Assessment of Knowledge, Attitudes and Practices Towards New Coronavirus (Sars-Cov-2) of Healthcare Workers During the Rapid Rise Period of the COVID-19 Outbreak*
COVID-19 Salgınının Hızlı Yükseliş Döneminde Sağlık Çalışanlarının Yeni Koronavirüse (Sars-Cov-2) Yönelik Bilgi, Tutum ve Uygulamalarının Değerlendirilmesi

● **Mehmet Emin YAŞAR***
 Fuat YALMAN**

* Öğr. Gör., Bingöl Üniversitesi, Solhan SHMYO, Sağlık Bilimleri Fakültesi, İş Sağlığı ve Güvenliği Bölümü, Bingöl/Türkiye.
Lec., Bingöl University, Faculty of Health Sciences, Department of Occupational Health and Safety, Bingöl/Turkey
meyasar@bingol.edu.tr
ORCID: 0000-0001-8137-2946

** Dr. Öğr. Üyesi, Düzce Üniversitesi, İşletme Fakültesi, Sağlık Yönetimi Bölümü,Düzce/Türkiye.
Asst. Prof., Duzce University, Faculty of Business, Department of Health Management, Duzce/Turkey.
fuatyalman@duzce.edu.tr
ORCID: 0000-0002-1041-1837

Abstract

The main purpose of this study is to evaluate the knowledge, attitudes and practices of healthcare professionals towards the novel coronavirus during the rapid rise of the COVID-19 epidemic and to determine the mediating effect of attitude on the effect of knowledge level on practices. A hospital-based cross-sectional research design was used in the study. The population of the study included healthcare workers of Istanbul Training and Research Hospital, which provides secondary healthcare services, and Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital, which provides tertiary treatment, in Istanbul. The convenience sampling method was preferred in the study. The data were collected by the researchers themselves using the online questionnaire technique. The total number of questionnaires that were evaluated and used in the analysis of the data is 409. SPSS and AMOS package programs were used in the analysis of the data. Descriptive statistics, independent sample t-test, ANOVA test and structural equation modelling were applied to the data. The findings obtained with the structural equation analysis showed that the construct validity of the model was provided. In addition, the path analysis revealed that the direct and indirect impact of knowledge level about COVID-19 on practices towards COVID-19 (mediated by attitude towards COVID-19) has an acceptable index of fit. A great majority of the healthcare workers had sufficient knowledge, a favourable attitude and good practices about sources, transmission, symptoms, signs, prognosis, treatment, management and preventive measures of COVID-19. The knowledge level about COVID-19 has both a direct and indirect impact on practices towards COVID-19 through the mediating role of attitude.

Keywords: COVID-19 outbreak, knowledge, attitudes, practices, healthcare workers.

Öz

Bu çalışmanın temel amacı, COVID-19 salgınının hızlı yükseliş döneminde sağlık çalışanlarının yeni koronavirüse yönelik bilgi, tutum ve uygulamalarını değerlendirmek ve bilgi düzeyinin uygulamalar üzerine etkisinde tutumun aracılık etkisini tespit etmektir. Araştırmada hastane tabanlı kesitsel araştırma deseni uygulanmıştır. Araştırmanın evrenini İstanbul ilinde ikinci basamak tedavi sunan İstanbul Eğitim Araştırma Hastanesi ile üçüncü basamak tedavi sunan Yedikule Göğüs Hatalıkları ve Göğüs Cerrahisi Eğitim ve Araştırma Hastanesinin sağlık çalışanları oluşturmuştur. Araştırmada kolayda örnekleme yöntemi tercih edilmiştir. Veriler internet üzerinden anket tekniği ile bizzat araştırmacılar tarafından toplanmıştır. Değerlendirmeye alınan ve verilerin analizinde kullanılan toplam anket sayısı 409'dur. Verilerin analizinde SPSS ve AMOS paket programları kullanılmıştır. Verilere betimleyici analizler, bağımsız örneklem t testi, anova analizi ve yapısal eşitlik modellemesi uygulanmıştır. Yapısal eşitlik analizi ile elde edilen bulgular, modelin yapı geçerliliğinin sağlandığını göstermiştir. Ayrıca yol analizi, COVID-19'a yönelik bilgi düzeyinin COVID-19'a yönelik uygulamalar üzerindeki doğrudan ve dolaylı etkisinin (COVID-19'a yönelik tutumun aracılık ettiği) kabul edilebilir bir uyum indeksine sahip olduğunu ortaya koymuştur. Sağlık çalışanlarının büyük çoğunluğu COVID-19'un kaynakları, bulaşması, semptomları, belirtileri, prognozu, tedavisi, yönetimi ve önleyici tedbirleri hakkında yeterli bilgiye, olumlu bir tutuma ve iyi düzeyde uygulamalara sahipti. COVID-19'a yönelik bilgi düzeyi, COVID-19'a yönelik uygulamalar üzerinde hem doğrudan hem de tutumun aracılık rolüyle dolaylı etkiye sahiptir.

Anahtar Kelimeler: COVID-19 Salgını, Bilgi, Tutum, Uygulamalar, Sağlık Çalışanları.

