ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Evaluations of Risk Factors Related to Covid-19 Disease in Healthcare Professionals

Sağlık Çalışanlarında Covid-19 Hastalığına Bağlı Risk Faktörlerinin Değerlendirilmesi

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ABSTRACT

Aim: The most prominent victims of the Covid-19 pandemic are healthcare workers. The increasing workload in hospitals and daily exposure to a disease factor threaten the health of healthcare professionals and the community. With this study, we aimed to investigate the risk factors in terms of infection of healthcare workers who are exposed to the disease during the health service delivery to Covid-19 patients, and whether current infection control measures are effective.

Materials and Methods: A case-control study was conducted with a questionnaire for healthcare workers diagnosed with Covid-19 and non-infected healthcare workers working in a Fatih Sultan Mehmet Training and Research Hospital in Istanbul in Istanbul.

Results: In the study in which 127 healthcare workers participated, the average duration of experience in the profession was found to be higher in cases compared to controls (p = 0.011). The rate of taking prophylactic drugs after high-risk exposure to Covid-19 patients was significantly higher in the case group compared to controls (p=0,001).

Conclusion: Healthcare workers with more experience in the profession appear to be at greater risk of Covid-19 infection and high-risk unprotected exposure may be associated with higher infection rates. Three days of prophylactic hydroxychloroquine after high-risk contact with a Covid-19 patient is not effective in preventing the disease.

Keywords: Covid-19, healthcare workers, risk factors, infection control, personal protective equipment

ÖZ

Amaç: Covid-19 pandemisinin en belirgin mağdurları sağlık çalışanlarıdır. Hastanelerde artan iş yükü ve her gün bir hastalık etkenine maruz kalmak, sağlık çalışanlarının ve toplumun sağlığını tehdit etmektedir. Bu çalışma ile Covid-19 hastalarına sağlık hizmeti sunumu sırasında hastalığa maruz kalan sağlık çalışanlarının enfeksiyon açısından risk faktörlerini ve mevcut enfeksiyon kontrol önlemlerinin etkili olup olmadığını araştırmayı amaçladık.

Gereç ve Yöntemler: İstanbul Fatih Sultan Mehmet Eğitim ve Araştırma Hastanesi'nde çalışan Covid-19 tanılı sağlık çalışanlarına ve enfekte olmayan sağlık çalışanlarına anket ile vaka kontrol çalışması yapılmıştır.

Bulgular: Çalışmaya 127 sağlık çalışanı katıldı. Meslekte ortalama deneyim süresi vaka grubunda daha yüksek bulundu (p = 0.011). Covid-19 hastalarına yüksek riskli maruziyet sonrası profilaktik ilaç alma oranı kontrollere göre vaka grubunda anlamlı olarak daha yüksekti (p=0,001).

Sonuç: Meslekte daha fazla deneyime sahip sağlık çalışanları, Covid-19 enfeksiyonu riski altında görünmektedir ve yüksek riskli korunmasız maruziyet, daha yüksek enfeksiyon oranları ile ilişkili olabilir. Covid-19 hastasıyla yüksek riskli temastan sonra üç günlük profilaktik hidroksiklorokin, hastalığı önlemede etkili değildir.

Anahtar Kelimeler: Covid-19, sağlık çalışanları, risk faktörleri, enfeksiyon kontrolü, kişisel koruyucu ekipman

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Introduction

The new type of coronavirus, which emerged in Wuhan, China, in December 2019, spread worldwide. In March 2020, World Health Organization (WHO) declared a pandemic, and the disease was named “Covid-19” disease (1). It is thought to be transmitted by fluids, through contaminated surfaces, or with direct contact (2,3). It is important to evaluate the risk factors for Covid-19 disease of healthcare workers (HCW) who come into contact with Covid-19 patients and are exposed to the disease agent, to detect the transmission method of the virus and to prevent future infections of healthcare workers and hospital-acquired virus spread (4). It is supported by studies that, the use of personal protective equipment (PPE) and education on infection control measures reduce the infection spread and certain types of exposure (endotracheal intubation, aspiration, etc.) increase the risk of infection 5. Demographic characteristics of HCW, working conditions at workplaces, training, and practices regarding infection control measures, and pre-existing diseases are potential risk factors.

