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ORIGINAL PAPER

Evaluation of nurses' knowledge about protective precautions and experiences in terms of various factors during Covid-19 pandemic

Betul Tosun[1], Nursemin Unal[2], Serap Gungor[3] İsmail Dusak[4], Canan Porucu[5], Ayla Yava[1]

[1]*Department of Nursing, Faculty of Health Sciences, Hasan Kalyoncu University, Gaziantep, Turkey*
[2]*Department of Nursing, Faculty of Health Sciences, Ankara Medipol University, Ankara, Turkey*
[3]*Vocational School of Health Services, Kahramanmaras Sutcu Imam University, Kahramanmaras, Turkey*
[4]*Sanliurfa Mehmet Akif Inan Education and Research Hospital, Sanliurfa, Turkey*
[5]*Medical Oncology Department, Gulhane Training and Research Hospital, University of Health Sciences, Ankara, Turkey*

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Abstract

Aim: The aim of the study was to evaluate nurses' knowledge of protective precautions and their experiences of various factors during the Covid-19 pandemic. *Design:* A descriptive cross-sectional study. *Methods:* In this descriptive cross-sectional study, the snowball method was selected for sampling to access nurses (n = 392) serving in the fight against the Covid-19 infection nationwide. The online data collection form had two parts: a sociodemographic form and a second part including 25 items on institutional protective measures, personal protective measures, and nursing care. *Results:* Most of the nurses caring for patients with Covid-19 were well-informed about institutional, personal, and patient protective precautions. The scores of female nurses, married nurses and those with children were higher. Multiple regression analysis revealed that in-service training, working in a clinic, and having colleagues diagnosed with Covid-19 positively affected knowledge, while having 0–5 years of professional experience negatively affected knowledge. *Conclusion:* This study may enlighten medical authorities and policymakers in their efforts to promote the quality of care delivered to patients with Covid-19 and the quality of working conditions of healthcare providers.

Keywords: Covid-19 pandemic, experiences, knowledge, nurses, personal protective equipment, precautions.

Introduction

The Covid-19 pandemic is a significant threat to human life, leading to death in severe cases (Gao et al., 2020). Healthcare professionals in direct contact with Covid-19 infected patients are vulnerable, and they can be a transmitter to their family members and colleagues without realizing it (Huang et al., 2020). The International Council of Nurses (ICN) underlined the ineffective data collection methods of governments for determining the exact number of Covid-19 infected healthcare professionals when they announced that worldwide at least 1.6 million healthcare providers had been infected with Covid-19 and more than 2,710 nurses had died from it (ICN, 2021).

A study reported that in China, where the pandemic originated, underlying reasons for the high number of infected healthcare providers included the failure to maintain adequate personal protection due to inadequate knowledge of protection protocols, prolonged exposure to numerous infected patients, becoming prone to infection due to heavy workload and lack of rest, lack of adequate personal protective equipment (PPE), and lack of knowledge of transmission of respiratory infectious diseases (Wang et al., 2020). In this unexpected crisis, healthcare providers did not have the chance to be systematically trained in Covid-19 prevention and this led to an increase in the dissemination risk of the infection.

It is known that in many regions of the world, nurses had problems obtaining sufficient PPE, such as face masks, gloves, and gowns (Jackson et al., 2020). Nurses were not only endangering their own lives but also endangering patient safety, a fundamental tenet of nursing, by not having PPE or using it incorrectly. In response to this unprecedented medical crisis, nurses had the longest contact with Covid-19 infected patients due to the nature of their profession and they

Corresponding author: Nursemin Unal, Department of Nursing, Faculty of Health Sciences, Ankara Medipol University, Ankara, Talatpasa Boulevard, No: 2, 06050, Altindag / Ankara, Turkey; email: nurse_unal@hotmail.com

were the key link in the chain of transmission of infection (Nemati et al., 2020). In the treatment process of Covid-19 patients, they are responsible for many tasks including clinical treatment, care, assistance with decontamination, coordination with other healthcare professionals, isolation, communication, education of patients and their relatives, triage, psychological support, caring for relatives, and palliative care. However, when they respond to a crisis like Covid-19, they run into problems that prevent them from caring for infected patients (Al Thobaity & Alshammari, 2020; Nemati et al., 2020). Lack of knowledge or misinformation among nurses is known to cause dissemination of infection, particularly in hospitals with gaps in infection control protocols (Omrani & Shalhoub, 2015). Thus, the key to breaking the chain of infection is nurses' knowledge and attitudes regarding protective measures (Nemati et al., 2020). The length of the pandemic period is not known; however, there is no doubt that the provision of proper medical services and nursing care is crucial in this process.

According to the data of the Ministry of Health in Turkey, the first Covid-19 infection case was detected on 11 March 2020 in Turkey and the number of confirmed cases continues to grow as the capacity for diagnostic tests increases. At the time of writing, in the middle of September 2021, the total number of confirmed Covid-19 cases stood at 6,458,630 and mortality at 57,559 (Turkey Republic Ministry of Health, 2021). The knowledge and experience of nurses who fight at the forefront of all kinds of natural disasters, wars, and epidemics and constitute the largest health workforce in the world are vital during the course of this pandemic.

Aim

The study aimed to evaluate nurses' knowledge of protective precautions and their experiences of various factors during the Covid-19 pandemic.