Introduction

Throughout human history, deadly infectious diseases are known to be the most frightening disasters that threaten social life. While natural disasters and wars were limited to certain geographical regions, infectious diseases affected all humanity and showed a great impact wherever people exist (Çobanoğlu, 2009). In December 2019, the virus seen in Wuhan, Hubei province of China, called "New Coronavirus" (SARS-Cov-2) and defined as "COVID-19" started to spread rapidly with human mobility. This new virus, which was first described on January 12, 2020, was named COVID-19 by the World Health Organization WHO after its rapid spread on a global scale due to its very rapid virulence and this epidemic was accepted as a pandemic. Therefore, this new virus is a coronavirus, a family of viruses that includes various viruses, temporarily named "2019-nCoV" and updated as COVID-19 as of February 12, 2020 (World Health Organization, 2020).

From past to present, pandemics have created serious public health threats by causing many casualties and physical and mental problems. It is known that COVID-19 disease is more common in healthcare workers than in society. Because healthcare workers are affected by different highly contagious diseases and are considered among the groups with the highest potential to be affected by future epidemics (Cetintepe and İlhan, 2020). The healthcare system's provision of equitable, consistent and adequate services during the pandemic period depends largely on healthcare professionals. In a study evaluating the data of approximately two million non-health workers and approximately 100 thousand health workers in the USA and the United Kingdom, it was reported that COVID-19 is seen 12 times more in healthcare workers (Nguyen et al., 2020). In the publications from China in the early period of the epidemic, it has been reported that 29% of those who became ill were healthcare workers (Wang et al., 2020). In an article published in the USA, it was stated that 9.6% of COVID-19 patients were healthcare workers; It has been reported that 46.6% of this group consists of nurses. In the same study, 68.6% of the healthcare workers who got sick were working in a period when their diseases were contagious; It has been reported that 47.9% of them had contact with patients with COVID-19 disease or a colleague (Hartmann et al., 2020). In a study published in China, it was reported that 52% of 2457 healthcare workers who had COVID-19 were nurses and 33% were doctors (Zheng et al., 2020). In a study conducted in Denmark, SARS-CoV-2 seropositivity was evaluated in healthcare workers and it was found to be 11.9% in the west of the country and 1.2% in the east (Jespersen et al., 2020).

In addition, in the study conducted by Zhang et al. (2020) on healthcare workers in China, 89% of healthcare workers have sufficient knowledge about COVID-19, 90% of them show the right behavior, among them experienced and highly educated it was determined that they displayed more positive behavior. Söğüt et al. (2020), in their study on midwifery students in Turkey, it was found that midwifery students have sufficient information about a large part of COVID-19. Similarly, in the study conducted by Khasawneh et al. (2020) with medical students in Jordan, it was found that most of the participants had sufficient knowledge about COVID-19. In other studies, it has been shown that the knowledge, attitudes and practices of healthcare professionals towards infectious diseases are at a good level (Sayed et al., 2011; Wang et al., 2020; Kim and Oh, 2016; Ergün et al., 2020). In other similar studies, it has been reported that there is a high level of knowledge concerning SARS-CoV-2 pandemic among

Greek health care workers and this is significantly associated with positive attitudes and practices towards preventive health measures (Papagiannis et al., 2020). Also, analysis has revealed that the level of the knowledge was positive in general, and optimistic attitudes and good practices are held (Puspitasari et al., 2020).

Furthermore, healthcare professionals can make their healthcare institutions a focal point for the spread of infection and lead to disease clusters (Rajakaruna et al., 2017). Because healthcare workers are faced with many problems that are different from normal working conditions due to the pandemic. The most important of these problems is the risk of infection and unwittingly causing the infection to spread (Yen et al., 2011; Yen et al., 2015). Among healthcare professionals; Situations such as poor understanding of the characteristics of the pathogen causing the pandemic, lack of knowledge about COVID-19, insufficient awareness and training on wearing and removing personal protective equipment, lack of knowledge on infection prevention and control, and prolonged contact with infected patients. listed as effective factors (Atkinson et al., 2020; Ali et al., 2020).

The number of healthcare workers affected by COVID-19 both in the world and in our country is at a considerable level. Among the studies conducted to date, there are a limited number of publications and reports evaluating the knowledge, attitude and practices of healthcare professionals towards COVID-19. On the other hand, perceptions about COVID-19 and the ongoing epidemic are changing rapidly. Hence, any lack of information among healthcare professionals; It can lead to misunderstandings, rumors and panic. Because receiving feedback from healthcare workers and determining their concerns; Providing life-saving information is of great importance in adapting response activities and building trust in the long term. In addition, to identify what healthcare professionals already know, how they react to it and why they may be resistant to change; It can help us develop effective and goal-oriented information, establish a more accurate dialogue with them, and encourage positive behavior. The purpose of this evaluation is; to direct the activities of risk communication, behavioral change and employee participation by determining the information, attitudes and practices of healthcare professionals regarding the new coronavirus as well as their information needs regarding COVID-19.