In this study, we aim to evaluate the risk factors for transmission of infection among HCWs who come into contact with Covid-19 patients and are exposed to the virus. In addition, the effectiveness of current infection control measures as a secondary goal was examined.

Material and Methods

Our study was conducted as a single-center, case-control study comparing healthcare workers exposed to Covid-19 patients with and without a diagnosis of Covid-19 disease, in the form of a survey study. During the Covid-19 pandemic period, between March-July 2020, healthcare workers in the İstanbul Fatih Sultan Mehmet Training and Research Hospital, who were exposed to Covid-19 patients and to surfaces contaminated by patients' secretions and diagnosed with Covid-19 disease and agreed to be volunteers were included in the study. The number of cases was determined according to the number of HCWs diagnosed with Covid-19 during the study period. The number of controls was determined according to WHO's case-control study protocol. It was targeted to include at least two controls for each number of cases 4. The control group was formed by a random matching method from HCW who worked under the same conditions and status as the case group and who did not have an infection in the specified period.

Contact with a suspected or confirmed Covid-19 patient for more than 15 minutes or contact with their belongings is defined as “exposure”. The case group consisted of HCWs who were working in the Fatih Sultan Mehmet Training and Research Hospital during the study period and were involved in the treatment of pandemic patients. In our study, cases with positive Covid-19 PCR test results or cases diagnosed as Covid-19 with lung imaging findings and clinical symptoms are included in the scope of confirmed Covid-19 cases. The control group consisted of HCW who were actively working in the same hospital during the pandemic period and in contact with the same group of patients who did not have Covid-19 disease. Those who did not give consent to participate in the study and those who had missing data were excluded from the study. Those who were determined as a case in the study and described a close contact with a confirmed Covid 19 outside of work within 14 days were also excluded from the study. To be used in our study, a unique questionnaire was prepared again, based on the questionnaire questions in the WHO's case-control study protocol (4).

NCSS (Number Cruncher Statistical System) program was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, percentage, minimum, maximum) were used while evaluating the study data. The conformity of the quantitative data to the normal distribution was made using the Shapiro-Wilk test and graphical examinations. Student-t-test was used to compare two groups of normally distributed quantitative variables, and Mann-Whitney U was used to compare two groups of non-normally distributed quantitative variables. Pearson chi-square test, Fisher's exact test, and Fisher-Freeman-Halton exact test were used to compare qualitative data. Statistical significance was accepted as $p<0.05$.

Approval for the study was obtained with the permission of the Ministry of Health Covid-19 Scientific Research Platform with the number x-2020-06-18T16_35_47.xml and the permission of the Clinical Research Ethics Committee of Fatih Sultan Mehmet Training and Research Hospital, numbered 2020/13.

Results

The study was conducted between 10 July and 30 August 2020 in Fatih Sultan Mehmet Training and Research hospital with 127 participants. Of these, 43 were cases diagnosed with Covid-19, and 84 were healthy participants. Eight of the participants, identified as cases, were excluded from the study because Covid-19 was detected in one of the households 14 days before the diagnosis of the disease. The final total number of cases was 35 and the number of controls was 84.

The distribution of the descriptive characteristics of the participants is shown in Table 1. Of the 119 participants, 62% (n=74) were female and 38% (n=45) were male. The mean age of the HCW participating in the study was 31.78±7.66 years. There was no statistically significant difference

between the age and gender distributions of the cases according to the groups (p>0.05).