Research questions:

1) What is the knowledge level of nurses who care for Covid-19 patients regarding institutional, personal, and patient protective precautions?
2) What are the experiences of nurses during the new Covid-19 pandemic?
3) What is / are the affective factors of nurses' knowledge levels regarding institutional, personal, and patient protective precautions?

Methods

Design

A descriptive cross-sectional study.

Sample

The snowball method was selected for sampling to access nurses serving in the effort to fight the Covid-19 infection nationwide. The union of healthcare professionals contributed to our research by reaching out to nurses across the country. Data for this descriptive cross-sectional study were collected by means of an online data collection form (Google Forms). First, data collection forms were sent to five different regional managers, who shared the data collection forms with ten nurse directors affiliated with them and invited them to participate in our study. In addition, the link to the online data collection form was disseminated by researchers via an instant messaging application, personal social media accounts and various internet platforms.

We received 403 responses to our data collection forms, which reached approximately 1,500 nurses in total. The data collection form comprised 55 items in total, and nationwide 403 participants from 35 cities responded to the online form between 30 April 2020 and 20 May 2020. Eleven participants were excluded from the sample due to various reasons (three of them did not complete the online form, three did not meet the inclusion criteria, and five did not click on "I agree that I understand the instructions and I agree to participate") and so the final sample included 392 participants.

Data collection

The data collection form consisted of two parts: 1) the first part included 23 items on sociodemographic characteristics of participants such as age, gender, city of abode, marital status, educational status, number of children, other medical personnel in the family, years of professional experience, and their working experiences in pandemic clinics (Table 1); 2) the second part included 25 items on institutional protective measures, personal protective measures, and nursing care, and was developed by researchers based on a literature review (Centers for Disease Control and Prevention [CDC], 2020; Chen et al., 2020; Tayran & Ulupinar, 2011; World Health Organization [WHO], 2020). In the second part, there were statements with correct and incorrect answers. Since information on the Covid-19 pandemic is new and is updated by the latest clinical evidence, these items could not be evaluated on the scale. It was, therefore, based on clinical practices and current evidence published in clinical guidelines valid

Table 1 Distribution of sociodemographic and definitive features of participants (n = 392)

Characteristics		mean ± SD	min.–max.
Age (years)		32.66 ± 7.40	21–55
		n	**%**
Gender	female	250	63.80
	male	142	36.20
Marital status	single	153	39.00
	married	239	61.00
Children	have a child	208	53.10
	no children	184	46.90
Educational status	high school	25	6.40
	vocational school	38	9.70
	university-bachelor's degree	280	71.40
	university-post-graduate degree	49	12.50
Professional experience	0–5 years	130	33.20
	6–10 years	117	29.80
	11–15 years	58	14.80
	16–20 years	39	9.90
	21 years or more	48	12.20
Other healthcare professionals among family members	yes	166	42.30
	no	226	57.70
Working unit	clinic	184	46.90
	intensive care	168	42.90
	clinic and intensive care	40	10.20
Experience in caring for patients with infectious diseases such as H1N1, SARS, or MERS	yes	142	36.20
	no	250	63.80
Chronic disease[a]	hypertension	14	3.60
	diabetes mellitus	7	1.80
	respiratory system disorders	20	5.10
	others (allergic, thyroid, renal or cardiac disorders)	29	7.40
	none	328	83.40
Where and who were you staying with now?	Home, alone.	82	20.90
	I am staying at hospital.	10	2.60
	I am staying at another house / hotel / guesthouse.	37	9.40
	Home, just like before the pandemic.	200	51.00
	Home, but isolated from family members.	63	16.10

[a]*more than one option is selected, results are multiplied; SD – standard deviation; min. – minimum; max. – maximum*

at the time of the research. There is no validity and reliability study of the items. However, it was edited and developed according to expert opinion from a professional in the field. Respondents were given one point for each correct answer and a total score was calculated ranging from minimum 0 to a maximum of 25 points. Some questions had more than one correct answer and the option "I don't know" was counted as an incorrect answer.

Data analysis

Data were analyzed with the Statistical Package for Social Sciences (SPSS) for Windows 22.0 program pack. The normality of the distribution was analyzed by the Kolmogorov-Smirnov test. Descriptive variables were presented in number, percentage, mean, standard deviation, median, and minimum and maximum values. The fact that the participants were not known by the researchers eliminated analysis bias. In the comparison of mean knowledge scores, the Mann Whitney U test was used for comparing two groups and the Kruskal Wallis test was used for comparing three and more groups. To examine the source of difference among multi-groups, the Mann Whitney U test was used for the comparison of two groups as further statistical analysis. Additionally, an analysis of causality was performed by multiple linear regression analysis and the stepwise model. Statistical significance was set at $p < 0.05$.

Results

In our study, 392 nurses with a mean age of 32.66 (± 7.4) years (min. = 21 years, max. = 55 years), from 35 different cities in Turkey, working in pandemic clinics and intensive care units were enrolled. The majority of the participants were female (63.8%),

61% married, 53.1% had children, 71.4% had a graduate degree, 33.2% had 0–5 years' working experience as a nurse and 42.3% had another healthcare professional in their family. Nearly half of the participants (46.9%) were working in Covid-19 clinics, and 63.8% had no experience in caring for patients with infectious diseases such as H1N1, SARS or MERS. The majority of the participants (83.4%) had no chronic diseases and the leading chronic diseases (5.1%) were diseases of the respiratory system. After the pandemic, 51% of them continued to live at home (Table 1).