Understanding healthcare workers' knowledge, attitudes, practices help to predict the outcomes of planned behavior. Thus, the main goal of the current study was to analyze the level of knowledge,

attitude, and practice concerning COVID-19, to determine the structural relationship between knowledge toward COVID-19, attitude toward COVID-19 and practice toward COVID-19 with structural equation modelling, to detect socio-demographic variables related to a satisfactory level of them and to explore awareness and health behaviours associated with the prevention of coronavirus infection.

Material and method
Ethics approval

Prior to conducting the study, we obtained informed consent from the participants. This research was carried out upon the approval of the ethics committee of Duzce University Scientific Research and Publication Ethics Committee (Date: 14.01.2021, Decision Number: 2021/31). Quantitative research methodology was used because it is suitable for the purpose and main problem of the research and the analysis of the data set was performed by using SPSS 26 and AMOS 24 statistical analysis programs.

Participants

Data collection carried out by hospital-based survey at the Istanbul Training and Research Hospital (It has 1750 healthcare workers), which provides secondary healthcare services, and Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital (It has 2300 healthcare workers), which provides tertiary treatment, in Istanbul. The population consisted of 4.050 healthcare professionals from this public hospitals. The convenience sampling method was used because it is easily accessible. It was ensured that the participants were in the hospital, had an internet connection, voluntarily participated in a face-to-face or online survey, and could read, understand and answer the given questions. A total of 409 healthcare workers took part in the research. Approximately equal samples were taken from each hospital.

Research Design and Procedure

A hospital-based cross-sectional research design was used. The study was carried out in two different public hospitals operating in Istanbul providing secondary healthcare services. The study was designed and conducted by researchers. The study period was between mid January and mid February 2021. Participants were previously informed that participation was voluntary and their consent was obtained.

Measurements of variables

We applied the turkish version of a ten items Likert-type COVID-19 knowledge level scale (Ahmed et al., 2020). The measuring tool has been found to provide high reliability for the study sample (α=0.889). And then, We applied the turkish version of a eight items Likert-type attitude scale toward COVID-19 (Ahmed et al., 2020). The measuring tool has been found to provide high reliability for the study sample (α=0.886). After that, We applied the turkish version of a six items Likert-type practice scale toward COVID-19 (Limbu et al., 2020). The measuring tool has been found to provide high reliability for the study sample (α=0.758).

In the first stage, permission was requested from the researchers who developed the original scales for the adaptation process and their approval was obtained. The scales were translated into Turkish separately by 3 experts who know both the language of the original scale and Turkish very well. In the second stage, the translations made by the authors and the translation group consisting of experts were compared. While making the comparison, each item was examined in terms of whether the translations were appropriate in terms of intended meaning. The third stage is the provision of the previous stage. At this stage, the scales translated into Turkish were given to a group of 3-5 people who are experts in the language of the original scale and independent from the experts in the second stage and these experts were asked to translate the scales from Turkish back to the original language. Later, the original expression of each item was compared one-to-one with the expression resulting from this translation. With the translation in the third stage, it was seen that the original scale was appropriate.

The concept of language equivalence is also named as language validity in the literature. For this purpose, the original scale and the draft scale were applied to a group of at least 30 people who know the languages of both scales well. In the application process, first the original scale and then the Turkish scale were applied at two-week intervals. After the application, the total scores of each individual in the study group obtained from both the original scale and the Turkish scale were calculated, and it was observed that the Pearson correlation coefficient of the relationship between the two applications was significant (p<0.01) and the degree of coefficient was 0.84 which shows a very high degree of harmony.

Data analysis

SPSS and AMOS package programs were used for statistical analysis. In order to evaluate the reliability in terms of internal consistency, separate Cronbach alpha coefficients of all two subscales were calculated. First, the reliability analysis was performed on the data, and then the main variables of the research (COVID-19 knowledge level, attitude toward COVID-19 and practice toward COVID-19) were examined in terms of means, standard deviations, reliability coefficients, frequency distribution and variance values. Second, confirmatory factor analyses (CFA), using structural equation modelling in AMOS 24, were performed to assess different latent structure models of the relationship between COVID-19 knowledge level, attitude toward COVID-19 and practice toward COVID-19. Criteria for determining confirmatory factor analysis model fit and measurement invariance were based on conventional standards (Munro, 2005; Brown, 2006; Byrne, 2001).

Results
Reliability of research data and pilot study
Conducting a pilot study;

A pilot study was carried out on 20 people with the draft scale and the expression errors in the questionnaire statements, misunderstandings by the respondents, spelling mistakes etc. have been corrected.

Test-retest reliability;

For the test-retest reliability, the draft scale was administered to 30 people twice with a 2-week interval and the total scores from the scale are given below. The level (degree) of the Pearson correlation coefficient between the first and the second application is 0.84 (84%) meaning that there is a very strong positive correlation between the first and the second application. It can be concluded that the measurements taken at different times are very similar, hence, the scale is highly reliable.

Application of the draft scale to the target audience;
An online survey technique was applied to 409 individuals.
Performing item analysis for internal consistency reliability;
For the reliability analysis, "item analysis based on item-total correlation" was performed on the data obtained from the target population.

