

## COVID-19 Cases among Healthcare Workers in Imam Reza Hospital: A Cross-Sectional Study in 2020

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### ABSTRACT

**Background:** Healthcare workers caring for patients with coronavirus disease 2019 (COVID-19) are at high risk of contracting the infection. This study is designated in imam Reza hospital in Mashhad, which is the largest hospital in east Iran, to determine COVID-19 cases characteristics among healthcare workers (HCWs).

**Methods:** In this descriptive, cross-sectional, single-center study in Imam Reza hospital in Iran, we enrolled confirmed healthcare workers with COVID-19 who worked at the forefront to fight against COVID-19 since its outbreak 2020. Demographic characteristics and work status and disease symptoms were studied in the affected personnel. Statistical analyses were conducted using SPSS software. The chi square test was used to investigate the relationship between the variables.

**Results:** In total, out of 2195 people working in the two departments, 154 (7.01%) had coronary heart disease. most of HCWs who were infected to covid19 were nurse (60%) and women (65%) and the lowest has been observed in para clinical staff (1%). There was no significant difference between the use of personal protective equipment and disease in the general department (GD) and high-risk department (HRD). It was indicated that the HRD group had a higher risk of developing COVID-19 compared with the GD group. Common symptoms were Sweating (91.1%), fever (84.93%), Cough (79.31%), and gastrointestinal symptoms (78.77%).

**Conclusion:** Results have found that Sweating and fever are common in HCWs with COVID-19. Also HCWs worked in HRD had a higher risk of COVID-19. However, further large sample studies are needed to confirm these findings.

**Key Words:** COVID-19, Health Worker, Hospital, IRAN

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## Introduction

The spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has already taken on pandemic proportions, affecting over 100 countries in a matter of weeks. A global response to prepare health systems worldwide is imperative (1). According to the latest statistics provided by the Ministry of Health and Medical Education of Iran at 5 July 2020, the total number of patients with covid19 in Iran has reached 237,878 and the total number of deaths from this disease has reached 11,408 (2). Also, About 10,000 of healthcare workers in Iran had been infected to COVID-19 (3).

Covid-19 poses an important occupational health risk to health workers (HWs) that has attracted global scrutiny (4).

during the periods of the COVID-19 outbreak or other infectious diseases, implementation of infection prevention and control (IPC) is of great importance in healthcare settings, especially regarding the personal protection of healthcare workers (5, 6). Health care workers are at the front line of any outbreak response and as such are exposed to hazards that put them at risk of infection with an outbreak pathogen (in this case COVID-19) (7).

according to a press conference of the WHO–China Joint Mission on COVID-19, NHCPRC reported that up until February 24th 2020 healthcare workers had been confirmed infected with COVID-19, with 22 (1.1%) deaths (8). Also, as of 8 April 2020, 22 073 cases of COVID-19 among HCWs from 52 countries had been reported to WHO. However, at the present time, there is no systematic reporting of HCW COVID-19 infections to WHO and therefore this number probably under-represents the true number of COVID-19 HCW infections globally (9).

According to a publication from China CDC, on 44 672 confirmed cases as of 17 February 2020 indicated 1688 (3.8%) infections were among HCWs, including five deaths.1 (10). In Italy, a situation report from 10 April 2020 reported 15 314 infections among HCW, representing 11% of all infections at that time (11).

Further publications have described the epidemiological and clinical characteristics of infections among HCWs. While many infections are indicated as mild, severe outcomes, including deaths, among HCWs have also been reported (12-16).

A survey by the Health Commission of Guangdong Province released information on the distribution of 2431 healthcare workers the Guangdong medical support teams. Nurses (w60%) were the predominant healthcare workers in the teams, followed by clinicians (w30%). Half of clinicians with job titles were deputy chief physician, and 25% specialized in respiratory and critical medicine (6). It is worth mentioning that 5.8% (140/2431) healthcare workers worked on the outbreak of severe acute respiratory syndrome in 2003(17).