Only 24.5% of the participants had had a Covid-19 PCR test and 1.3% of their tests were positive. Nearly half of the participants (46.4%) had a colleague who had had a positive Covid-19 PCR test and 2% had a family member who had had a positive Covid-19 PCR test. The majority of the participants (76.8%) reported that they had received in-service training in Covid-19. More than two-thirds of the participants (66.8%) followed up-to-date information on clinical protection methods from traditional media. The hardest challenge for participant nurses in caring for (suspected) Covid-19 diagnosed patients was providing hygiene and isolation interventions (66.1%). Few participants (2.6%) were not able to access PPE in their working environment (Table 2).

Table 2 Distribution of Covid-19 definitive features of participants (n = 392)

		n	%
Have you had a Covid-19 test?	yes	96	24.50
	no	296	75.50
Have you had a positive Covid-19 test result?	yes	5	1.30
	no	387	98.70
Have you had anyone in your family diagnosed with Covid-19?	yes	8	2.00
	no	384	98.00
Have you had any healthcare professionals around you diagnosed with Covid-19?	yes	182	46.40
	no	210	53.60
Have you received in-service training on Covid-19?	yes	301	76.80
	no	91	23.20
How do you follow up to date information on clinical protection methods for Covid-19?	scientific articles	145	36.70
	traditional media	262	66.80
	social media	222	56.60
	guidelines of nursing and medical organizations	190	4.80
	colleagues	192	4.90
	I do not follow it	17	4.30
What is the hardest challenge in nursing interventions?*	interventions in nutrition	118	3.10
	interventions in urinary system and bowel elimination	192	49.00
	interventions in respiratory systems	240	61.20
	problems in comorbid diseases	118	30.10
	interventions in hygiene and isolation	259	66.10
	emotional support	115	29.30
	communication	121	30.90
	medication interventions	116	29.60
	monitoring vital signs	97	24.70
	iv cannulation	2	0.50
Were you able to access PPE without any problem in your working environment?*	face mask	321	81.90
	gown	281	71.70
	overalls	215	54.90
	bonnet	300	76.50
	goggles	273	69.60
	gloves	359	91.60
	face shield	262	66.80
	shoe covers	109	27.80
	none	10	2.60

**more than one option is selected, results are multiplied; PPE – personal protective equipment*

The distribution of responses of participants on institutional, personal, and patient protective precautions are shown in Table 3. Nurses' accurate, inaccurate, and uncertain responses, and the frequency of their responses, are listed in the table.

The mean knowledge score derived from answers was 19.26 (± 2.82) (min. = 10; max. = 25). The median knowledge score of female nurses (z = -1.959; p = 0.05), married nurses (z = 1.888; p = 0.009), and nurses who had children (z = -3.467; p < 0.001) were higher. The median score of nurses who had five years or less of experience was statistically lower than that of nurses who had six-ten years of experience, or 11–15 years of experience (x^2 = 21.079; p < 0.001). In addition, the median knowledge score of nurses who had had a diagnostic Covid-19 test was statistically higher than that of those who had not had a test (z = 2.858; p = 0.004); while the median knowledge score of nurses who had had a colleague diagnosed with Covid-19 was statistically higher than for those who had not had a colleague diagnosed with Covid-19 (z = -2.347; p = 0.019). The median knowledge score of nurses who had received in service training was statistically significantly higher than that of nurses who had not received additional training (z = -5.293; p < 0.001) (Table 4).

Table 3 Distribution of responses of participants on institutional, personal and patient protective (n = 392) (Part 1)

Items		n	%
1. Were you informed before a Covid-19 diagnosed / suspected patient was referred to your clinic?	yes[b]	281	71.70
	no	45	11.50
	undecided	66	16.80
2. Were Covid-19 diagnosed / suspected patients admitted to the clinic wearing PPE – at least a face mask and a gown – when they arrived at the clinic?	yes[b]	294	75.00
	no	58	14.80
	undecided	40	10.20
3. Were staff transferring Covid-19 diagnosed / suspected patients wearing PPE? (face mask, bonnet, gown, gloves, goggles, face shield)	yes[b]	347	88.50
	no	20	5.10
	undecided	25	6.40
4. Were nurses accepting Covid-19 diagnosed / suspected patients wearing PPE? (face mask, bonnet, gown, gloves, goggles, face shield)	yes[b]	349	89.00
	no	15	3.80
	undecided	28	7.10
5. In which elevators were patients with Covid-19 transferred?	public elevators where anyone has easy access	83	21.20
	a separate elevator with combination locked door[a]	225	57.40
	undecided	84	21.40
6. Were there warning and reminder notices at the entrance of the rooms where patients with Covid-19 were hospitalized?	yes[b]	256	65.30
	no	72	18.40
	undecided	64	16.30
7. Was the working environment divided into clean and dirty zones?	yes[b]	287	73.20
	no	76	19.40
	undecided	29	7.40
8. How do you meet your need to use the toilet?	I do not go to the toilet on my shift.	96	24.50
	I use the toilet just like before the pandemic.	282	71.90
	I take personal precautions (I do sanitation and hygienic cleaning each time, take off my personal protective equipment at breaktime, etc.).[b]	14	3.60
9. How do you meet your need for nutrition?	I pay attention not to eat or drink anything on my shift.	108	27.60
	I have my meal regularly just like before the pandemic.	269	68.60
	I take personal precautions (I bring my meal from home, I eat my meal at breaktime while I keep my personal hygiene and physical distance from my colleagues, I have my meals at work in disposable serving boxes at preplanned meal times and staff order.).[b]	15	3.80