Normality Analysis

When the number of observations is 29 or more, Kolmogorov-Smirnov Test is used for normality (Kalaycı, 2008). Therefore, Kolmogorov-Smirnov Test was used to determine whether the data showed a normal distribution and as a result of the analysis, it was seen that the data were not normally distributed. It is common to observe abnormal data in studies of this nature. Micceri (1989) states that normality is rare in social science studies that require the use of non-parametric tests. In addition, in cases where the number of subjects entering the analysis is high, it can be accepted that the variables meet the normality assumption according to the central limit theorem (Smidt et al., 2001). On the other hand, according to Tabachnick and Fidell (2013), if the skewness/kurtosis values obtained from the normal distribution analysis are between -1.5 and +1.5, the data is considered to have a normal distribution. Table 1 shows the skewness and kurtosis values of the data.

Table 1. *Skewness and Kurtosis Values of the Data*

Variables	Skewness Values	Kurtosis Values
Knowledge toward COVID-19	-1,885	5,299
Attitude toward COVID-19	-1,167	3,169
Practice toward COVID-19	-,894	1,458

As can be seen from the table, the skewness and kurtosis values of all variables are between -1.5 and +1.5. Therefore, analysis techniques with normal distribution were applied to all data.

Demographic characteristics of study participants

Four hundred and nine (409) healthcare workers in Turkey participated in this survey. Table 2 shows the main characteristics of the participants in the study. It can be seen that 43.5% males and 56.5% females were the respondents for this study. Among 409 respondents, 72.1% were aged 20–29 years, 16.1% were aged 30-39 years, 7.8% were aged 40-49, 3.7% were aged 50-59 and the remaining 0.2 % were aged >59 years. Participants about two-thirds (77.3%) had college education levels. Most respondents were unmarried (71.6%) and were nurses (53.8%). Other occupations such as doctors, paramedics, medical laboratory assistant, patient consultant, health officer and technical staff accounted for 5.1%, 3.7%, 8.3%, 2.4%, 13.9% and 12.7%, respectively. And the majority of participants had 0-5 years experience (62.9%). There was no significant difference in knowledge towards COVID-19 score according to sex, age, experience, marital status, speciality and

educational level of the participants. Similarly there was no significant difference in attitude towards COVID-19 score according to sex, age, experience, marital status, speciality and educational level of the participants. Therefore there was a statistically significant difference in practices towards COVID-19 score according to sex (t test = -3.002; P < .05), marital status (t test = 2.771; P < .05) and educational level of the participants (Anova = 3.191; P < .05). However, there was no significant relationship among the age of the participants, the educational level of the participants, the experience of the participants and the speciality of the participants.

Table 2. *Demographic Characteristics of Participants and T Test and Anova Analysis Results*

Variables	Frequency (n)	Percentage (%)	Knowledge towards COVID-19		Attitude towards COVID-19		Practices towards COVID-19	
			t Test / Anova (t/F)	p-value (2tailed)	t Test/ Anova (t/F)	p-value (2tailed)	t Test / Anova (t/F)	p-value (2tailed)
Sex								
Male	178	43.5	-1.124[a]	.262	-1.054[a]	.293	-3.002[a]	.003
Female	231	56.5						
Age categories								
20-29	295	72.1						
30-39	66	16.1	.811[b]	.519	2.161[b]	.073	2.230[b]	.065
40-49	32	7.8						
50-59	15	3.7						
>59	1	0.2						
Experience (years)								
0-5	284	69.4						
6-10	57	13.9						
11-15	14	3.4	1.067[b]	.381	1.965[b]	.070	1.468[b]	.188
16-20	21	5.1						
21-25	13	3.2						
26-30	14	3.4						
>30	6	1.5						
Marital Status								
Married	116	28.4	.451[a]	.652	1.147[a]	.253	2.771[a]	.006
Unmarried	293	71.6						
Speciality								
Doctors	21	5.1						
Nurses	220	53.8						
Paramedics	15	3.7						
Medical laboratory assistant	34	8.3	1.654[b]	.131	.539[b]	.779	1.071[b]	.379
Patient consultant	10	2.4						
Health officer	57	13.9						
Technical staff	52	12.7						
Educational attainment								
Junior college and below	56	13.7	2.125[b]	.121	2.466[b]	.086	3.191[b]	.042
College	316	77.3						
Postgraduate	37	9.0						

[a] Independent sample t test [b] ANOVA test

Descriptive findings related to factors

Descriptive statistics, averages, standard deviations, reliability coefficients, number of participants and variance values are given in Table 3.

Table 3. *Descriptive Statistics Related to Factors*

Variables	N	Mean	Standard Deviation	Variance	Cronbach's alpha
Knowledge toward COVID-19	409	4.2800	.66029	.436	.889
Attitude toward COVID-19	409	3.8166	.60196	.362	.886
Practice toward COVID-19	409	3.9623	.74139	.550	.758

The overall reliability coefficient was found to be Alpha= 0.896. Because $0.80 \leq \alpha < 1.00$, the scale is highly reliable. Ensuring validity and reliability shows the existence of a structural relationship between knowledge toward COVID-19, attitude toward COVID-19 and practice toward COVID-19 of health care workers during the rapid rise period of the COVID-19 outbreak.

