Determination of the Factors Affecting the COVID-19 Knowledge Levels and the Status of Being Diagnosed with COVID-19 in Healthcare Employees Struggling with Pandemic

Pandemi ile Mücadele Eden Sağlık Çalışanlarının COVID-19 Bilgi Düzeyleri ve COVID-19 Tanısı Alma Durumlarını Etkileyen Faktörlerin Belirlenmesi

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ABSTRACT

The present study was conducted to determine of the factors affecting the COVID-19 knowledge levels and the status of being diagnosed with COVID-19 in healthcare employees struggling with the pandemic. This study, which was planned in cross-sectional and descriptive-correlational design. The healthcare employees working in hospitals in 6 city centers in the Black Sea Region, which has the highest number of COVID-19 cases in Turkey, were included in the study (n=385). It was determined in the present study that 33.85±9.11 (min.20, max.60), 57.9% of the participants were female, 43.4% were nurses, and 47% were infected with coronavirus. It was found that the factors that affected the coronavirus knowledge scores of health employees significantly were being diagnosed with COVID-19, presence of chronic diseases, receiving psychological support, female gender, and fighting COVID-19 in the front line. The risk factors for being infected with coronavirus disease were found to be the lack of personal protective equipment, unit worked at, and N95 mask replacement time ($p<0.05$). As a result of this study, ıt is recommended to provide evidence-based trainings to prevent transmission of future outbreaks and to support coping strengths since infection in healthcare employees is high.

Keywords: Turkey, COVID-19 knowledge score, Causes of transmission, Healthcare employees, Risk factors

ÖZ

Bu çalışma, pandemi ile mücadele eden sağlık çalışanlarının COVID-19 bilgi düzeyleri ve COVID-19 tanısı alma durumlarını etkileyen faktörlerin belirlenmesi amacıyla yapılmıştır. Çalışma, kesitsel ve ilişki arayıcı desende planlandı. Türkiye'deki COVID-19 vaka sayısının en fazla olduğu Karadeniz Bölgesindeki altı il merkezinde yer alan hastanelerde görev yapan sağlık çalışanları araştırmaya dahil edildi (n=385). Çalışmada, katılımcıların yaş ortalamasının 33.85±9.11 (min.20, max.60), %57.9'unun kadın, %43.4'ünün hemşire ve %47'sinin koronavirüs ile enfekte olduğu belirlendi. Sağlık çalışanlarının koronavirüs bilgi puanını önemli ölçüde etkileyen faktörlerin; COVID-19 tanısı almış olmak, kronik hastalık varlığı, psikolojik destek almış olma, kadın cinsiyet ve COVID-19 ile ön safhada mücadele etmek (front line) olduğu bulunmuştur. Koronavirüs hastalığına yakalanmada risk faktörlerinin; kişisel koruyucu ekipman eksikliği, çalışılan birim ve N95 maske değişim süresi olduğu belirlenmiştir ($p<0,05$). Çalışmadan elde edilen bulgular sonucunda, sağlık çalışanlarında bulaşın fazla olması nedeniyle gelecekteki salgınlar için bulaştan korunmaya yönelik kanıta dayalı eğitimlerin verilmesi ve başetme güçlerinin desteklenmesi önerilmektedir.

Anahtar Kelimeler: Türkiye, COVID-19 bilgi puanı, Bulaş nedenleri, Sağlık çalışanları, Risk faktörleri

Ethical approval was obtained from the Human Research Ethics Committee of Gümüşhane University (Date: 04.02.2021 No: 2020/01). The study was conducted in compliance with the ethical standards specified in the Helsinki Declaration.