Table 3 Distribution of responses of participants on institutional, personal and patient protective (n = 392) (Part 2)

Items		n	%
10. For how long can a surgical face mask / N95 face mask be used?	2 hours	48	12.20
	4–6 hours[b]	196	50.00
	8 hours and longer	103	26.30
	I do not know	45	11.50
11. Do you completely cover your nose and mouth while wearing a surgical face mask / N95 face mask?	yes[b]	381	97.20
	no	3	0.80
	undecided	8	2.0
12. Do you wear gloves that cover your wrists?	yes[b]	388	99.00
	no	2	0.50
	undecided	2	0.50
13. After leaving a patient's room for the next patient which of the following do you first pull off when changing your PPE?	gloves[b]	324	82.70
	mask	12	3.10
	goggles	56	14.30
14. Which of the following do you put on first when putting on PPE?	gloves	39	9.90
	mask	86	21.90
	goggles	13	3.30
	gown[b]	145	37.00
	undecided	109	27.80
15. Which PPE do you change when caring for the next patient in a Covid-19 clinic?	only gloves[b]	187	47.70
	all protective equipment	174	44.40
	undecided	31	7.90
16. What do you do after taking off your PPE?	I dispose of them in medical waste disposal bins.[b]	350	89.40
	I leave them in patient room to reuse.	17	4.30
	Undecided	13	3.30
	I keep them in the dirty room.	1	0.30
	I keep them on a rack and have them UV radiation sterilized.	7	2.10
	I keep them in fresh air.	1	0.30
	I have them washed.	2	0.60
	I have them disinfected.	1	0.30
17. How do you take off your gown?	I pull strongly and tear it off.	115	29.30
	I untie all strings and take it off.[b]	225	57.40
	I take it off with the help of my colleagues.	52	13.30
18. How do you take off your face mask, goggles, and face shield?	I grasp it from the outer side and move it away.	14	3.60
	I hold it from sides or strings and move it away without touching the outer side.[b]	373	95.20
	I don't care.	5	1.30
19. Do you warn your colleagues when they violate isolation regulations?	yes[b]	359	91.60
	no	11	2.80
	not decided	22	5.60
20. What do you do first after leaving work?	It changes time to time.	19	4.90
	Take a walk.	5	1.30
	I go directly home, take my clothes off and have a bath / take a shower at work and change my clothes.[b]	368	94.00
21. How do you clean your clothes that you wear during work?	I wash them at home as soon as I arrive home (at 60°C in washing machine with regular detergent) / I have them cleaned at work.[b]	352	87.20
	I keep them in fresh air.	40	10.20
	I wash them with my other regular laundry.	10	2.60
22. Do you pay attention to which products are used for cleaning in your work environment?	yes[b]	303	77.30
	no	15	3.80
	partially	74	18.90

Table 3 Distribution of responses of participants on institutional, personal and patient protective (n = 392) (Part 3)

Items		n	%
23. How do patients with Covid-19 communicate with their relatives?[a]	hospital visit	15	3,80
	personal cellphone of the patient[a]	241	61.50
	cellphone of the caring medical personnel	11	2.80
	fixed-line telephone at the hospital (internal line)[b]	30	7.70
	hospital visit is not allowed, patient relatives are briefed by the physician[b]	40	10.20
	undecided	55	14.00
24. How are the deceased patients with Covid-19 transferred to the morgue?	just like any other deceased patient	32	8.20
	in body bags[b]	320	81.60
	I don't know	40	10.20
25. Do all staff involved in transfer of the corpse have to wear personal protective equipment?	yes[b]	372	94.90
	no	7	1.80
	undecided	13	3.30

[a]more than one option is selected, results are multiplied; [b]correct answer; PPE – personal protective equipment

Table 4 Comparison of nurses' mean knowledge score about COVID-19 pandemic measures with descriptive features

		n	median (IQR)	min.– max.	p-value
Gender	female	250	20 (4.00)	11–24	z = -1.959
	male	142	19 (4.00)	10–25	p = 0.050*
Marital status	married	239	20 (4.00)	10–25	z = 1.888
	single	153	19 (4.00)	10–23	p =0.009*
Children	have a child	208	20 (4.00)	10–24	z = -3.467
	no children	184	19 (4.00)	10–25	p < 0.001**
Educational status	high school	23	18 (5.50)	13–23	
	vocational school	37	19 (5.00)	13–24	x^2 = 3.846
	university-bachelor's degree	279	20 (3.00)	10–25	p = 0.279
	university-post-graduate degree	49	20 (4.00)	10–24	
Professional Experience (Years)	0–5 years[a]	130	19 (4.25)	10–23	
	6–10 years[b]	117	20 (4.00)	14–25	x^2 = 21.079
	11–15 years[c]	58	20 (3.00)	10–24	p < 0.001**
	16–20 years[d]	39	20 (4.00)	13–24	(a–b, c)
	21 years or more[e]	48	20 (4.75)	13–24	
Other healthcare professionals among family members	yes	166	20 (5.00)	10–25	z = -0.269
	no	226	20 (3.00)	10–24	p = 0.788
Working unit	clinic	184	20 (4.00)	11–24	x^2 = 3.777
	intensive care	168	19 (4.00)	10–25	p = 0.151
	clinic and intensive care	40	19 (4.00)	10–24	
Experience in caring for patients with infectious diseases such as H1N1, SARS or MERS	yes	142	20 (4.00)	12–25	z = -1.605
	no	246	19 (4.00)	10–24	p = 0.109
Chronic disease	yes	65	20 (5.00)	11–24	z = 0.992
	no	327	20 (3.00)	10–25	p = 0.321
Have you had a Covid-19 test?	yes	96	20 (3.00)	12–24	z = -2.858
	no	296	19 (4.00)	10–25	p = 0.004*
Have you had any healthcare professionals around you diagnosed with Covid-19?	yes	182	20 (4.00)	11–25	z = -2.347
	no	210	19 (4.00)	10–24	p = 0.019*
Have you received any in-service training on Covid-19?	yes	301	20 (4.00)	10–25	z = -5.293
	no	91	18 (4.00)	10–23	p < 0.001**