The model fit measures

In this study, a total of 23 questions formed two latent variables. Out of these 23 items, 2 items were not included in the analysis since they had a poor factor load. Model fit was tested with the model goodness-of-fit indicators given in Table 4 and accepted in the literature.

Table 4. *Model Fit Measures*

Measure	Estimate	Threshold	Interpretation
CMIN/DF	2.891	Between 1 and 5	Acceptable range
CFI	0.903	≥ 0.90	Within range
GFI	0.893	≥ 0.85	Within range
SRMR	0.057	≤ 0.08	Within range
RMSEA	0.068	≤ 0.10	Within range
IFI	0.904	≥ 0.90	Within range
RMR	0.054	≤ 0.08	Within range

In Table 4, it is seen that all latent variables of the study provide the general model goodness of fit values suggested by Munro (2005), Brown (2006) and Byrne (2001).

The results of the measurement model

It was assumed that the reasoning between the variables in the research model can be explained. Confirmatory factor analysis was performed to test the validity of the scales used, and the structure of

all scales were verified. Figure 1 shows the confirmatory factor analysis results and model fit for the variables of knowledge toward COVID-19, attitude toward COVID-19 and practice toward COVID-19.
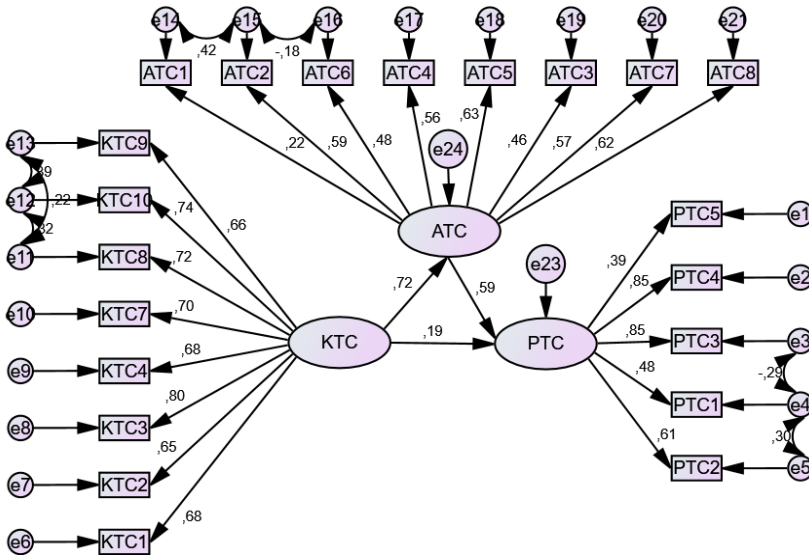
Figure 1. *The Results of the Full Model*

The estimates or standard loading of each item ranges from 0.21 to 0.85. Table 5 shows that the cronbach's α coefficients are above the minimum criterion (> 0.60). Finally, for average variance extracted (AVE) and construct reliability (CR), Fornell and Larcker (1981) stated that although the AVE value is below 0.50, if the CR value is above 0.70, AVE values below 0.50 can be accepted. In addition, Table 5 shows that the structures applied in the research meet the reliability and validity criteria.

Table 5. *The Items' Estimate and the Constructs' Cronbach's a, AVEs and CRs.*

Constructs	Items	Estimate	Cronbach's α	Average Variance Extracted (AVE)	Construct Reliability (CR)
Practice toward COVID-19 (PTC)	PTC5	.392	.758	0.44	0.75
	PTC4	.855			
	PTC3	.852			
	PTC1	.479			
	PTC2	.615			

Knowledge toward COVID-19 (KTC)	KTC1	.680	.889	0.50	0.91
	KTC2	.649			
	KTC3	.803			
	KTC4	.681			
	KTC7	.699			
	KTC8	.723			
	KTC10	.736			
	KTC9	.659			
Attitude toward COVID-19 (ATC)	ATC1	.218	.886	0.28	0.74
	ATC2	.585			
	ATC6	.476			
	ATC4	.562			
	ATC5	.632			
	ATC3	.460			
	ATC7	.572			
	ATC8	.616			

Since the CR vavues are greater than 0.7, the factors have high construct reliability. The fit values examined show that the data fit the model well. Table 6 shows the results of the structural model.

Table 6. *The Result of the Structural Model*

Hypothesis	Paths	Estimate	S.E.	C.R.	P	Result
Effect of Knowledge toward COVID-19 on Practice toward COVID-19 (Before Mediation)						
H_1	PTC <--- KTC	.603	.080	6.214	***	H_1 supported
Effect of Knowledge toward COVID-19 on Practice toward COVID-19 (After Mediation)						
H_2	ATC <--- KTC	0.721	.067	3.856	***	H_2 supported with a partial mediation
	PTC <--- ATC	0.588	.396	3.259	.001	
	PTC <--- KTC	0.189	.064	2.328	.020	

The indirect relationship and its properties are shown in Table 7. When the mediator variable (Attitude toward COVID-19 / ATC) is included in the model with the independent variable (Knowledge toward COVID-19 / KTC) are included in the model, the direct effect of the independent variable (Knowledge toward COVID-19 / KTC) on the dependent variable (Practice toward COVID-19 / PTC) is reduced. The standardized regression value between the independent variable (Knowledge toward COVID-19 / KTC) and the dependent variable (Practice toward COVID-19 / PTC) decreased from 0.613 to 0.333.