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INTRODUCTION

Coronaviruses have been reported to cause mild and moderate respiratory infections in the last 50 years.[1] In December 2019, transmission of the novel coronavirus (SARSCoV-2) that causes coronavirus disease 2019 (COVID-19) occurred in Wuhan, China.[2] It was then reported that COVID-19 started to be transmitted from person to person.[3] The World Health Organization confirmed it epidemic this situation.[4]

Healthcare authorities argue that aerosol, contact and droplet pathways are the most important causes for transmission.[5,6] It was also stated that radiologists (29.4%), nurses (9.4%), respiratory therapists (3.2%), and doctors (2.4%) are the first groups in occupational groups that have the highest risk among healthcare employees. Healthcare employees (6.0%), who cover their mouths and noses with medical masks or N95 masks, are less infected than those do not wear any masks (18.8%).[7]

The primary goal of infection control programs is decreasing the risk of healthcare employees being exposed to this infection during COVID-19 pandemic. The lack of protective clothes, excessive workload, inadequate diagnosis and testing, providing care to the infected patients are among the most important risk factors in terms of the exposure of healthcare employees to COVID-19.[8-10] Identifying cases rapidly, isolation, knowing the causes of transmission, prevention and control methods for infection are the measures that may be taken to prevent the spread of this pandemic within the society and among healthcare employees.[4]

There are limited number of studies in the literature that examine the causes of COVID-19 infection in healthcare professionals. It was seen that many of these studies were conducted on the causes of transmission of COVID-19 infection and evaluated the knowledge, attitudes and behaviors related to the causes of COVID-19 infection in general population and in students.[11-13] Based on this, the present study was conducted to determine the COVID-19 knowledge levels and factors affecting the transmission in healthcare employees who fought against the pandemic because of the fact that the COVID-19 pandemic, which causes significant problems in our country and in the entire world, carries great risks especially for healthcare employees and the high transmission of healthcare employees.

The present study was conducted to determine COVID-19 knowledge levels and factors affecting transmission in healthcare employees struggling with the pandemic.

METHODS

Design

This study is a cross-sectional and descriptive-correlational study.

Setting and Time

The research data were collected in six city centers in the Black Sea Region of Turkey between 20 February - 05 March 2021.

Sampling

The universe of the study involved of the healthworker working in 6 cities in the Black Sea Region of Turkey. Because of the high number of COVID-19 cases in these cities, it was decided to conduct the study in hospitals in the city centers (6 high-risk cities in the country). It was calculated that 348 healthcare employees should be sampled when sampling was calculated in 50% observance rate with 5% standard deviation, and 95% power range with the OpenEpi Program. After the necessary permissions were received for the study, an online questionnaire form was prepared with Google Forms web application; and was sent to the smartphones of healthcare employees via WhatsApp. Considering the probability

of having missing data, the response acceptance was turned off when 10% more participants and 385 healthcare employees were contacted compared to the required sampling size.

Inclusion criteria of the study were;

- Being healthcare worker
- Being 18 years old and above,
- Participating in the study voluntarily.

Dependent Variables of this study: Knowledge level

Independent Variables of this study: Gender, educational status, çalışma yılı, chronic disease status, psychological support status, N95 mask change time and professional year

Measurements

The data of this study were collected using the questionnaire form.

Questionnaire Form

The form that was developed by the researchers consisted of four parts. Part one included a question on whether the healthcare employees is infected with definited SARS-CoV-2 infection with Polymerase Chain Reaction (PCR). The second section contains 9 questions on sociodemographic characteristics (i.e. gender, age, professional experience, etc.) of the healthcare employees. The third part has 8 questions on the COVID-19 related experiences and prevention methods during the pandemic. In part 4, the "Coronavirus Knowledge Form" that was developed by the researchers was used.

Coronavirus Knowledge Form

This form, which was developed by the researchers in line with the literature data to measure COVID-19 knowledge of healthcare employees, consisted of 15 questions.[14,15] This form includes questions such as knowing ways of infected of COVID-19, knowing the causes of infected, knowledge about the use of personal protective equipment and knowing the methods of protection etc. A wrong answer given to the questions was considered 1 (one) point, a correct answer was considered 2 (two) points, and the answer "I do not know" was considered 0 (zero) point. The total score was considered between 0-30. After the questionnaire was created, it was evaluated by a statistician in addition to the researchers. A pilot application was conducted with 20 people who were not included in the study. The Cronbach Alpha Value of the Coronavirus Knowledge Form was found to be 0.73 in our study.