**p < 0.05, **p < 0.001 statistical significance; z – Mann Whitney U test; x^2 – Kruskal Wallis test; (a–b, c) – after correction with Mann Whitney U test; [a]statically different from b, c, d and e*

Factors affecting the mean knowledge score of nurses were examined with regression analysis. Multiple linear regression was conducted to analyze the strongly hypothetical relationships between the variables studied. According to the regression analysis, the most valid models were given in this study. The dependent variable was Nurses' Knowledge Total Score. Independent variables were; gender, age (years), marital status, having children, educational status, professional experience (years), other healthcare professional among family members, experience in caring for patients with infectious diseases such as H1N1, SARS or MERS, chronic disease, working unit, having been tested for Covid-19, having received in-service training in Covid-19, having a colleague diagnosed with Covid-19 (Table 5).

The Durbin Watson coefficient was found to be 2.012 in the regression analysis with a stepwise model. The first model predicted 6% of variance, while, after adding other factors, the fourth model predicted 13.8% of variance. The significance level of the F value of the fourth model was statistically significant ($f = 15.541$; $p < 0.001$). In the regression analysis predicting the factors affecting the mean knowledge score of nurses (fourth Model), beta coefficients, t and p values show that having in-service training in Covid-19, working in a clinic, having a close colleague diagnosed with Covid-19, and professional experience have a statistically significant positive effect on mean knowledge score, derived from the correct answers of the nurses (Table 5).

Table 5 Evaluation of factors affecting nurses' knowledge of the protective precautions

Model	Nurses' knowledge total score	R^2	F	β	t	p-value
1	(constant)	0.060	26.104		62.526	< 0.001**
	Have you received any in-service training on Covid-19? = Yes			0.250	5.109	< 0.001**
2	(constant)	0.113	24.842		61.640	< 0.001**
	Have you received any in-service training on Covid-19? = Yes			0.239	5.009	< 0.001**
	Professional experience (years) = 0–5 years			-0.225	-4.708	< 0.001**
3	(constant)	0.123	19.215		53.773	< 0.001**
	Have you received any in-service training on Covid-19? = Yes			0.254	5.319	< 0.001**
	Professional experience (years) = 0–5 years			-0.223	-4.700	< 0.001**
	Working unit = clinic			0.128	2.678	0.008*
4	(constant)	0.138	15.541		48.767	< 0.001**
	Have you received any in-service training on Covid-19? = Yes			0.254	5.333	< 0.001**
	Professional Experience (Years) = 0–5 years			-0.208	-4.346	< 0.001**
	Working unit = clinic			0.131	2.761	0.006*
	Have you had any healthcare professionals around you diagnosed with Covid-19? = Yes			0.096	2.015	0.045*

*measures by regression analysis (n = 392) Durbin Watson = 2.012; *p < 0.05; **p < 0.001 statistical significance*

Discussion

Since the earliest days of the nursing profession, nurses have undertaken important duties in disasters and emergencies such as the Covid-19 pandemic. Covid-19 is a highly contagious complex disorder, requiring hospitalization and intensive care, and supportive nursing care has a crucial role in the treatment process. Nurses have a critical role in the comprehensive evaluation, rapid recognition of and response to clinical deterioration, symptomatic care, prevention of complications, psychological support, isolation and disinfection interventions, and communication / collaboration in the medical team (Liu et al., 2020). While nurses carry out these duties, the increase in the number of patients and workload due to the pressure on the health system adversely affects their health and work performance (Labrague & de Los Santos, 2021). In order to protect themselves from infection, nurses, who have a key role in patient care, must strictly perform basic interventions such as proper use of PPE and must have knowledge of personal and institutional precautions in patient care. Nurses, who spend the longest time with patients compared to other healthcare professionals, are also role models for developing awareness in the general population in following required precautions (Zhong et al., 2020).

It is known that in countries such as Iran, Italy, France, and the USA, where the pandemic has had an immense impact, healthcare providers had difficulty accessing PPE, and those who did not have adequate PPE were infected with Covid-19 (Balmer & Pollina, 2020; Malatre-Lansac, 2020; Ranney et al., 2020). In many nations, campaigns were organized to collect PPE such as face masks, gloves, and disinfectants (Eghbali et al., 2020). The first large-scale survey conducted in the USA in April

2020 revealed that the main concern of most nurses was the lack of equipment (American Nurses Association [ANA], 2020). Our study found that most nurses working in pandemic clinics in Turkey did not have serious problems accessing PPE provided by institutions. However, in view of the possibility of a prolongation of the pandemic and the possibility of an increase in patient load, continuity of the medical supply chain and efficient use of medical supplies is more crucial than ever.