			Groups		
		Total	Cases (n=35)	Control (n=84)	P value
Age	*Min-Max (Median)*	20-54 (30)	20-52 (34)	20-54 (29)	[a]***0,055***
	Mean±Sd	31,78±7,66	33,91±7,88	30,89±7,43	
	<35 Age	80 (67,2%)	19 (54,3%)	61 (72,6%)	[b]***0,052***
	≥35 Age	39 (32,8%)	16 (45,7%)	23 (27,4%)	
Gender	**Female**	74 (62,2%)	24 (68,6%)	50 (59,5%)	[b]***0,354***
	Male	45 (37,8%)	11 (31,4%)	34 (40,5%)	
Educational level	**Primary**	15 (12,6%)	7 (20,0%)	8 (9,5%)	[b]***0,291***
	High school	19 (16,0%)	5 (14,3%)	14 (16,7%)	
	University	85 (71,4%)	23 (65,7%)	62 (73,8%)	
Job in hospital	**Physician**	32 (26,9%)	7 (20,0%)	25 (29,8%)	[b]***0,477***
	Nurse	47 (39,5%)	14 (40,0%)	33 (39,3%)	
	Other	40 (33,6%)	14 (40,0%)	26 (31,0%)	
Hospital unit	**Emergency&Surgical**	91 (76,5%)	28 (80,0%)	63 (75,0%)	[b]***0,558***
	Internal Medicine&Others	28 (23,5%)	7 (20,0%)	21 (25,0%)	
Hospital unit	**Emergency Medicine**	51 (42,9%)	16 (45,7%)	35 (41,7%)	[b]***0,684***
	All other units	68 (57,1%)	19 (54,3%)	49 (58,3%)	
Length of employment in profession	*Min-Max (Median)*	0,25-30 (5)	0,5-30(6,5)	0,25-29 (4)	[d]***0,011****
	Mean±Sd	7,16±6,38	8,79±6,39	6,48±6,28	
Length of employment in the hospital	*Min-Max (Median)*	0,1-25 (3)	0,5-20 (5)	0,1-25 (3)	[d]***0,053***
	Mean±Sd	4,78±4,35	5,44±3,92	4,51±4,51	
Daily working time	**≤12 hours**	72 (60,5%)	23 (65,7%)	49 (58,3%)	[b]***0,453***
	>12 hours	47 (39,5%)	12 (34,3%)	35 (41,7%)	
Monthly working hours during the pandemic	**≤160 hours**	37 (31,1%)	10 (28,6%)	27 (32,1%)	[c]***0,673***
	160-200 hours	57 (47,9%)	16 (45,7%)	41 (48,8%)	
	≥200 hours	25 (21,0%)	9 (25,7%)	16 (19,0%)	
Special education on health care for Covid-19 patients	**Yes**	56 (47,1%)	15 (42,9%)	41 (48,8%)	[b]***0,553***
	No	63 (52,9%)	20 (57,1%)	43 (51,2%)	
Education on infection control measures	**Yes**	84 (70,6%)	24 (68,6%)	60 (71,4%)	[b]***0,755***
	No	35 (29,4%)	11 (31,4%)	24 (28,6%)	
Training on the use of personal protective equipment	**Yes**	105(88,2%)	30 (85,7%)	75 (89,3%)	[e]***0,550***
	No	14 (11,8%)	5 (14,3%)	9 (10,7%)	
Type of training received on the use of personal protective equipment	**Narrative**	71 (67,0%)	18 (60,0%)	53 (69,7%)	[b]***0,337***
	Training with video	56 (52,8%)	16 (53,3%)	40 (52,6%)	[b]***0,948***
	Practical training	25 (23,6%)	5 (16,7%)	20 (26,3%)	[b]***0,292***

[a]*Student-t Test* [b]*Pearson Chi-Square Test* [c]*Fisher Freeman Halton Test*
[d]*Mann Whitney U Test* [e]*Fisher's Exact Test *p<0,05*

