



## The Risk of Novel Coronavirus Infection among Healthcare Workers in a Therapeutic Center in Ardabil County, Northwest of Iran: A Descriptive Cross-Sectional Study (2021)

Somaieh Matin<sup>1</sup>, Mehdi Sarailoo<sup>2</sup>, Abdollah Dargahi<sup>3\*</sup>, Mehdi Vosoughi<sup>3\*</sup>, Helia Gholizadeh<sup>2</sup>, Abbas Abbasi-Ghahramanloo<sup>4</sup>

1. Assistant Prof, Dept. of Internal Medicine, Ardabil University of Medical Sciences, Ardabil, Iran.
2. BSc in Public Health, Students Research Committee, School of Public Health, Ardabil University of Medical Sciences, Ardabil, Iran.
3. Assistant Prof., Social Determinants of Health Research Center, Ardabil University of Medical Sciences, Ardabil, Iran.
4. Assistant Prof., Dept., of Public Health, School of Health, Ardabil University of Medical Sciences, Ardabil, Iran.

 **Citation:** Matin S, Sarailoo M, Dargahi A, Vosoughi M, Gholizadeh H, Abbasi-Ghahramanloo A. The Risk of Novel Coronavirus Infection among Healthcare Workers in a Therapeutic Center in Ardabil County, Northwest of Iran: A Descriptive Cross-Sectional Study (2021). *J Occu Health Epidemiol* 2021; 10(4):282-7.

### Article Info

\* **Corresponding author:**  
Abdollah Dargahi,  
Mehdi Vosoughi,  
**E-mail:**  
a.dargahi29@yahoo.com  
mvn\_20@yahoo.com

**Article history**  
**Received:** Aug 2021  
**Accepted:** Nov 2021

 10.52547/johe.10.4.282

**Print ISSN:** 2251-8096  
**Online ISSN:** 2252-0902

Peer review under  
responsibility of Journal of  
Occupational Health and  
Epidemiology

### Abstract

**Background:** Coronaviruses (CoVs) belong to the family Coronaviridae, the order Nidovirales, and the genus Coronavirus. This research aimed to assess the risk of infection with SARS-CoV-2 (COVID-19) among healthcare workers at Imam Khomeini Hospital, Ardabil County, Northwest of Iran.

**Materials and Methods:** In this descriptive cross-sectional study, 201 health care workers of Imam Khomeini hospital were recruited. The questionnaire included demographic information (including age, gender, height, and weight items) and information about job and working conditions, the degree of exposure to people suspected of having the disease, and the degree of compliance with health protocols.

**Results:** The mean age of the healthcare workers (HCWs) was  $34.37 \pm 7.42$  years. In terms of job distribution, most of the HCWs were nurses (57.2%), and only 4.5% were experts. Regarding blood groups, most of the HCWs had the O+ blood group (35.3%). Besides, the PCR results showed that 85.1% of the HCWs had a positive PCR result, and 14.9% were negative.

**Conclusion:** In general, nurses were the most at-risk group among HCWs. This is because they were more frequently in direct contact with patients than other staff members.

**Keywords:** Health Care Workers, Coronaviruses, Hospital, Nurses.

### Introduction

Today, the severe acute respiratory syndrome coronavirus (SARS-COV-2), which causes COVID-19, has turned into a global concern [1, 2]. The disease appeared in China and spread to other countries, which turned into a pandemic. Until now (11 November 2021), COVID-19 has infected 250.6 million individuals and killed 5.07 million persons worldwide. In Iran, 5.99 million persons have been infected with it, and 127.299 persons have died from COVID-19 [3]. In fact, this outbreak

has been existing since the beginning of the pandemic in all countries, even in those with ideal health and political conditions [4, 5]. This virus enters cells inside the lungs, including pneumocytes, and uses them as the main sites of inflammation [6, 7]. The main symptoms of COVID-19 have been reported to be fever, dry cough, shortness of breath, nausea, vomiting, abdominal discomfort, and diarrhea, not being very typical in this disease [8-10]. Few studies have shown that COVID-19 can transmit from one human to another

through respiratory fomites, coughs, or sneezing [11-13]. In addition, some studies have reported airborne transmission of the disease, yet it has not been proved [14, 15].