Table 7. *Indirect Effect Of The Model*

Indirect Path	Unstandardized Estimate	Standardized Estimate	p value
KTC --> ATC --> PTC	0,333	0,424	***

The results of the structural model

From the result, it is found that with a direct effect of 'knowledge toward COVID-19', there is a significant impact established on practice toward COVID-19. Thus, H_1 is statistically

supported. On the other hand, with the presence of a mediator, attitude toward COVID-19, it can be seen that the relationship between 'knowledge toward COVID-19' and 'practice toward COVID-19' becomes less significant and creates a partial mediation effect into the relationship.

Conclusion

The COVID-19 disease, which has recently affected the world and spread to continents in a short time, has become a life-threatening agent and an international type of fear. This disease was first seen on December 12, 2019 in Wuhan, China. Due to the rapid spread of the virus, it has been reported in the latest statistical data that it has now infected more than 150 countries. Health workers are also in close contact with infected patients due to their profession, and they also play a vital role in the control of infection. This study was tried to assess the knowledge, attitude and practices toward the COVID–19 outbreaks among healthcare workers and to test the structural relationship between knowledge, attitude and practices with structural equation modelling. In this study, the socio-demographic, knowledge, attitude and practices toward COVID-19 of 409 healthcare workers were analyzed. This is the first study that examined especially healthcare workers' mental health and its associated factors during the novel coronavirus outbreak in Turkey using a medium-scale cross-sectional design.

This study was conducted in the second boom period of the COVID-19 outbreak and in areas critically affected by the outbreak. In this study, it was investigated whether there was a relationship between the attitudes and practices toward COVID-19 of the healthcare workers and their sociodemographic characteristics, the changes they experienced in daily life due to coronavirus, and their levels of knowledge about the coronavirus disease. According to the results of this research work, the knowledge, attitude and practices toward COVID-19 of the healthcare workers participating in the research were sufficient, optimistic and good. Knowledge level toward COVID-19 are significantly associated with attitude toward COVID-19.

Overall, healthcare workers have sufficient knowledge, optimistic attitude and good practices toward COVID-19. In this study, a great majority of the participants had sufficient knowledge of clinical symptoms of the disease which is similar to recent studies (Guan et al., 2020). Participants were aware of the asymptomatic transmission of the virus. Studies, support the possible transmission of

coronavirus from asymptomatic patients (Guan et al., 2020; Rothe et al., 2020). Our finding showed a great majority of the study participants had favorable attitude towards the COVID-19. This findings is in line with the study conducted in China and Iran (Huynh et al., 2020; Bhagavathula et al., 2020) and Saudi Arabia (Asaad et al., 2019). The results of the current study showed that healthcare professionals need accurate information about the signs and symptoms of the disease, as well as a fairly good level of knowledge about COVID-19.

Among the factors affecting the transmission of COVID-19 infection among healthcare workers, the poor understanding of the characteristics of the pathogen causing the infection, the insufficient awareness and training on wearing and removing personal protective equipment, secondary infections and occupational hazards, lack of sufficient time for systematic training and practices, inspection and lack of guidance, long working hours, mental distress such as fatigue, stress, anxiety, physical and mental violence. Healthcare workers who are at risk and who feel anxious and who do not have adequate pandemic preparation may not be able to provide adequate and quality health care, together with occupational exposure and difficulties specific to the pandemic period. On the other hand, healthcare professionals should take part in the fight against the pandemic regarding the protection and improvement of the health of the society on the other hand, ensuring the continuity of quality health care and service despite the need for healthcare.

As a result, teaching key information to encourage healthcare professionals to adopt positive behaviors, preventing COVID-19 disease among healthcare professionals, addressing false information and rumors with feasible information, and organizing seminars on improving hygiene, information with people who have an impact on community life, such as healthcare administrators and doctors. materials, promote internal dialogue and social cohesion by focusing on addressing stigma and xenophobia among healthcare professionals, and periodically encourage those at the highest risk, barriers to healthy behavior, information needs, preferred/trusted communication channels and it is recommended to regularly evaluate information, attitudes and practices to determine community perception of risks.

COVID-19 disease is currently seen as a global public health problem worldwide due to its potentially high mortality rate. Healthcare workers, on the other hand, play a critical role in preventing the COVID-19 outbreak through appropriate care and preventive procedures, as they have direct contact with patients in

such global outbreaks. In addition, social issues become more complex when it comes to the chain of infection in such pandemics. Therefore, in such a new global epidemic situation, it is also important to investigate the knowledge, attitudes and practices of health professionals regarding the pandemic.