Data Analysis

Statistical package was used for the social sciences (SPSS) 23 program for data analyses. The Student ***t***-test and One-Way ANOVA Test (Bonferroni for multiple comparisons) were used to determine the relations between knowledge scores and socio-demographic features of the healthcare employees. Linear Regression Analysis was used to determine the factors associated with COVID-19 knowledge scores, and Logistical Regression Analyses were used to determine the factors that were associated with COVID-19 diagnosis. The statistical significance level was taken as $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Human Research Ethics Committee of Gümüşhane University (Date: 04.02.2021 No: 2020/01). The study was conducted in compliance with the ethical standards specified in the Helsinki Declaration.

RESULTS AND DISCUSSION

The mean age of the healthworkers who participated in the questionnaire was 33.85±9.11 (min.20, max.60), and 57.9% were female. A total of 59% of the healthcare employees were married, 40.5% were undergraduate, and 86.2% were at the front line in the fight against COVID-19. It was found that 43.4% of the participants were nurse, 32.2% had less than 5 years' working experience, and 47% had Polymerase Chain

Reaction (PCR)-confirmed SARS-CoV-2 infection. Statistically significant differences were detected between the mean knowledge scores of healthcare employees according to the school they graduated from ($p<0.05$). Further analysis made to determine the group that caused the difference showed that the significance stemmed from the graduate group, and the knowledge scores of graduate healthcare employees were significantly higher ($p<0.001$). It was also found that healthworkers who were diagnosed with COVID-19 ($p<0.001$), those with chronic diseases ($p<0.001$), doctors ($p<0.001$) and frontline healthcare employees ($p=0.001$) had higher knowledge scores at significant levels. No significant differences were detected between COVID-19 knowledge scores according to gender and marital status ($p>0.05$). Statistically positive relations were detected between the year of work of healthcare employees and COVID-19 knowledge scores ($r:0.529$, $p<0.001$). (Table 1).

Table 1. Distribution of COVID-19 Knowledge Scores according to Some Descriptive Characteristics of Healthcare Workers (n=385)

Characteristics	Positive n/N (%)	Average Knowledge score Mean±SD	p value
Gender			
Female	108/223 (48)	14.41±9.07	
Male	73/162 (45)	15.42±9.05	0.283*
Educational Status			**<0.001****
High School[a]	23/53 (43)	13.43±9.88	d>c,
Associate Degree[b]	32/78 (41)	9.09±8.6	d>b,
Undergraduate[c]	66/156 (42)	15.33±8.18	c>b,
Post-graduate[d]	51/98 (52)	19.38±7.65	d>a
Marital Status			
Married	71/158 (42)	15.64±9.18	
Single	110/227 (48)	14.13±8.92	0.104*
COVID-19 diagnosis status			
Yes	181 (47)	22.38±5.75	**<0.001***
No	204 (53)	19.80±6.84	
Chronic disease status			
Yes	38/92 (41)	22.13±5.90	**<0.001***
No	143/293 (49)	19.13±6.97	
Profession			
Nurse[a]	64/167 (38)	12.90±7.74	**<0.001****
Doctor[b]	54/84 (64)	20.63±7.77	b>c=a
Other healthcare employee[c]	63/134 (47)	13.61±9.87	
Unit worked at			
Front line	151/332 (45)	18.60±10.85	**0.001***
Others	23/53 (43)	14.23±8.62	
Professional year Mean±SD	3.06±1.92		**r=0.529 p<0.000*****

Chronic Disease: Diabetes, Hypertension, Heart Diseases, Respiratory Tract Diseases, **t*-test, ** One-Way ANOVA (Bonferroni in multiple comparisons) *** Pearson Correlation Analysis

According to the Multiple Linear Regression Analysis results, factors significantly affecting the COVID-19 knowledge scores of health employees were being diagnosed with COVID-19, receiving psychological support, presence of chronic diseases, female gender, and in front line in the fight against COVID-19. These variables described 14% of the total variance (Table 2).