Some healthcare providers have reported that the crisis enabled them to gain skills in coping with challenges, an awareness of how to protect themselves, and communication skills and that serving during the crisis was a special experience for them (Liu et al., 2020). This study found that nurses who cared for severe cases of Covid-19 had considerable difficulty (66.1%) with hygiene and isolation practices. Not surprisingly, interventions that require physical effort are particularly challenging when wearing PPE. Nurses stressed that it was very hard to perform nursing interventions in a comprehensive manner to all systems of the patient when wearing PPE (Jiang et al., 2020). Nurses also reported that sweaty gowns and steamed up goggles were significant obstacles to nursing care, particularly in hot weather conditions.

In this study, we found that the knowledge of nurses of personal / institutional precautions in patient care related to Covid-19 paralleled information on precautions published in national and international guidelines. The fact that the mean knowledge score of nurses was close to the maximum score can be interpreted as indicating that their knowledge of Covid-19 and precautions were at the desired level. This finding is similar to the findings of many studies on healthcare professionals worldwide (Huynh et al., 2020; Nashwan et al., 2021; Nemati et al., 2020; Saadeh et al., 2021; Saqlain et al., 2020; Shi et al., 2020). In Pakistan, it is reported that the knowledge of 93.2% of healthcare professionals (nurses, physicians, and pharmacists) of Covid-19 was at the desired level, and there was no difference between professions (Saqlain et al., 2020). It is also reported that healthcare professionals exhibited positive behavior with regard to using PPE (Saqlain et al., 2020). Another study from China reports that knowledge of healthcare professionals regarding Covid-19 was at the required level (Shi et al., 2020). In a study evaluating the knowledge, attitudes, and practices of healthcare workers (HCWs) with regard to wearing surgical face masks to limit the spread of Covid-19, only 35% of HCWs who participated in the survey knew how to use a surgical mask. Nearly 80% of healthcare workers knew how long to wear a mask, while more than half of them knew how to dispose of worn masks (Kumar et al., 2020).

The mean knowledge score of women was higher than that of men in our findings. A study from China also reported a higher knowledge score in women (Zhong et al., 2020). However, several studies conducted with healthcare workers did not report any difference in knowledge scores between women and men (Saqlain et al., 2020; Semerci et al., 2021; Wahed et al., 2020). Our findings may be explained by the cultural role of women in Turkey since they are regarded as the guardian of the home and children.

Nurses who had children also had higher mean knowledge scores, as did married nurses, a finding supported by another study (Zhong et al., 2020). This finding may be related to individuals' responsibilities in sustaining the continuity of daily life at home, caring not only for him / herself but also for all members of the family. Also, concerns of healthcare professionals about being a vector for dissemination of the virus to their homes and family may be the main motive in having a better knowledge of Covid-19 and precautions. However, this is contradicted by another study suggesting that marital status does not affect the knowledge of participants (Wahed et al., 2020). The mean knowledge score of nurses who had 0–5 years of experience was found to be lower. While some studies report a positive impact of professional experience on knowledge on Covid-19 and precautions, others fail to do so (Nemati et al., 2020; Saqlain et al., 2020; Semerci et al., 2021). One possible interpretation of our findings may be that the training provided by professional experience has a positive impact on professional practice (Zhang et al., 2020). The mean knowledge score of participants who had colleagues diagnosed with COVID-19 was higher. It may be supposed that close encounters trigger a perception of risk and the need for personal protection, so those who experience them are more motivated to read, research, and learn.

In parallel with the findings reported in the literature, nurses who had in-service training had higher mean knowledge scores (Semerci et al., 2021). The majority of the participants in this study had received in-service training. The issue of coordinating processes such as transmission channels, ways of protection, patient room settings, patient admission, and patient transmission of Covid-19, has become more crucial since the outbreak. The Ministry of Health and different professional associations in Turkey have produced guidelines based on recommendations

of organizations such as the CDC and WHO, as well as current literature. Each hospital administration and nurse training division in the country has adopted these guidelines for providing in-service training. In addition, it has been reported from China that most healthcare professionals dealing with Covid-19 patients received in-service training programs in hospitals (Shi et al., 2020). During this unexpected crisis, healthcare providers from different departments had to work together in care teams, and teamwork became a challenge. Worldwide, healthcare providers were assigned to Covid-19 services regardless of whether they had any intensive care unit experience or experience in caring for patients on a mechanical ventilator, and they had to learn and adopt complex practices and procedures that require advanced technical skills in a very short time (Liu et al., 2020). Training programs provided by hospitals and related organizations are reported to be critical to the prevention of infectious diseases (Kanjee et al., 2011; Paudyal et al., 2008).

Multiple regression analysis reveals that in-service training, working in a clinic, and having colleagues diagnosed with Covid-19 positively affect knowledge; while having 0–5 years of professional experience negatively affects knowledge. This causal relationship, supported by the previously mentioned findings, is noteworthy. Studies report that being an experienced nurse, working in a clinic, having in-service training, and having a higher perception of risk have a positive impact on the knowledge of nurses regarding the infection (Liu et al., 2020; Semerci et al., 2021; Zhang et al., 2020). Nurses' knowledge and experiences of Covid-19 are influenced by the presence of people who are infected with the virus in their immediate surroundings. These findings should be a guide for nurse directors in assigning nurses to pandemic clinics.