In the study, it was found that the level of compliance of health workers with knowledge, attitudes and practices about preventing COVID-19 was quite good. It is estimated that the high level of knowledge, attitudes and compliance with the practices of health workers about preventing COVID-19 is one of the most important factors that help the country to successfully control COVID-19 in the beginning. In addition, this research has revealed the importance of continuously increasing and maintaining the awareness of healthcare professionals about their knowledge, attitudes and practices on COVID-19 prevention. In addition, this research provides valuable information for countries currently facing the ongoing pandemic to identify and address gaps in knowledge, attitudes and practices on COVID-19 prevention, as well as to identify the mental health impact of COVID-19.

COVID-19 disease is seen as an important global health problem that affects societies, especially healthcare workers. Even though different individuals and groups have experienced some psychological and social problems at different levels, the most affected group has been the health workers. Conducting descriptive studies to determine the mental and psychological needs of healthcare workers during the epidemic will greatly contribute to the pandemic management process.

References

Ahmed, M. A., Rehab, H. E., Mahdi, A. A., and Maher, E. (2020). Knowledge and attitudes towards Middle East respiratory sydrome-coronavirus (MERS-CoV) among health care workers in south-western Saudi Arabia. *East Mediterr Health J.*, 26 (4), 435-442.

Ali, S., Noreen, S., Farooq, I., Bugshan, A., and Vohra, F. (2020). Risk Assessment of Healthcare Workers at the Frontline against COVID-19. *Pak J Med Sci.*, 36, 99-103.

Asaad, A. M., El-Sokkary, R., Alzamanan, M., and El-Shafei, M. (2020). Knowledge and attitudes towards Middle East respiratory syndrome-coronavirus (MERS-CoV) among health care workers in south-western Saudi Arabia. *East Mediterr Health J.,* 26 (4), 435-442.

Atkinson, P., French, J., Lang, E., McColl, T. and Mazurik, L. (2020). Just the Facts: Protecting frontline clinicians during the COVID-19 pandemic. *Canadian Journal of Emergency Medicine*, 1-5.

Bhagavathula, A. S., Aldhaleei, W. A., Rahmani, J., Mahabadi, M. A. and Bandari, D. K. (2020). Novel Coronavirus (COVID-19) Knowledge and Perceptions: A Survey on Healthcare workers. *medRxiv*, https://doi.org/10.1101/2020.03.09.20033381

Brown, T. A. (2006). Confirmatory factor analysis for applied research. New York: Guilford Press.

Byrne, B. M. (2001). Structural equation modeling with AMOS: Basic concepts, applications, and programming. Lawrence Erlbaum Associates.

Cetintepe, S. P. and İlhan, M. N. (2020). COVID-19 Salgınında Sağlık Çalışanlarında Risk Azaltılması. *Journal of Biotechnology and Strategic Health Research*, *4*, 50-54.

Çobanoğlu, N. (2009). Ölümcül Olabilen Bulaşıcı Hastalıklarla İlgili Tıbbi Araştırmalarda Etik, Sağlık Bilimlerinde Süreli Yayıncılık, Orhan Yılmaz (Ed.), TÜBİTAK, Ulakbim, Ankara, (s. 29-38).

Ergün, E., Ergün, Ş. and Çelebi, İ. (2020). Acil Sağlık Hizmetleri Personellerinin COVID-19 Hakkında Bilgi, Korunma Düzeyleri ve Etkileyen Etmenler. *Paramedik ve Acil Sağlık Hizmetleri Dergisi*, 1(1), 16-27.

Fornell, C. and Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 48, 39-50.

Guan, W. J., Ni, Z. Y., Hu, Y, Liang, W. H., Ou, C. Q. and He, J. X. et al. (2020). Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med*., 1-13.

Hartmann, S., Rubin, Z., and Sato, H. et al. (2020). Coronavirus 2019 (COVID-19) Infections Among Healthcare Workers, Los Angeles County, Clin Infect Dis. 2020 Aug 17: ciaa1200. doi:10.1093/cid/ciaa1200. Epub ahead of print. PMID: 32803237; PMCID: PMC7454348.

Huynh, G., Nguyen, T. N. H., Tran, V. K., Vo, K. N., Vo, V. T. and Pham, L. A. (2020). Knowledge and attitude toward COVID-19 among healthcare workers at District 2 Hospital, Ho Chi Minh City. *Asian Pacific Journal of Tropical Medicine*, 13(6), 260-265.

Jespersen, S., Mikkelsen, S. and Greve, T. et al. (2020). Severe Acute Respiratory Syndrome Coronavirus 2 Seroprevalence Survey

Among 17 971 Healthcare and Administrative Personnel at Hospitals, Prehospital Services, and Specialist Practitioners in the Central Denmark Region. *Clinical Infectious Diseases*, ciaa1471, doi: 10.1093/cid/ciaa1471.

Kalaycı, Ş. (2008). *SPSS Uygulamalı Çok Değişkenli İstatistik Teknikleri* (3. Baskı). Ankara: Asil Yayın Dağıtım.