Table 1. *Distribution of descriptive characteristics of the groups*

While the average professional experience period of the group was 8.79 years in the case group, it was determined as 6.48 years in the control group. The total working time of the case group was higher than the control group, and a statistically significant difference was found (p=0.011; p<0.05). In the case group, the working duration at the hospital of the cases was also higher (although not statistically significant) compared to the participants in the control group (5.44 years in the case group, 4.51 years in the control group; p=0.053; p>0.05). The comparisons of the questions in which the rate of compliance with the practices related to infection control measures are shown in Table 2. There was no statistical difference between the participants in terms of applying infection control measures and using PPE when necessary (p>0.05). The comparison of the case and control groups in terms of exposure and contact characteristics of Covid-19 patients is shown in Table 3. There was no statistical difference between the case and control groups in terms of compliance with the precautions related to infection control (p values are given in Table 3). Participants were compared in terms of chronic disease, continuous drug use, smoking, and prophylactic drug use after exposure to Covid-19 patients. 83% of the participants did not have any chronic disease and 84% of the participants did not use any medication. Twentyseven people stated that they had a chronic disease. Of them, 7 had asthma, and 7 had hypertension or heart disease. 23% of the case group and14% of the control group had a chronic disease. However, there is no significant difference between the groups (p:0.255). While the rate of continuous use of any drug was 26% in the case group, it was 12% in the control group, but it was not found to be statistically significant (p:0.061). The rate of cigarette or other tobacco products used was 32% in total, and there was no difference between the case and control groups (p>0.05). 34% of the patients declared that they had used prophylactic drugs (Hydroxychloroquine was advised by the Turkish Ministry of

Health guidelines at that time) after exposure to Covid-19 patients in the case group.

		Total	Group		P value
			Cases (n=35)	Control (n=84)	
		n (%)	n (%)	n (%)	
Performing hand hygiene when necessary	Every time	92 (77,3)	28 (80,0)	64 (76,2)	[b]0,651
	Frequently	27 (22,7)	7 (20,0)	20 (23,8)	
Method of performing hand hygiene before touching the patient	Alcohol-based disinfectant	42 (35,3)	9 (25,7)	33 (39,3)	[b]0,158
	Using non-sterile gloves	56 (47,1)	15 (42,9)	41 (48,8)	[b]0,553
	Washing with soap and water	67 (56,3)	20 (57,1)	47 (56,0)	[b]0,905
Method of performing hand hygiene after touching the patient	Alcohol-based disinfectant	47 (39,5)	10 (28,6)	37 (44,0)	[b]0,116
	Changing gloves	38 (31,9)	10 (28,6)	28 (33,3)	[b]0,612
	Washing with soap and water	88 (73,9)	27 (77,1)	61 (72,6)	[b]0,608
Availability of hand sanitizer in the work area	Yes	109 (91,6)	31 (88,6)	78 (92,9)	[e]0,478
	No	10 (8,4)	4 (11,4)	6 (7,1)	
Whether or not standard infection control measures are taken in contact with each patient	Yes, always	78 (65,5)	26 (74,3)	52 (61,9)	[c]0,161
	Frequently	34 (28,6)	6 (17,1)	28 (33,3)	
	Rarely	4 (3,4)	1 (2,9)	3 (3,6)	
	Never	1 (0,8)	1 (2,9)	0 (0,0)	
	No idea	2 (1,7)	1 (2,9)	1 (1,2)	
Using personal protective equipment when necessary	Yes, always	80 (67,2)	26 (74,3)	54 (64,3)	[b]0,290
	Frequently	39 (32,8)	9 (25,7)	30 (35,7)	
Availability of adequate personal protective equipment in the hospital	Yes	91 (76,5)	26 (74,3)	65 (77,4)	[b]0,866
	No	11 (9,2)	4 (11,4)	7 (8,3)	
	No idea	17 (14,3)	5 (14,3)	12 (14,3)	
Insufficient equipment	Medical face mask	12 (24,5)	2 (14,3)	10 (28,6)	[e]0,466
	Face shield	19 (38,8)	3 (21,4)	16 (45,7)	[b]0,115
	Respirator mask	25 (51,0)	7 (50,0)	18 (51,4)	[b]0,928
	Protective clothing	37 (75,5)	9 (64,3)	28 (80,0)	[e]0,285

[b]Pearson Chi-Square Test [c]Fisher Freeman Halton Test [e]Fisher's Exact Test

Table 2. Comparison of compliance with infection control measures

This rate was 3.6% in the control group and the difference between the two groups was statistically significant (p=0.001; p<0, 01). The most common symptoms related to the disease are, respectively; anorexia (71%), taste disturbance (66%), and fatigue (60%) were recorded. The incidence of symptoms is given in Figure 1.