Limitation of study

This study has some implicit limits. First, it is a cross-sectional study conducted during the Covid-19 outbreak period, and the data for this study could not be collected observationally in the hospital. Responses were based on nurses' honesty and were influenced by their ability to remember; therefore, they may be subject to recall bias. Snowball sample selection clustering may also have limited the generalizability of the study.

Conclusion

The findings of this study revealed that most nurses caring for patients with Covid-19 are well-informed about PPE and their practices follow the guidelines published by national and international medical organizations.

Nurses working for a prolonged time are experiencing difficulties in meeting their personal physiological needs and sustaining the quality of nursing care they are supposed to deliver. This descriptive study is important since it presents the experiences of nurses of Covid-19 and PPE from various cities and hospitals located all over the country. It is recommended that in-service training be provided, especially for male, single nurses without children, who do not have much professional experience, who work in an intensive care unit, and who have not had any close colleagues diagnosed with Covid-19 in order to increase their awareness and knowledge of Covid-19 and precautions. The findings of this study may enlighten medical authorities and policymakers in promoting the quality of care delivered to patients with Covid-19 and the quality of working conditions of healthcare providers. A structured training program on up-to-date prevention methods for Covid-19 should be developed in collaboration with local medical authorities, professional organizations, and the Ministry of Health. Nurses working in Covid-19 clinics, but also those working in other departments, should be encouraged to participate in this training program. Further observational studies on compliance with isolation regulations would help develop new strategies.

Ethical aspects and conflict of interest

The study was approved by the Faculty of Health Sciences Ethical Board for Scientific Research in a university located in Turkey (Decision date: 29 April 2020, Decision No: 2020 / 0015). The aim of the study was explained to the participants and the instructions for completing the form were given at the top of the data collection form. Participants who clicked the "I agree that I understand the instructions and I agree to participate" button were included in the study.

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and / or interpretation, literature search, writing manuscript and critical manuscript (BT, NU, SG, ID, CP, AY).

References

Al Thobaity, A., & Alshammari, F. (2020). Nurses on the frontline against the COVID-19 pandemic: an integrative review. *Dubai Medical Journal*, *3*(3), 87–92. https://doi.org/10.1159/000509361

American Nurses Association. (2020). *More than 32k nurses share experience from the front lines*. ANA-Michigan. https://anamichigan.nursingnetwork.com/nursing-news/179188-more-than-32k-nurses-share-experience-from-the-front-lines

Balmer, C., & Pollina, E. (2020). *Italy's Lombardy asks retired health workers to join coronavirus fight*. World Economic Forum. https://www.weforum.org/agenda/2020/03/italys-lombardy-etired-health-workers-coronavirus-covid19-pandemic

Centers for Disease Control and Prevention. (2020). *Using personal protective equipment (PPE)*. https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html

Chen, X., Tian, J., Li, G., & Li, G. (2020). Initiation of a new infection control system for the COVID-19 outbreak. *The Lancet Infectious Diseases*, *20*(4), 397–398. https://doi.org/10.1016/S1473-3099(20)30110-9

Eghbali, M., Negarandeh, R., & Froutan, R. (2020). COVID-19 epidemic: hospital-level response. *Nursing Practice Today*, *7*(2), 81–83. https://doi.org/10.18502/npt.v7i2.2728

Gao, J. L., Zheng, P. P., Jia, Y., Chen, H., Mao, Y., Chen, S., Wang, Y., Fu, H., & Dai, J. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *Plos One*, *15*(4), e0231924. https://doi.org/10.1371/journal.pone.0231924

Huang, L., Xu, F., & Liu, H. (2020). Emotional responses and coping strategies of nurses and nursing college students during COVID-19 outbreak. *medRxiv*. https://doi.org/10.1101/2020.03.05.20031898

Huynh, G., Nguyen, T. N. H., Tran, V. K., Vo, K. N., Vo, V. T., & Pham, L. A. (2020). Knowledge and attitude toward COVID-19 among healthcare workers at District 2 Hospital, Ho Chi Minh City. *Asian Pasific Journal of Tropical Medicine*, *13*(6), 260–265. https://doi.org/10.4103/1995-7645.280396

International Council of Nurses. (2021). *COVID-19 infections & deaths among nurses and other healthcare workers – updated*. https://www.icn.ch/sites/default/files/inline-files/IND2021-Factsheet-01-UPDATED-EN.pdf

Jackson, D., Jones, C. B., Baptiste, D., Gelling, L., Morin, K., Neville, S., & Smith, G. D. (2020). Life in the pandemic: some reflections on nursing in the context of COVID-19. *Journal of Clinical Nursing*, *29*(13–14), 2041–2043. https://doi.org/10.1111/jocn.15257

Jiang, Q., Liu, Y., Wei, W., Zhu, D., Chen, A., Liu, H., Wang, J., Jiang, Z., Han, Q., Bai, Y., Hua, J., Zhang, Y., Guo, J., Li, L., & Li, J. (2020). The prevalence, characteristics, and related factors of pressure injury in medical staff wearing personal protective equipment against COVID-19 in China: a multicentre cross-sectional survey. *International Wound Journal*, *17*(5), 1300–1309. https://doi.org/10.1111/iwj.13391

