemic wave and effective organization by making the necessary preparations. We think that in this way, we can fight the epidemic more effectively and prevent hospital infections.

#### Scientific Responsibility Statement

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

#### Animal and human rights statement

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.*

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#### Conflict of interest

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