Discussion

In this study, we aimed to show that various demographic characteristics, experience and working conditions of employees, infection control measures, and medical background are effective in the occurrence of Covid-19 disease in HCW who are heavily exposed to viral agents during the delivery of healthcare services to Covid-19 patients. In this study, we have seen that there is no significant difference between age, gender, education level, duty and unit in the hospital, working hours, infection control measures, and training in the use of personal protective equipment among HCW in terms of the risk of Covid-19 infection. In addition, no factor would create a significant difference between cases and controls in compliance with infection control measures. On the contrary, the period of experience in the profession was longer in the case group and the difference was found statistically significant. In terms of PPE (personal protective equipment) usage during exposure to Covid-19 patients, we did not detect a factor that would significantly increase the risk of infection. We found that prophylactic drug use was higher in the case group. In the literature, there are different results from the studies investigating the risk factors of HCW for Covid-19 disease. In a systematic review, it was stated that the use of PPE and infection control precautions education reduced the risk of infection, while some exposures such as intubation, which were in direct contact with the patient or their secretions, increased this risk. In a survey study, it was concluded that the unit worked, occupational group, gender, and age made a significant difference. They found that the infection rate was higher in nurses younger than 45 years of age who are working in units other than the frontline clinics, compared to doctors older than 45 years of age working in "frontline" clinics (6). In this study, we did not find a significant difference between those under 35 years of age and those over 35 years of age. Due to the low number of participants above the age of 45 (8.4%) in our study, we performed the statistical analysis of the age factor by comparing those under 35 years of age and above, therefore the result may be different. The majority of the cases in our study were female. In our literature research on the subject, we found that the number of female cases was higher in some studies, and on the other hand, in some studies, the male case number was higher or that there was no distributional difference in both genders (7-10). This may be due to the difference in gender distribution of HCW who were employed in different countries and different health

			Group		
		Total n (%)	Cases n (%)	Control n (%)	P-value
Number of exposures to Covid 19 patients	≤50 people	37 (35,9)	14 (43,8)	23 (32,4)	[b]**0,539**