The incubation period of COVID-19 is from 2 to 10 days, with the major way of transmitting this virus being person-to-person contact [16-18]. Now, using effective vaccines, upon acceleration of vaccine approvals, and through speedy distribution of vaccines, diagnosing the disease takes a shorter time. Besides, long-term outcomes have not been identified [19]. However, it should be mentioned that despite progresses made in the vaccination process, there is still no effective medicine and treatment identified for this disease. Thus, it is crucial for individuals to follow health instructions [20]. HCWs are at a high risk of infection with COVID-19 [21, 22]. Nurses are among the largest care communities during the outbreak of infectious diseases, being at the forefront of patient care. Thus, they are faced with the highest risk of death [23]. Besides, since HCWs and nurses are more exposed to the virus, they can carry and transfer it to the family and coworkers, or both [24, 25]. Herron et al (2020) conducted a study to investigate the use of protective equipment and its correlation with the risk of COVID-19 contraction. Accordingly, the test results of 10.627 healthcare workers in Italy were positive, and 34 of them died, indicating a mortality rate of 0.3%. Besides, they stated that the Italian officials announced the mortality rate was higher, which was not accurately notified due to some restrictions. According to the results of this study, the most worrisome statistic was the increase in the number of deaths among the healthcare professionals [26].

Since the data on the infection risk among healthcare workers are limited, and healthcare workers are at the forefront of the fight against COVID-19, there is an urgent need for new studies to be conducted on this disease [1]. Accordingly, this research was conducted to assess the risk of infection with SARS-CoV-2 (COVID-19) among HCWs at Imam Khomeini Hospital in the Ardabil County. Against this backdrop, health conditions of all employees, including specialists, experts, nurses, and service personnel are examined in this study.

## Materials and Methods

In this descriptive cross-sectional study, the target community included the HCWs of Imam Khomeini Hospital in the Ardabil County. Accordingly, it was conducted in 2021 in Imam Khomeini Hospital in

the Ardabil County. Given that Imam Khomeini Hospital is one of the major hospitals in the Ardabil County for hospitalizing COVID-19 patients, the treatment staff of this hospital were examined in the present study. This study is extracted from the research project approved by the Student Research Committee, School of Public Health, Ardabil University of Medical Sciences, Ardabil, Iran (IR.ARUMS.REC.1399.353).

The statistical population of this study included healthcare workers of Imam Khomeini Hospital in the Ardabil County. To this end, we used questionnaires that included demographic information on variables, such as age, gender, clinical symptoms, underlying diseases, types of drugs used, smoking, occupation, hours of work, number of daily clients, use of masks or shields, types of working hours, weight, height, body mass index, number of family members, place of residence, persons' role in the family, presence of an infected person in the family, communication with the person suspicious of the disease, and observance or non-observance of health protocols. After completing the relevant information, the data were sorted by statistical analysis in SPSS V.20.0, with their significance or non-significance determined. A p-value > 0.05 was considered statistically significant. In case of any problems in some parts of the questionnaire, such as being empty or illegible, the patient would be contacted to complete the relevant parts by observing ethical protocols. The inclusion criteria were giving consent to participation in the study and definitive diagnosis of COVID-19 based on the CT scan or a PCR test for 201 staff members of the mentioned hospital. The exclusion criteria included incorrect or incomplete registration of the HCWs' information in the system, patients hospitalized for reasons other than COVID-19, and HCWs who, at the time of admission, stated they would not like their data to be used. To estimate crude odds ratios and adjusted ones, univariate and multiple logistic regression models were used, respectively. Besides, the Hosmer-Lemeshow guideline was used to select variables in a multiple model.