However, to date there are a limited number of publications and national situation reports that provide information on the number of healthcare worker (HCW) infections. Understanding infection in HCWs is critical to informing the specific infection prevention and control measures needed to protect HCWs from infection (9). Especially in other low and middle-income countries with potential COVID-19 outbreaks, should learn early how to protect their healthcare workers (2).

This study aimed to Investigating the characteristics of employees with Covid19 among imam Reza hospital employees in Mashhad, that is largest hospital in east of Iran.

## Methods

The present study was a cross-sectional which conducted among the HCWs (>18 years of age) with acute respiratory symptoms in a single-center setting, who worked at the forefront to fight against COVID-19 since it outbreak.

The designated Hospital have 1800-bed and serving for the medical treatment in this outbreak, and is the biggest hospital in east of country. The total number of hospital staff is 4300, which includes 600 physician and 3700 other medical staff.

For the purposes of this study, the World Health Organization (WHO) definition of HCW was used which defines a HCW as any person whose main activities are aimed at enhancing health. This includes clinical staff (doctors, nurses, etc.), paramedical staff (radiographers, laboratory personnel, pharmacists, etc.), support staff (cleaners, orderlies, etc.) and administrative staff. The study was based on data from infected workers since the onset of the spread of COVID-19 to 20 April 2020.

HCWs in different departments were divided into two groups based on risk exposure. High-risk exposure was defined as the high-risk department (HRD) with interventional medical or surgical procedures that generate respiratory aerosols, including the respiratory department, infection department, ICU and surgical department. Other low-risk clinical departments were regarded as general departments (GD). Diagnosed cases of Covid19 infection was identified as outcome variables.

All individuals who were infected in the hospital at the time of the study from 19/02/2020 to 20/04/2020 and whose information was recorded in the software related to the registration of patient personnel were included in the study. This information includes the name and surname, department, contact number, age, sex, date of infection, symptoms, number of people involved in the family, use of personal protective equipment, job title. And the average working hours per week were examined in the recorded software. Data were collected through face-to-face and telephone interviews. During the interview, the staff was reminded that the results of this information will be used without mentioning the names of individuals in the study and verbal consent was obtained from individuals. Also, all the information of the people is at the disposal of the person in charge of following up the affairs of the affected employees and the people have been coded by them before entering the study and all the information has been used in the research without mentioning the name and national code. Also, patients who could not remember the answers to the questions were

excluded from the study.

### *Case definition*

The case with acute respiratory symptoms was defined by any or multiple of the present symptoms like cough, fever, beachy Pena, chest distress, headache, hemoptysis, others related to acute respiratory illness. All suspected cases were diagnosed with the test by PCR nucleic acid.

Needed data related to personnel were extracted from Employment Database and Hospital Information system (HIS).

Data collected from staff included: job title, Percentage of infected HCW by department, Percentage of patients in each job title, age, job years, Average daily working hours per month and Has anyone in their family had COVID-19 disease?

Also, Data about symptoms of the disease and having underlying illness and proper personal protective equipment (PPE) by telephone were asked of the affected HCW. It was tried to make people's information unrecognizable.

### *Statistical Analysis*

Continuous variables were described as mean (standard deviation) and median (interquartile range), while categorical variables were presented as Frequency (percentages). Statistical analyses were conducted using SPSS software (version 21.0).

$P$ -value  $< 0.05$  was considered to be statistically significant. The Chi-square test was used to investigate the relationship between the variables.

### **Results**

The total number of infected HCW were 170 by the end of MAY 2020, of which 167 (94.4%) were employed in the medical wards. 61% of them were women and the average age of employees were  $36.9 \pm 7.3$ . Out of 1445 personnel working in general wards, 107 (7.4%) became infected by COVID-19.

In total, out of 2195 people working in the two departments, 163 (7.4%) had coronary heart disease.