Table 2. Findings on Multiple Regression Analysis between COVID-19 Knowledge Scores and Independent Variables of Healthcare Employees

Model	B	SE	β	t	p
Constant	40.49	4.07		9.93	<0.001
COVID-19 diagnosis status	-3.72	0.99	-0.20	-3.73	<0.001
Chronic Disease	-4.36	1.03	-0.20	-4.24	<0.001
Psychological support status	-1.95	0.58	-0.185	-3.37	0.001
Gender	4.50	0.95	0.22	4.73	<0.001
Unit worked at	3.48	1.26	0.13	2.75	0.006

Model R=0.38; R^2 =0.15; Adjusted R^2=0.14; F=13.47; P< .001. Dependent Variable: Coronavirus Knowledge Level. COVID-19 Diagnosis Status (0: Yes; 1: No) Chronic Disease (0: Yes; 1: No) Psychological Support Status (0: Yes; 1: No) Gender (0: Male; 1: Female) Unit Worked at (0: Those who do not work in front line 1: Those who work in front line)

When the Logistical Regression Model that was created to determine the risk of COVID-19 infection was examined, it was found that the "lack of personal protective equipment", "N95 mask change time", and "unit worked at" were risk factors for being infected with coronavirus disease (p<0.05). Risk of being infected with coronavirus disease was 1.89 times more for those who experienced lack of personal protective equipment, 0.42 times more for those who replaced the N95 mask within more than eight hours, and 10.31 times more for those working in front lines. The model explained developing coronavirus disease risk at a rate of 30% (Table 3).

Table 3. Findings on Logistical Regression Analysis between COVID-19 Diagnosis and Independent Variables of Healthcare Employees

Variable	β	p	OR(%95 GA)*
Gender			
Female	0.554	0.060	1.74 (0.976-3.101)
Male (Reference)			
Inadequate personal protective equipment			
Yes	0.638	**0.034**	1.89 (1.04-3.41)
No (Reference)			
N95 mask change time			
More than 8 hours	-0.859	**0.012**	0.42 (0.21-0.83)
Less than 8 hours (Reference)			
Unit worked at			
Those who work in front line	2.334	**<0.001**	10.31(4.810-22.12)
Those who do not work in front line (Reference)			
Nagelkerke R^2= 0.30 Hosmer-Lemeshow = 0.45			

*OR: Rate of probabilities shown with Odds Ratio; and 95% Confidence Interval

In this section, the findings of our study are discussed in line with the literature data. Considering the studies in the literature, it was found that the participants of our study were similar to the sociodemographic characteristics of previous studies.[14,15] The most notable sociodemographic finding was that the healthcare employees were young and middle-aged. We believe that this can be explained by the recruitment of newly graduated healthcare employees to fight the pandemic.

In the study that was conducted by Shi et al. in a psychiatric hospital, it was reported that the doctors and nurses who cared for patients with COVID-19 had extensive knowledge on COVID-19, and receive training at the hospital where they worked.[16] It was determined in our study that the COVID-19 knowledge scores of healthcare employees with female gender, who were married, and who had postgraduate educational level were significantly higher. Similar to our study results, Ngwewondo et al. and Roupa et al. reported in their studies that women had higher knowledge scores on COVID-19 infection.[17-18] Similar to our study, Roupa et al. reported that healthcare employees who had graduate education levels had higher knowledge scores.[18]