## Results

The results showed that the mean age of the HCWs was 34.37, with a standard deviation of 7.42 years. Besides, 145 (72.1%) HCWs were female, and 56 (27.9%) were male. In this study, only 1.5% of the HCWs had a smoking history. In terms of job distribution, most of the HCWs were nurses (57.2%), and only 4.5% were hospital experts. Regarding the blood group, most of the

HCWs had an O+ blood group (35.3%). The following table shows the HCWs' demographic distribution (Table 1). Data analysis results showed that from all HCWs at the risk of COVID-19, 115 (57.2%) were nurses, and only 9 (4.5%) were

hospital experts (Table 1). In terms of the certainty of the disease, the PCR test results showed that the disease was confirmed in 171 (85.1%) HCWs (Table 2).

**Table 1.** Frequency data of HCWs at Imam Khomeini Hospital, Ardabil County

Variable		Frequency N(%)	Variable		Frequency N(%)
Gender	Man	56 (27.9)	Education	High school diploma and lower	43 (21.4)
	Female	145 (72.1)		Bachelor's degree and higher	158 (78.6)
Shift work	Fixed	46 (22.9)	PCR results	Positive	171 (85.1)
	Rotating shift	155 (77.1)		Negative	30 (14.9)
Job type	Hospital employees	30 (14.9)	Blood group type	A+	54 (26.9)
	Hospital experts	9 (4.5)		A-	6 (3.0)
	Nurses	115 (57.2)		B+	33 (16.4)
	Active nurses	25 (12.4)		B-	12 (6.0)
	Service personnel	22 (10.9)		AB+	19 (9.5)
			O+	71 (35.3)	
			O-	6 (3.0)	

Table 2 shows distribution of the factors associated with COVID-19 among the HCWs infected with COVID-19 at Imam Khomeini Hospital, Ardabil County.

Besides, Table 2 shows the results of underlying diseases and symptoms of the disease in the HCWs infected with COVID-19 at Imam Khomeini Hospital, Ardabil County. According to the results, only 23.4% of the the HCWs had underlying diseases, yet 76.6% did not have any underlying

diseases (Table 2). In addition, 91% of the HCWs had symptoms of the disease.

Table 2 shows CT scan results of the HCWs infected with COVID-19 at Imam Khomeini Hospital, Ardabil County. According to the results, only 51.7% of the CT scan tests of the infected HCWs were positive (Table 2).

The following table shows the effect of various factors on the result of the PCR test being positive.

**Table 2.** Distribution of factors associated with Covid-19 disease among HCWs infected with COVID-19 at Imam Khomeini Hospital, Ardabil County

Variable		Frequency N (%)	Variable		Frequency N(%)
Having an underlying disease	Yes	47 (23.4)	CT scan result	Positive	104 (42.8)
	No	154 (76.6)		Negative	86 (51.7)
Symptoms of the disease	Yes	183 (91)		Suspicious	11 (5.5)
	No	18 (9)			

**Discussion**

The world was taken by surprise by the acute respiratory syndrome coronavirus 2 and the disease in December 2019 [27]. The new variants have appeared, which are more powerful, with their transmission rate being by 70% higher in some variants than in other strains [28]. Besides, given that nurses and HCWs are at the forefront of healthcare and social care systems (29), and considering that other studies indicate that HCWs are at a high risk of COVID-19 contraction [30], we

easily feel the need for more studies of this kind. Unfortunately, in some countries like Italy, HCWs have experienced high rates of COVID-19 contraction and death [31]. The prevalence of COVID-19 depends on many factors. For example, some studies show that its prevalence has a high correlation with the availability of personal protective equipment (PPE), access to testing facilities, and the type of the healthcare system [27, 32]. However, the infection rate is at an all-time high level in certain countries because of the