**Table 1.** Number and proportion of HCW with COVID19 in each job title

Job title	nurses	head nurses	health information management	nurse assistant	cleaner	total
Number of HCW with COVID19	93	9	2	31	19	154
Percent N; %	60.7%	7.4%	1.2%	19.0%	11.7%	100.0%
Total Number of HCW	1404	20	132	359	280	2195
Percent N; %	64.0%	.9%	6.0%	16.4%	12.8%	100.0%

The data show that of all employees with coronary artery disease, the largest group was nurses with 61%. (Nursing assistants (19%), cleaner (11.7%), head nurses (7.4%) and health information management experts (1.2%)).

Results of chi-square test showed that there was a statistically significant difference between the incidences in different occupational groups, ( $p < 0.001$ )

The mean (SD) work experience in the hospital was 7.1 (5.8) years, and the average working hours was 5.59 hours per day. Also, the 15% of people were in the special inpatient wards and 85% in inpatient wards. In the study of the presence of an underlying disease among patients, a total of 19.2% of these employees had underlying disease

in which they had the highest number of blood pressure (26.47%) and heart disease (23.53%).

Other characteristics of infected personnel are given in Table 2.

According to Table 2, the highest number of patients with COVID-19 among health care workers is related to nurse assistance (11%), and then nurses with 9%. And the lowest has been observed in para clinical staff (1%).

8% of the HCW were in inpatient wards and 4% were administrative staff. HCW with COVID-19 were more common in women than men.

Table 3 shows the use of personal protective equipment for employees with COVID-19 in their workplaces.

Table 2. Characteristics of infected HCW

Percentage of infected HCW by department					Average daily working hours per month	gender		Diagnosed family member Covid19	
Job title	HRD: high-risk department	GD: general department	age	Work Experience		male	female		
clinical staff	physician	1 (1.8%)	9 (7/8%)	47 ± 8.9	16.7 ± 5.4	5.5 ± 3.5	6 (60%)	4 (40%)	5 (71.4%)
	nurse	34 (5.38%)	59 (50.86%)	33.4 ± 6.8	7.8 ± 5.24	5.7 ± 4.9	36 (38.70%)	57 (61.30%)	29 (37.10%)
	head nurse	3 (5.77%)	6 (5.17%)	44.1 ± 5.2	16.7 ± 7.6	5.4 ± 3.8	1 (11.10%)	8 (88.9%)	3 (50%)
	supervisor	-	2 (1.72%)	46.5 ± 6.3	23.0 ± 5.65	4.9 ± 2.1	0 (0%)	2 (100%)	1 (50%)
	health information management	1 (1.8%)	1 (0/86%)	33.4 ± 6.11	4.8 ± 5.27	3.7 ± 1.9	1 (50%)	1 (50%)	1 (33.3%)
	paramedical staff	-	3 (%2.58)	35.8 ± 8.3	11.5 ± 5.28	4.6 ± 3.8	-	3 (37.5%)	3 (100%)
	nurse assistant	11 (21.15%)	21 (17.23%)	40.9 ± 5.58	6.77 ± 3.37	5.7 ± 4.1	12 (37.5%)	20 (62.5%)	7 (28%)
	cleaner	4 (7.69%)	15 (12.3%)	41.2 ± 6.34	5.8 ± 2.30	6.1 ± 5.2	11 (38.70%)	8 (42.1%)	1 (5.80%)
total clinical staff in department		54 (100%)	116 (100%)						
total clinical staff		54 (29.54%)	116 (63.38%)	36.7 ± 7.4	8.23 ± 5.81	5.6 ± 4.8	71 (41.76%)	99 (58.24%)	46 (33.58%)
non clinical staff (administrative staff)		13 (7.08%)		38.0 ± 5.43	6.2 ± 5.46	4.3 ± 3.9	4 (30.76%)	9 (69.23%)	2 (22.2%)

Table3. Frequency of use of personal protective equipment for employees with Covid19 in their workplaces.