It was reported by the Center for Disease Control and Prevention (CDC) that among the 49.370 COVID-19 patients between February 12 and April 9, 2020, 19% were healthcare employees. Many healthcare employees claimed that they were infected in healthcare settings.[19] In our study, COVID-19 knowledge scores of the healthcare employees who were infected with coronavirus disease were significantly higher. Contrary to our study results, a different study reported that those who did not show COVID-19 symptoms had higher knowledge scores.[12] According to the CDC, individuals who have chronic diseases constitute the risk group for COVID-19 infection.[19] It was found in our study that COVID-19 knowledge scores of the healthcare employees with chronic diseases were significantly higher. It is possible to explain this with the desire to acquire knowledge to know the measures for being in the risk group, which causes anxiety in healthcare employees and to protect themselves from infected. In our study, doctors had higher COVID-19 knowledge scores at significant levels compared to other healthcare professionals. Similar to our study, Shi et al. reported that although doctors were less trained about COVID-19 infection than nurses, they had higher knowledge levels than nurses.[16] Similarly, in their study, Roupa et al. reported that healthcare employees who were doctors had higher COVID-19 knowledge scores.[18] COVID-19 knowledge scores of frontline healthcare employees were significantly higher than those working in the second line in our study. Contrary to our study results, it was reported in another study that the knowledge levels of healthcare employees who do not work in frontline are significantly higher.[18] It was seen that trainings provided in hospitals in previous outbreaks played important roles in the prevention of the epidemics.[20] It was not questioned whether healthcare employees working in front line received training on COVID-19 infection in our study. However, we believe that training healthcare employees by using evidence-based knowledge in hospitals and acquiring skills in this way will strengthen them providing them with important support in their fight against the pandemic. It was found in our study that COVID-19 knowledge scores increased as the working year of healthcare employees increased. Contrary to our study results, Roupa et al. reported significant changes in knowledge scores depending on the year of working in the profession.[18] In this respect, healthcare employees who worked less than 5 years said that their knowledge scores increased at significant levels when compared to those with 6-10 years of work experience.[18] It is already known that the working year in profession increases the level of professional knowledge. However, the fact that COVID-19 infection is a novel pandemic, and there is no clear knowledge yet changes this. Less working years shows that there is young

dynamic staff who are just starting in their profession. It is possible to explain this by making better use of the sources of knowledge of young people (i.e. social media, internet, articles, etc.) and easier access to knowledge.

In our country and around the world, psychiatrists and nurses provide psychological support to society and healthcare employees during the pandemic.[21,22] It was reported in a previous study that doctors and nurses have psychological care requirements during pandemic process. It was also reported that the psychological care requirements of doctors and nurses are different. It was determined during the pandemic that doctors and nurses require psychological care to help themselves, help patients, and improve their ability to cope with difficulties.[23] In our country, the Mental Health Program for Coronavirus (KORDEP in Turkish) was established. KORDEP provided psychosocial support to individuals in the risk group who were exposed to the psychological effects of COVID-19, especially to healthcare employees during the pandemic. In our study, it was found that the COVID-19 knowledge scores of healthcare employees receiving psychological support during the pandemic process were high. There were no studies in the literature investigating the effects of receiving psychological support on the level of knowledge. In our study, we believe that receiving psychological support during the pandemic increases coping power and knowledge levels by raising awareness among healthcare employees.

In the literature, a limited number of studies investigated the causes and possible risk factors of COVID-19 infected in healthcare employees. In our study, it was found that risk factors for COVID-19 are the unit worked at, N95 mask change frequency, and inadequate personal protective equipment. Although Eyre et al. reported that no significant relations were detected between gender and COVID-19, Consonni et al. found that men are more infected with COVID-19 compared to women.[24,25] We found in our study that gender is not a risk factor for COVID-19.