COVID-19 pandemic. As a result, senior HCWs, especially doctors and nurses, have been forced to join the frontline workers, and some of them have been back from retirement to provide leadership, experience, and expertise to other professionals so as to raise their morale. Health disorders and risk factors related to COVID-19 include high blood pressure, immunosuppression, chronic lung diseases, diabetes mellitus, and old age, whose effects have been significant [33, 34]. According to our results, about 23.4% of the HCWs had an underlying disease that could be effective in making them vulnerable to COVID-19. Given the high prevalence of COVID-19 contraction among the HCWs, they should use some simple methods, like practicing hand hygiene and social distancing, during their work shifts (rotating and non-rotating) to better take care of themselves and the community [35]. According to our results, among all HCWs, nurses were the most at-risk group, which could be due to their face-to-face interaction with patients. In addition, based on the frequency and percentage of COVID-19 patients in the present study and other similar studies [1], the number of the infected people (relative to the population) was more in nurses than in other healthcare workers. Yuanyuan et al (2020) reported that many factors, such as long working hours increased stress and anxiety among nurses, which predisposed them to a high infection risk [36]. Our results showed that the CT scan test could not be very reliable, for the infection was diagnosed by the CT scan test only in 51.7% of the infected HCWs. In a study by Poortahmasebi et al (2020), they suggested that the CT scan should be used for symptomatic and hospitalized patients, not as a primary screening tool for diagnosing COVID-19 [37]. In the case of the PCR test, our data showed that the accuracy of this test was 85.1%, having been helpful for COVID-19 screening. However, in the study by Long et al (2020), different results were obtained so that they reported PCR tests could produce false negative results [38]. Our data analysis showed that only 23.4% of the HCWs had underlying diseases, with most of the diseases having been diabetes and asthma. This was because asthma has a very close connection with the respiratory system, so this underlying disease could be detected among HCWs. Besides, many studies showed that diabetes is one of the most dangerous underlying diseases for COVID-19. Regarding blood groups, most of the HCWs had the O+ blood group (35.3%), which indicated two different facts. Firstly, the majority of the HCWs had this type of blood group, and secondly, the O+ blood group was the most at-risk blood group in the case of COVID-19

contraction. This finding was consistent with those of the study by Sarailoo et al. In the study by Sarailoo et al, people of different occupations in the community were examined. Accordingly, the results showed that the highest probability of COVID-19 contraction in the people of the community was related to positive blood groups O+ and A+ [30]. We suggest that HCWs have a fixed work location at a medical center. In this regard, the study by McMichael et al reported that the temporal and geographical transmission of the disease was partially due to the movement of HCWs from one facility to another [39]. One way to reduce the mortality rate among healthcare workers is to involve people over the age of 50 in administrative capacities rather than in direct patient care activities [40, 41].

### Conclusion

Unfortunately, the prevalence of positive COVID-19 among HCWs is on the rise day by day all over the world. Hence, health systems should take an efficient decision on taking care of HCWs and providing them with high quality PPE by taking into consideration the results of the present study, including reliability of the CT scan and PCR tests. We also suggest that to accurately monitor the infection of HCWs with COVID-19, PCR tests be used more than CT scans. Besides, underlying diseases are not very effective in COVID-19 contraction. However, for HCWs with underlying diseases, it is better to change their type of tasks. This study can be used as a reference for research on COVID-19 in HCWs.

### Acknowledgement

The authors would like to express their gratitude to the research deputy of Ardabil University of Medical Sciences for financially supporting this research (IR.ARUMS.REC.1399.353).

**Conflict of interest:** None declared.

### References

1. Nguyen LH, Drew DA, Graham MS, Joshi AD, Guo CG, Ma W, et al. Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *Lancet Public Health* 2020; 5(9):e475-83.
2. Karami C, Normohammadi A, Dargahi A, Vosoughi M, Zandian H, Jeddi F, et al. Investigation of SARS-CoV-2 virus on nozzle surfaces of fuel supply stations in North West of Iran. *Sci Total Environ* 2021; 780:146641.