department	PPE set	physician	Nurse	Head nurse	supervisor	HIM staff	paramedical staff	nurse assistant	cleaner	total(n)
HRD: high-risk department	mask N95 & gloves & full protection coveralls	-	20 (76.9%)	2 (100%)	1 (100%)	1 (100%)	-	10 (100%)	5 (16.7%)	39
	Operation mask & gloves	1 (100%)	6 (23.1%)	0 (0%)	0 (0%)	0 (0%)	-	0 (0%)	1 (83%)	8
GD: general department	mask N95& gloves & full protection coveralls	-	51 (76.1%)	5 (71.4%)	1 (100%)	3 (100%)	7 (87.5%)	17 (80.9%)	13 (100%)	99
	Operation mask& gloves	9 (100)	16 (23.9%)	2 (28.6%)	0 (0%)	0 (0%)	1 (12.5%)	4 (19.1%)	0 (0%)	31



### **PPE**

82% of infected HCW used individual protection set in the face of patients, which is 84% in HRD and 80% in GD.

### **Common symptoms**

Common symptoms were Sweating (91.1%), fever (84.93%), Cough (79.31%), gastrointestinal symptoms (78.77%), weakness and lethargy (71.92%), shortness of breath (68.49%), muscle pain (38.36%), headache (28.7%), loss of sense of smell and taste (20.69%), chest pain (11.64%) among the HCWs diagnosed with COVID-19.

### **Discussion**

Health care workers are always at the forefront of fighting epidemics in hospitals in times of crisis. Health workers play a critical role not only in the clinical management of patients but also in ensuring that adequate infection prevention and control measures are implemented in health care facilities (18). Although, nosocomial infections of respiratory infectious diseases are common to see between HCWs (19). In the early days of the covid19 outbreak, more than 3,000 medical workers in Hubei Province were infected, 40% in hospitals and 60% in communities (20).

This study was designated in imam Reza hospital in Mashhad, to determine COVID-19 cases among healthcare workers. According to the findings of the present study, more than 10% of physicians and about 28% of head nurses and supervisors, as well as about 10% of nurses caring for Covid19 patients were infected with this disease. Overall, 8.5 percent of clinical staff and 4% of administrative staff became infected with COVID-19. The lowest incidence was observed in the staff of para clinical departments (1%) and health information management staff (2%).

In the present study, the number of infected staff in nurses' staff (nurses, supervisors, head nurses, nurse assistants) was more than other staff. Fortunately, none of the staff died of COVID-19.

Infections in health-care workers have already been reported during COVID-19 outbreak in others countries too (21). According to China's National Health Commission reports, more than 3300

health-care workers have been infected as of early March and, according to local media, by the end of February at least 22 had died. In Italy, 20% of responding health-care workers were infected, and some have died (22).

As most of nurses' work involves direct contact with patients, they have high vulnerability to COVID-19, it is necessary to establish hospital-specific protocols to reduce the risk of nurses' infection in interactions with COVID-19 patients (23).

So, Additional precautions are required by health care workers especially nurses, to protect themselves and prevent transmission in the healthcare setting and COVID-19 was found linked with the exposed department and PPE use in this and the same study. Similar to our finding, previous researches have proved the higher susceptibility of respiratory infectious disease for HRD workers (24). This phenomenon has also been discovered in epidemics of SARS (25, 26). Similar to SARS, current evidence indicates that COVID-19 is primarily transmitted through respiratory droplets (27).

However, number of infected or dead health care worker from COVID-19 vary between countries due to the time of disease outbreak, differential public health resources, governmental policies and controls to enforce quarantine and social distancing, face mask wear, the amount of testing performed, ascertainment bias, available medical supplies and technology and social greeting habits (28).

Insufficient access to PPE for healthcare workers, according to the protocols of the World Health Organization, it is one of the risk factors that increase the probability of being exposed to the virus and infecting the health care worker with this disease. PPE shortages including medical masks and N95 respirators, have been widely reported in this pandemic (22, 29).