Coronavirus can be transmitted directly (with coughing, sneezing, and inhalation with droplets) and indirectly (with contact with oral, nasal and eye mucous membranes) from person to person.[26] One of the important factors in protection from infected is using personal protective equipment. Previous studies report that the improper use and inadequacy of medical masks and personal protective equipment are risk factors for COVID-19 infection for healthcare employees.[9,27,28] We found in our study that people who could not use personal protective equipment had increased COVID-19 infected risks. Our study findings are similar to the findings of previous studies emphasizing the importance of using personal protective equipment. Healthcare employees are advised to use personal protective equipment because there might be transmission during aerosol processes.[17,29] In a randomized controlled study that was conducted before COVID-19 pandemic, it was reported that N95 masks are superior to surgical masks, and do not prevent influenza infection in healthcare employees.[30] In the study of Ng et al. (2020) conducted with 41 healthcare employees who had contact with a COVID-19-infected patient during aerosol-forming procedures, it was reported that 85% of the healthcare employees wore surgical masks, others wore N95 masks, and no healthcare employees were infected with COVID-19.[17] They determined in their study that N95 masks were not superior to surgical masks in preventing COVID-19 in healthcare employees. Although no differences were detected between surgical mask and N95 mask in protecting against COVID-19 in our study, it was found that the frequency of N95 mask change was effective. We found in our study that as the N95 mask replacement time increased, the risk of being infected with COVID-19 also increased. Although there are different results in the literature regarding the protection of N95 and surgical mask from infection, experts recommend that healthcare employees use N95 masks or equivalent

equipment when aerosol-forming procedures are applied.

In their retrospective study, Ran et al., (2020) associated poor hand hygiene after frontline work, prolonged working hours, and contact with patients with COVID-19 infection.[9] In Eyre et al.'s (2020) study, COVID-19 rate was found to be 22.6% in frontline healthcare employees caring for COVID-19 patients, compared to 8.6% for healthcare employees who did not care for COVID-19 patients.[25] It was found in our study that the biggest risk factor for COVID-19 is working in the front line.

Strengths and limitations

There are a few strengths in our study. First of all, it is the strength of our study that in was conducted with health employees who were and who were not diagnosed with COVID-19 and who worked in cities considered to have high risk in COVID-19 pandemic throughout the country. Secondly, knowledge, attitude and behavior studies were conducted in the literature in COVID-19 pandemic, but studies comparing the effects of COVID-19 knowledge scores on protection from infected were not detected in health employees who were and who were not diagnosed with COVID-19. In this respect, our study is important in that it is a pioneering study in determining COVID-19 knowledge levels and factors affecting infected in healthcare employees.

There are some limitations in this study. We investigated the effects of COVID-19 knowledge scores on infected in healthcare employees in our study; however, we did not examine the effects of attitudes and behaviors on protection from infected in healthcare employees. We believe that this is the most important limitation of our study. It is already known that health employees are trained about COVID-19 in all healthcare institutions in our country; however, the training status of the health employees was not evaluated in our study because the contents and scopes of these trainings were not known. In addition ıt has not been clear revealed whether being diagnosed with COVID-19 increases the knowledge score or whether healtcare employees with a low knowledge score get the disease. The complete universe was not reached in our study; therefore, the results of the present study cannot be reflected to the general population.

CONCLUSION AND RECOMMENDATIONS

As a result of our study, the knowledge scores of those who were female, and who worked as frontline health employees, diagnosed with COVID-19, who had chronic diseases, who received psychological support, were high. Risk factors regarding the infected of COVID-19 infection to healthcare employees were the lack of personal protective equipment, working in the frontline, and the N95 mask replacement time being more than 8 hours.

As a result of the study, COVID-19 knowledge levels and causes of infected in healthcare employees were determined; and the following recommendations are made in line with these data;

- Creating and disseminating evidence-based training programs,
- Taking protective measures, such as using personal protective equipment, hand hygiene, and social distancing,
- Care about the changing times of N95 masks and other protective equipment,
- Making necessary arrangements to provide personal proctective equitment in health polices.

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