3. Abedi V, Olulana O, Avula V, Chaudhary D, Khan A, Shahjouei S, et al. Racial, Economic, and Health Inequality and COVID-19 Infection in the United States. *J Racial Ethn Health Disparities* 2021; 8(3):732-42.
4. Cassan G, Van Steenvoort M. Political regime and COVID 19 death rate: Efficient, biasing or simply different autocracies? An econometric analysis. *SSM Popul Health* 2021; 16:100912.
5. Dargahi A, Jeddi F, Vosoughi M, Karami C, Hadisi A, Ahamad Mokhtari S, et al. Investigation of SARS CoV-2 virus in environmental surface. *Environ Res* 2021; 195:110765.
6. Hamming I, Timens W, Bulthuis ML, Lely AT, Navis G, van Goor H. Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis. *J Pathol* 2004; 203(2):631-7.
7. Dargahi A, Jeddi F, Ghobadi H, Vosoughi M, Karami C, Sarailoo M, et al. Evaluation of masks' internal and external surfaces used by health care workers and patients in coronavirus-2 (SARS-CoV-2) wards. *Environ Res* 2021; 196:110948.
8. Bai Y, Yao L, Wei T, Tian F, Jin DY, Chen L, et al. Presumed Asymptomatic Carrier Transmission of COVID-19. *JAMA* 2020; 323(14):1406-7.
9. Kotfis K, Skonieczna-Żydecka K. COVID-19: gastrointestinal symptoms and potential sources of SARS-CoV-2 transmission. *Anaesthesiol Intensive Ther* 2020; 52(2):171-2.
10. Karami C, Dargahi A, Vosoughi M, Normohammadi A, Jalali F, Asghariazar V, et al. SARS-CoV-2 in municipal wastewater treatment plant, collection network and hospital wastewater. *Environ Sci Pollut Res Int* 2021:1-9.
11. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg* 2020; 76:71-6.
12. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med* 2020; 382(16):1564-7.
13. Zandian H, Alipouri Sakha M, Nasiri E, Zahirian Moghadam T. Nursing work intention, stress, and professionalism in response to the COVID-19 outbreak in Iran: A cross-sectional study. *Work* 2021; 68(4):969-79.
14. Morawska L, Tang JW, Bahnfleth W, Bluysen PM, Boerstra A, Buonanno G, et al. How can airborne transmission of COVID-19 indoors be minimised? *Environ Int* 2020; 142:105832.
15. Lewis D. Is the coronavirus airborne? Experts can't agree. *Nature* 2020; 580(7802):175.
16. Meiramkulova K, Devrishov D, Zhumagulov M, Arystanova S, Karagoishin Z, Marzanova S, et al. Performance of an Integrated Membrane Process with Electrochemical Pre-Treatment on Poultry Slaughterhouse Wastewater Purification. *Membranes (Basel)* 2020; 10(10):256.
17. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The Incubation Period of Coronavirus Disease 2019 (COVID-19) from Publicly Reported Confirmed Cases: Estimation and Application. *Ann Intern Med* 2020;172(9):577-82.
18. Zandian H, Sarailoo M, Dargahi S, Gholizadeh H, Dargahi A, Vosoughi M. Evaluation of knowledge and health behavior of University of Medical Sciences students about the prevention of COVID-19. *Work* 2021; 68(3):543-9.
19. Shoenfeld Y. Corona (COVID-19) time musings: Our involvement in COVID-19 pathogenesis, diagnosis, treatment and vaccine planning. *Autoimmun Rev* 2020; 19(6):102538.
20. Sharma SN, Singh SK. Challenges and Threats due to Deadly Corona Virus in India and Dealing it with Social Vaccine (distancing) - the Only Weapon. *J Commun Dis* 2020; 52(1):7-13.
21. Lighter J, Phillips M, Hochman S, Sterling S, Johnson D, Francois F, et al. Obesity in Patients Younger Than 60 Years Is a Risk Factor for Covid-19 Hospital Admission. *Clin Infect Dis* 2020; 71(15):896-7.
22. Nicola M, O'Neill N, Sohrabi C, Khan M, Agha M, Agha R. Evidence based management guideline for the COVID-19 pandemic-Review article. *Int J Surg* 2020; 77:206-16.
23. Choi KR, Skrine Jeffers K, Cynthia Logsdon M. Nursing and the novel coronavirus: Risks and responsibilities in a global outbreak. *J Adv Nurs* 2020; 76(7):1486-7.
24. Shah ASV, Wood R, Gribben C, Caldwell D, Bishop J, Weir A, et al. Risk of hospital admission with coronavirus disease 2019 in healthcare workers and their households: nationwide linkage cohort study. *BMJ* 2020; 371:m3582.
25. Zandian H, Sharghi A, Moghadam TZ. Quality of work life and work-family conflict: a cross-sectional study among nurses in teaching hospitals. *Nurs Manag (Harrow)* 2020. doi:10.7748/nm.2020.e1881.
26. Herron JBT, Hay-David AGC, Gilliam AD, Brennan PA. Personal protective equipment and Covid 19-a risk to healthcare staff? *Br J Oral Maxillofac Surg* 2020; 58(5):500-2.
27. Zahirian Moghadam T, Pourfarzi F, Karami C, Rahimpouran S, Zandian H, Dargahi A. The Effect of Working-based Individual Protective Behaviors (WIPB) on COVID-19 Mortality in North-West of Iran: A Case-Control Study. *J Occu Health Epidemiol* 2021; 10(3):158-68
28. Kirby T. New variant of SARS-CoV-2 in UK causes surge of COVID-19. *Lancet Respir Med* 2021; 9(2):e20-1.
29. Maben J, Bridges J. Covid-19: Supporting nurses' psychological and mental health. *J Clin Nurs* 2020; 29(15-16):2742-50.