As the pandemic accelerates, access to personal protective equipment (PPE) for health workers, where the risk to healthcare workers is high, is a key concern (30). We speculated that HRD experienced more exposures, such as a higher

frequency of interventional medical operation and aerosol-generating procedure (31).

In view of the global PPE shortage, the following strategies can facilitate optimal PPE availability: Minimize the need for PPE, Ensure PPE use is rational and appropriate and Coordinate PPE supply chain management mechanisms (32).

At the start of SARS-CoV-2 infections in Iran there was not enough protection against infection (33).

However, our study and some of other studies such as Smith and Bartoszko in their study showed that Although N95 respirators appeared to have a protective advantage over surgical masks in laboratory settings, Low certainty evidence suggests that medical masks and N95 respirators offer similar protection against viral respiratory infection including coronavirus in healthcare workers during non-aerosol-generating care. Preservation of N95 respirators for high-risk, aerosol-generating procedures in this pandemic should be considered when in short supply (30, 34).

Also, According to the present study, in the inpatients departments where the rate of contact and closeness to patients was higher than in the administrative departments, the rate of hospital staff with covid19 was more, Which confirms the findings of the Chu study (35).

Common symptoms between HCW in this study were Sweating (91.1%), fever (84.93%), Cough (79.31%), these symptom are the same of Li Ran study findings that showed fever (85.71%) and cough (60.71%) were most common symptoms between HCW (19).

But is different from Chew study that showed commonly reported symptoms are headache, throat pain and lethargy (36).

Also, It was indicated that the HRD group had higher risk in developing COVID-19 compared with the GD group which is similar to Ran study (19).

Direct contact with infected people can easily transmit the virus. Despite having enough skill and knowledge, nurses in their exposures to infected patients can be affected very quickly (33).

nature of invasive patient care activities, such as intubation and other procedures that involve potential exposure to respiratory secretions, raise risk for healthcare workers working in ICUs (37).

Management of acute respiratory failure and hemodynamics is key. ICU practitioners, hospital administrators, governments, and policy makers must prepare for a substantial increase in critical care bed capacity, with a focus not just on infrastructure and supplies, but also on staff management. Critical care triage to allow the rationing of scarce ICU resources might be needed (38).

In the current situation, it seems useful to pay attention to the national and international recommendations and guidelines on how to better manage the various dimensions of the covid19 crisis at the level of health centers such as hospitals. Among the guidelines published in this regard, we can name the guidelines of the World Health Organization, such as WHO Critical preparedness, readiness and response actions for COVID-19 (39) and recommendations for Rational use of (PPE) for employees (32) and prevent and control nosocomial infections to HCW for the care of patients with COVID-19 (40), especially the intensive care units (41).

### **Limitations**

Potential unmeasured confounding, especially with regards to gender differences was possibly a limitation in our study. Also, Limitations lie in small sample size, single-center aspect, and less representative research subjects, making the results difficult to be generalized. A limitation of this study is that some data is retrospective; Recall bias on the part of the HCW is a possibility.

### **Conclusion**

Understanding COVID-19 infection among healthcare workers and risk factors for adverse outcomes not only to describe virus transmission patterns and infection risk factors, but also to prevent future infection of healthcare workers and other patients, to inform and update important infection prevention Is. and control measures at the health care facility and at the national level, and

are needed to reduce secondary transmission of COVID-19 in health care settings.

Overall, the study showed that HCWs worked in HRD had a higher risk of COVID-19. Higher risk with longer duty hours was found, especially in HRD. Frequent information and feedback sessions with local managers and the broader facility community, complemented by clear, concise, and measured communication, will help teams stay focused on care and secure in their roles.

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### Competing interests

The authors report no conflicts of interest.

### Authors' contributions

M. Y and S. F; designed the survey, analyzed data and wrote the manuscript, N. A and Z. E; collected data, and wrote the manuscript, S. F; edited the manuscript. All authors have read and approved the manuscript in its final form.

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