	51-500 people	44 (42,7)	12 (37,5)	32 (45,1)	
	>500 people	22 (21,4)	6 (18,8)	16 (22,5)	
Close contact with patients	Frequently	78 (65,5)	23 (65,7)	55 (65,5)	[c]**0,971**
	Occasionally	19 (16,0)	5 (14,3)	14 (16,7)	
	Rarely	14 (11,8)	5 (14,3)	9 (10,7)	
	Never	8 (6,7)	2 (5,7)	6 (7,1)	
Duration of close contact with patients	<5 minutes	46 (41,1)	11 (32,4)	35 (44,9)	[b]**0,285**
	5-15 minutes	34 (30,4)	10 (29,4)	24 (30,8)	
	>15 minutes	32 (28,6)	13 (38,2)	19 (24,4)	
Personal protective equipment used during contact with patients	Medical face mask	91 (81,3)	29 (87,9)	62 (78,5)	[b]**0,245**
	Face shield	84 (75,0)	25 (75,8)	59 (74,7)	[b]**0,905**
	Respirator mask	79 (70,5)	25 (75,8)	54 (68,4)	[b]**0,433**
	Protective clothing	103(92,0)	32 (97,0)	71 (89,9)	[e]**0,278**
Masks used during close contact with patients	Medical face mask	25 (22,1)	9 (27,3)	16 (20,0)	[c]**0,644**
	Respirator mask	55 (48,7)	17 (51,5)	38 (47,5)	
	Medical face mask & Respirator mask	32 (28,3)	7 (21,2)	25 (31,3)	
	Not sure	1 (0,9)	0 (0,0)	1 (1,3)	
If gloves are worn, post-contact removal	Yes	110(96,5)	31 (93,9)	79 (97,5)	[c]**0,328**
	No	2 (1,8)	1 (3,0)	1 (1,2)	
	Not sure	2 (1,8)	1 (3,0)	1 (1,2)	
Hand hygiene <u>before</u> contact with the patient	Every time	73 (62,4)	25 (73,5)	48 (57,8)	[c]**0,203**
	Frequently	35 (29,9)	6 (17,6)	29 (34,9)	
	Rarely	8 (6,8)	3 (8,8)	5 (6,0)	
	Never	1 (0,9)	0 (0,0)	1 (1,2)	
If hand hygiene was performed <u>before</u> contact with the patient, which method was preferred?	Alcohol-based disinfectant	39 (34,2)	11 (32,4)	28 (35,0)	[b]**0,768**
	Washing with soap and water	48 (42,1)	16 (47,1)	32 (40,0)	
	Both of them	27 (23,7)	7 (20,6)	20 (25,0)	
Hand hygiene <u>after</u> contact with the patient	Every time	94 (80,3)	29 (85,3)	65 (78,3)	[c]**0,604**
	Frequently	20 (17,1)	4 (11,8)	16 (19,3)	
	Rarely	3 (2,6)	1 (2,9)	2 (2,4)	
If hand hygiene was performed <u>after</u> contact with the patient, which method was preferred?	Alcohol-based disinfectant	28 (23,9)	7 (20,6)	21 (25,3)	[b]**0,707**
	Washing with soap and water	55 (47,0)	18 (52,9)	37 (44,6)	
	Both of them	34 (29,1)	9 (26,5)	25 (30,1)	
Whether or not any procedure that generates aerosols is performed	Yes	63 (52,9)	16 (45,7)	47 (56,0)	[b]**0,594**
	No	47 (39,5)	16 (45,7)	31 (36,9)	
	Not sure	9 (7,6)	3 (8,6)	6 (7,1)	
The state of being in the environment while performing any procedure that generates aerosols	Yes	90 (75,6)	26 (74,3)	64 (76,2)	[c]**1,000**
	No	23 (19,3)	7 (20,0)	16 (19,0)	
	Not sure	6 (5,0)	2 (5,7)	4 (4,8)	
Use of personal protective equipment by those in the environment while performing an aerosol-generating procedure	Medical face mask	75 (77,3)	22 (81,5)	53 (75,7)	[b]**0,543**
	Face shield	83 (85,6)	24 (88,9)	59 (84,3)	[e]**0,751**
	Respirator mask	82 (84,5)	20 (74,1)	62 (88,6)	[e]**0,114**
	Protective clothing	91 (93,8)	25 (92,6)	66 (94,3)	[e]**0,669**