30. Sarailoo M, Matin S, Vosoughi M, Dargahi A, Gholizadeh H, Damavandi MR, et al. Investigating the relationship between occupation and SARS-CoV2. *Work* 2021; 68(1):27-32.
31. Ranney ML, Griffeth V, Jha AK. Critical Supply Shortages - The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. *N Engl J Med* 2020; 382(18):e41.
32. Fraher EP, Pittman P, Frogner BK, Spetz J, Moore J, Beck AJ, et al. Ensuring and Sustaining a Pandemic Workforce. *N Engl J Med* 2020; 382(23):2181-3.
33. Jordan RE, Adab P, Cheng KK. Covid-19: risk factors for severe disease and death. *BMJ* 2020; 368:m1198.
34. Mhango M, Dzobo M, Chitungo I, Dzinamarira T. COVID-19 Risk Factors among Health Workers: A Rapid Review. *Saf Health Work* 2020; 11(3):262-5.
35. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus–Infected Pneumonia in Wuhan, China. *JAMA* 2020; 323(11):1061-9.
36. Moosavi S, Lai CW, Gan S, Zamiri G, Akbarzadeh Pivehzhani O, Johan MR. Application of Efficient Magnetic Particles and Activated Carbon for Dye Removal from Wastewater. *ACS Omega* 2020; 5(33):20684-97.
37. Poortahmasebi V, Zandi M, Soltani S, Jazayeri SM. Clinical Performance of RT-PCR and Chest CT Scan for COVID-19 Diagnosis; A Systematic Review. *Front Emerg Med* 2020; 4(2s):e57.
38. Long C, Xu H, Shen Q, Zhang X, Fan B, Wang C, et al. Diagnosis of the Coronavirus disease (COVID-19): rRT-PCR or CT? *Eur J Radiol* 2020; 126:108961.
39. McMichael TM, Currie DW, Clark S, Pogosjans S, Kay M, Schwartz NG, et al. Epidemiology of Covid-19 in a Long-Term Care Facility in King County, Washington. *N Engl J Med* 2020; 382(21):2005-11.
40. Gómez-Ochoa SA, Franco OH, Rojas LZ, Raguindin PF, Roa-Díaz ZM, Wyssmann BM, et al. COVID-19 in Health-Care Workers: A Living Systematic Review and Meta-Analysis of Prevalence, Risk Factors, Clinical Characteristics, and Outcomes. *Am J Epidemiol* 2021; 190(1):161-75.
41. Groenewold MR, Burrer SL, Ahmed F, Uzicanin A, Free H, Luckhaupt SE. Increases in Health-Related Workplace Absenteeism among Workers in Essential Critical Infrastructure Occupations During the COVID-19 Pandemic—United States, March–April 2020. *MMWR Morb Mortal Wkly Rep* 2020; 69(27):853-8.