Khasawneh, A. I., Humeidan, A. A., Alsulaiman, J. W., Bloukh, S. and Ramadan, M. (2020). Medical students and COVID-19: Knowledge, attitudes, and precautionary measures. a descriptive study from Jordan. *Frontiers in Public Health*. https://dx.doi.org/10.3389/fpubh.2020.00253.

Kim, O. S. and Oh, J. H. (2016). The Convergence Study on Anxiety, Knowledge, Infection Possibility, Preventive Possibility and Preventive Behavior Level of MERS in Nursing Students. *Journal of the Korea Convergence Society*, 7(3), 59-69.

Limbu, D. K., Piryani, R. M. and Sunny, A. K. (2020). Healthcare workers' knowledge, attitude and practices during the COVID-19 pandemic response in a tertiary care hospital of Nepal. *PLoS ONE*, 15(11), e0242126. https://doi.org/10.1371/journal.pone.0242126

Micceri, T. (1989). The unicorn, the normal curve, and other improbable creatures. *Psychological Bulletin*, *105*, 156-166.

Munro, B. H. (2005). Statistical Methods For Health Care Research. Philadelphia: Lippincott Williams and Wilkins, 351-376.

Nguyen, L. H., Drew, D. A. and Graham, M. S., et al. (2020). Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *Lancet Public Health*, 5, e475–83.

Papagiannis, D., Malli, F., Raptis, D. G., Papathanasiou, I. V. and Fradelos, E. C. et al. (2020). Assessment of Knowledge, Attitudes, and Practices towards New Coronavirus (SARS-CoV-2) of Health Care Professionals in Greece before the Outbreak Period. *International Journal of Environmental Research and Public Health*, 17, 4925.

Puspitasari, I. M., Yusuf, L., Sinuraya, R. K., Abdullah, R. and Koyama, H. (2020). Knowledge, Attitude, and Practice During the COVID-19 Pandemic: A Review. *Journal of Multidisciplinary Healthcare*, *13*, 727–733.

Rajakaruna, S. J., Liu, W. B., Ding, Y. B. and Cao, G. W. (2017). Strategy and technology to prevent hospital-acquired infections: Lessons from SARS, Ebola, and MERS in Asia and West Africa. *Military Medical Research*, 4(1), 32.

Rothe, C., Schunk, M., Sothmann, P., Bretzel, G., Froeschl, G. and Wallrauch, C. et al. (2020). Transmission of 2019-NCOV infection from an asymptomatic contact in Germany. *N Engl J Med.*, 382(10), 970-971.

Sayed, M. E., Kue, R., Mcneil, C. and Dyer, K. S. (2011). A Descriptive Analysis of Occupational Health Exposure in an Emergency Medical Services System. *Prehosp Emerg Care*, *15*, 506-510.

Smidt, R. K., Levine, D. M. & Ramsey, P. P. (2001). Applied Statistics. Prentice Hall.

Söğüt, S., Dolu, I. and Cangol, E. (2020). The relationship between COVID-19 Knowledge Levels and Anxiety States of Midwifery Students During the Outbreak: A Cross-Sectional Web-Based Survey. *Perspectives in Psychiatric Care*, https://dx.doi.org/10.1111/ppc.12555

Tabachnick, B. G. and Fidell, L. S. (2013). Using Multivariate Statistics (6th ed.). Boston, MA: Pearson.

Wang, D., Hu, B., and Hu, C. et al. (2020). Clinical characteristics of 138 hospitalised patients with 2019 novel coronavirusinfected pneumonia in Wuhan, China. *JAMA*, *323*, 1061-1069.

Wang, C., Hornby, P. W., Hayden, F. G., and Gao, G. F. (2020). A Novel Coronavirus Outbreak of Global Health Concern. *Lancet*, 395(10223), 496.

World Health Organization (WHO). (2020). Coronavirus Disease (COVID-19) Dashboard. https://COVID19.who.int/table

Yen, M. Y., Lin, Y. E., Lee, C. H., Ho, M. S., Huang, F. Y. and Chang, S. C. et al. (2011). Taiwan's traffic control bundle and the elimination of nosocomial severe acute respiratory syndrome among healthcare workers. *Journal of Hospital Infection*, 77(4), 332-337.

Yen, M. Y., Schwartz, J., Wu, J. SJ. and Hsueh, P. R. (2015). Controlling Middle East respiratory syndrome: lessons learned from severe acute respiratory syndrome. *Clinical Infectious Diseases*, 61(11), 1761-1762.

Zhang, M., Zhou, M., Tang, F., Wang, Y. and Nie, H. (2020). Knowledge, Attitude and Practice Regarding COVID-19 Among Health Care Workers in Henan, China. *Journal of Hospital Infection*, 105, 183-187. https://dx.doi.org/10.1016/j.jhin.2020.04.012

Zheng, L., Wang, X., and Zhou, C. et al. (2020). Analysis of the Infection Status of Healthcare Workers in Wuhan During the COVID-19 Outbreak: A Cross-sectional Study. *Clin Infect*

Dis, 71(16), 2109-2113. doi:10.1093/cid/ciaa588. PMID: 32409825; PMCID: PMC7239233.

Additional Statement
The authors contributed equally to the study.