[b]Pearson Chi-Square Test [c]Fisher Freeman Halton Test [e]Fisher's Exact Test

Table 3. Exposure and contact characteristics of Covid-19 patients

facilities. There are different results in the literature regarding the risk posed by the unit in terms of Covid-19. In a study in which employees were examined as "frontline" and "non-frontline", it was reported that "non-frontline" employees had a higher risk of Covid19 (6). Ran et al. reported that those working in high-risk departments such as chest diseases, infectious diseases, and intensive care were infected more than in other low-risk departments(11). Zheng et al. found that employees in emergency and acute care clinics were infected more compared to intensive care and operating room personnel(12).

In our study, the units worked were categorized as emergency services, internal medicine units, surgical units, and other units. 43% of the cases in our study were employees of the emergency department, but there was no significant difference between cases and controls in terms of units worked. During the pandemic period, most of the

healthcare professionals in our hospital worked alternately in the Covid-19 polyclinic and services, so this may have been affected by the change of place of duty. In different studies evaluating the risk factors of Covid-19 in HCW, it has been stated that the most frequently affected group of HCW is

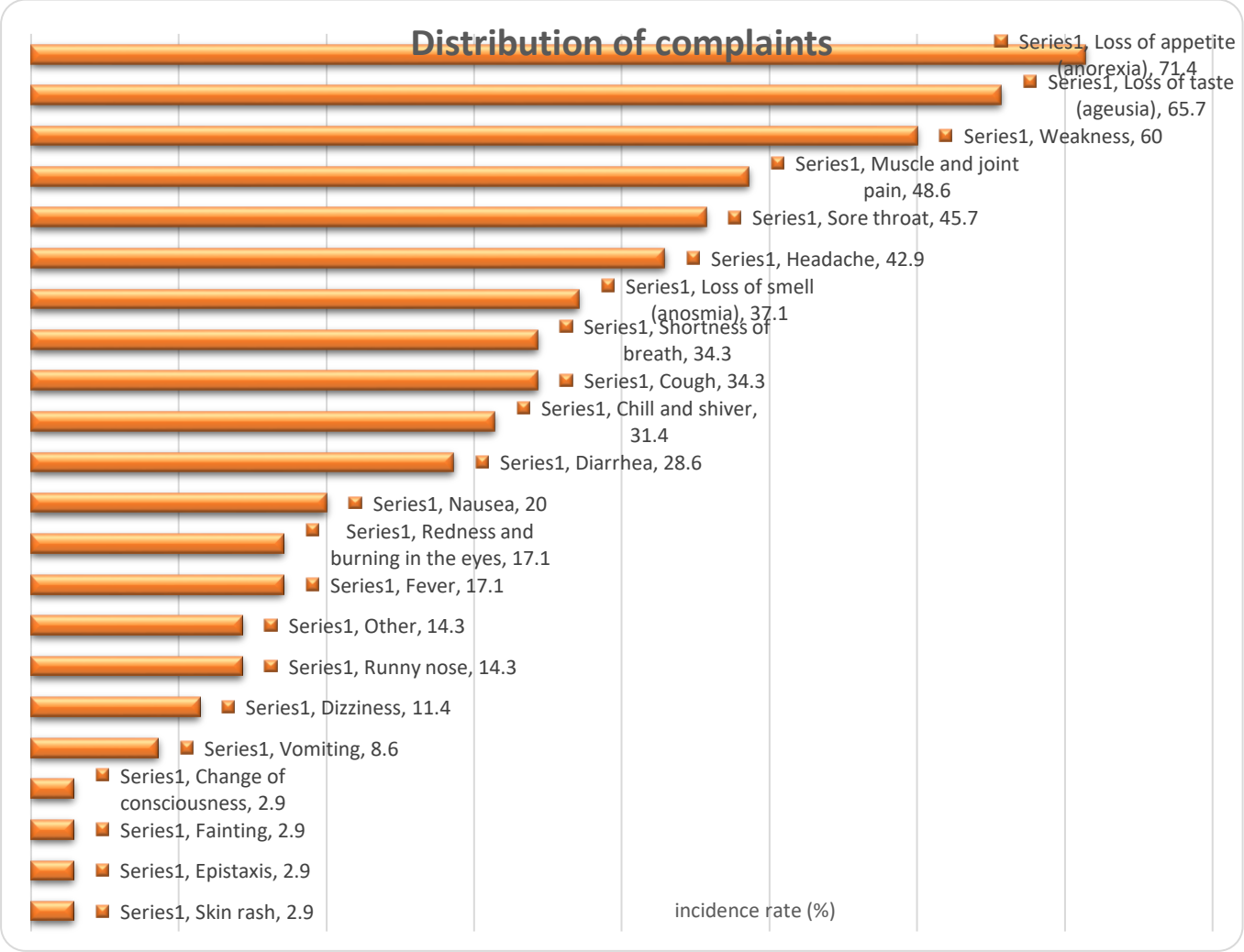

Figure 1. Symptoms in healthcare workers diagnosed with Covid-19

nurses (6, 8, 13, 14). In our study, 40% of the cases were nurses, 20% were doctors, 40% were other HCW and no statistically significant difference was observed between occupational groups.

We thought that there is a higher risk of infection for nurses because they have longer and more intense contact with the patient during patient care and treatment. Zhang et al. determined that 89% of the HCW who participated in the survey had sufficient knowledge about Covid-19 and 89.7% of them followed the correct practices for Covid-19. It has been seen that there is a significant relationship between the level of knowledge and attitudes, and it has been determined that those with higher levels of knowledge have higher self-confidence in combating the virus(15). While a positive relationship was found between careful removal of PPE and education level,

there was a negative relationship with the median work experience period. Similarly, in the study of Chatterjee et al., the risk of Covid-19 was found to be higher in those who worked for more than 1 year compared to those who worked for less than 1 year (odds ratio 2.5 p: <0.001) (10). In this

study, the professional experience period was higher in the case group. One of the reasons may be that experienced professionals are less careful about the use of PPE, as the result of this study indicates. Again, in this study, the rate of stating that they felt tired was lower in HCW with 5-9 years of experience compared to those with less than 5 years of experience, and this was attributed to the fact that those with more professional experience were experienced in coping with extraordinary situations. Those with more professional experience may have taken more roles in the frontline in the fight against the pandemic, and this may have increased the risk of infection. It has been reported in

the literature that close contact with the patients and not using appropriate PPE during contact are among the most

important factors in the transmission of infection in HCW who have had Covid-19. In our study, we did not detect any difference between groups related to not using any of the PPEs. While the proportion of patients in the case group stating that they wore a respirator mask while performing aerosol-generating procedures was 74%, it was 88.6% in the control group, but there was no statistically significant difference (p: 0.114). Considering the transmission dynamics of respiratory tract infections and previous studies, the importance of PPE and infection control measures is an indisputable fact. The fact that there was no significant difference between case and control groups regarding infection control measures and the use of PPE in our study may be due to the subjective data of the survey study. The rate of participants who stated that they did not comply with the rules regarding infection control measures and the use of PPE was very low. It is possible that the participants did not honestly answer the questions on this subject. Algorithms were created by the Ministry of Health to combat the pandemic in our country. These algorithms were updated frequently in light of current studies. According to the "Management Algorithm" published by the Ministry of Health, Risk Categories for Covid-19 Contact Health Workers, which were also applied in our hospital, were determined. Employees who fit the description were given hydroxychloroquine prophylactically for 3 days at that time. Those who were given preventive medication were those who had “high-risk contact” with a suspected COVID-19 patient; that is, when HCW who were in intense contact with the patient without wearing a medical mask or N95 mask, and the Covid-19 patient they met, also did not wear a medical mask (19). In this study, due to the post-exposure prophylactic drug use of healthcare professionals, in line with the algorithm, the rate of using protective drugs after exposure to Covid-19 patients was higher in the case group (34%) than in the control group (3.6%). This result supports that the use of 3 days of prophylactic hydroxychloroquine is not effective in preventing the disease.

Limitations

One of the most important limitations of our study is that it is single-centered and the data obtained cannot be generalized to the entire population of HCW. The small number of cases makes a statistical analysis of some parameters impossible, it is possible to study with a multicenter and larger sample to give better results. Since the symptoms of HCW were questioned only in the case group, statistical analysis could not be performed for the control group. A study can be planned to determine which symptoms better indicate the likelihood of Covid-19 infection in HCW, who were exposed to Covid-19 patients with various symptoms, but Covid-19 was not detected in comparison with Covid-19 was detected. Due to the low sensitivity of the Covid-19 diagnostic test in the early stages of the disease, patients diagnosed with tomography were also included in the study, which is one of the limitations of the study. The fact that it is a survey study and therefore the data obtained are subjective information stated by the participants by their self-evaluation limits the reliability of the results, especially regarding the use of PPE and compliance with infection control measures, most of the participants stated that they always followed the rules and no meaningful results could be obtained.

Conclusion

In this cross-sectional study, in which we investigated the risk of infection transmission after exposure to COVID-19 patients in HCW, our findings were that the working time of the employees in the profession increased the probability of infection. We did not detect any difference in other demographic characteristics indicating increased risk. HCWs who are more experienced in the profession seem to be at higher risk of Covid-19 infection. In addition, high-risk unprotected exposure may be associated with higher infection rates in HCW. Three days of prophylactic hydroxychloroquine after high-risk contact with Covid-19 patients were not effective in preventing the disease.

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Authors’ Contribution: TCÖ and FSD designed and carried out the research, coordinated the study, participated in all of the research. FÇ, FSD, FCŞ collected the data and prepared the manuscript. FSD and TCÖ assisted in designing and conducting the research. FÇ, FDS, and FCŞ participated in manuscript preparation and performed the statistical analysis. TCÖ and FSD corrected the English manuscript and revised further statistical data. All authors have read and approved the content of the manuscript.

Ethical Statement: Approval for the study was obtained with the permission of the Ministry of Health Covid-19 Scientific Research Platform with the number x-2020-06-18T16_35_47.xml and the permission of the Clinical Research Ethics Committee of Fatih Sultan Mehmet Training and Research Hospital, numbered 2020/13. All authors declared that they follow the rules of Research and Publication Ethics.

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