Kanjee, Z., Catterick, K., Moll, A. P., Amico, K. R., & Friedland, G. H. (2011). Tuberculosis infection control in rural South Africa: survey of knowledge, attitude and practice in hospital staff. *Journal of Hospital Infection*, *79*(4), 333–338. https://doi.org/10.1016/j.jhin.2011.06.017

Kumar, J., Katto, M. S., Siddiqui, A. A., Sahito, B., Jamil, M., Rasheed, N., & Ali, M. (2020). Knowledge, attitude, and practices of healthcare workers regarding the use of face mask to limit the spread of the new coronavirus disease (COVID-19). *Cureus*, *12*(4), e7737. https://doi.org/10.7759/cureus.7737

Labrague, L. J., & de Los Santos, J. A. A. (2021). Fear of COVID-19, psychological distress, work satisfaction and turnover intention among frontline nurses. *Journal of Nursing Management*, *29*(3), 395–403. https://doi.org/10.21203/rs.3.rs-35366/v1

Liu, Q., Luo, D., Haase, J. E., Guo, Q., Wang, X. Q., Liu, S., Xia, L., Liu, Z., Yang, J., & Yang, B. X. (2020). The experiences of health-care providers during the COVID-19 crisis in China: a qualitative study. *The Lancet Global Health*, *8(*6), 790–798. https://doi.org/10.1016/S2214-109X(20)30204-7

Malatre-Lansac, A. (2020). *Public health in the time of Covid-19: three lessons learned*. Institut Montaigne. https://www.institutmontaigne.org/en/blog/public-health-time-covid-19-three-lessons-learned

Nashwan, A. J., Abujaber, A. A., Mohamed, A. S., Villar, R. C., & Al-Jabry, M. M. (2021). Nurses' willingness to work with COVID-19 patients: the role of knowledge and attitude. *Nursing Open*, *8*(2), 695–701. https://doi.org/10.1002/nop2.674

Nemati, M., Ebrahimi, B., & Nemati, F. (2020). Assessment of Iranian Nurses' knowledge and anxiety toward COVID-19 during the current outbreak in Iran. *Archives of Clinical Infectious Diseases*, *15*(COVID-19), 2102848. https://doi.org/10.5812/archcid.102848

Omrani, A. S., & Shalhoub, S. (2015). Middle East Respiratory Syndrome Coronavirus (MERS-CoV): what lessons can we learn? *Journal of Hospital Infection*, *91*(3), 188–196. https://doi.org/10.1016/j.jhin.2015.08.002

Paudyal, P., Simkhada, P., & Bruce, J. (2008). Infection control knowledge, attitude, and practice among Nepalese health care workers. *American Journal of Infection Control*, *36*(8), 595–597. https://doi.org/10.1016/j.ajic.2007.10.026

Ranney, M. L., Griffeth, V., & Jha, A. K. (2020). Critical supply shortages – the need for ventilators and personal protective equipment during the COVID-19 pandemic. *New England Journal of Medicine*, *382*(18), e41. https://doi.org/10.1056/NEJMp2006141

Saadeh, D., Sacre, H., Hallit, S., Farah, R., & Salameh, P. (2021). Knowledge, attitudes, and practices toward the coronavirus disease 2019 (COVID-19) among nurses in Lebanon. *Perspectives in Psychiatric Care*, *57*(3), 1212–1221. https://doi.org/10.1111/ppc.12676

Saqlain, M., Munir, M. M., ur Rehman, S., Gulzar, A., Naz, S., Ahmed, Z., Tahir, A. H., & Mashhood, M. (2020). Knowledge, attitude, practice and perceived barriers among health care professionals regarding COVID-19: a cross-sectional survey from Pakistan. *Journal of Hospital Infection*, *105*(3), 419–423. https://doi.org/10.1016/j.jhin.2020.05.007

Semerci, R., Kudubes, A. A., & Eşref, F. Ç. (2021). Assessment of Turkish oncology nurses' knowledge regarding COVID-19 during the current outbreak in Turkey.

Supportive Care in Cancer, *29*(4), 1999–2006. https://doi.org/10.1007/s00520-020-05700-w

Shi, Y., Wang, J., Yang, Y., Wang, Z., Wang, G., Hashimoto, K., Zhang, K., & Liu, H. (2020). Knowledge and attitudes of medical staff in Chinese psychiatric hospitals regarding COVID-19. *Brain, Behavior, & Immunity-Health*, *4*, 100064. https://doi.org/10.1016/j.bbih.2020.100064

Tayran, N., & Ulupinar, S. (2011). Development of a scale study: validity and reliability of a scale compliance with isolation precautions. *Florence Nightingale Journal of Nursing*, *19*(2), 89–98.

Turkey Republic Ministry of Health. (2021). *COVID-19 Bilgilendirme Platformu* [*COVID-19 information platform*]. https://covid19.saglik.gov.tr/

Wahed, W. Y. A., Hefzy, E. M., Ahmed, M. I., & Hamed, N. S. (2020). Assessment of knowledge, attitudes, and perception of health care workers regarding COVID-19, a cross-sectional study from Egypt. *Journal of Community Health*, *45*(6), 1242–1251. https://doi.org/10.1007/s10900-020-00882-0

Wang, J., Zhou, M., & Liu, F. (2020). Reasons for healthcare workers becoming infected with novel coronavirus disease 2019 (COVID-19) in China. *Journal of Hospital Infection*, *105*(1), 100–101. https://doi.org/10.1016/j.jhin.2020.03.002

World Health Organization. (2020). *Rational use of personal protective equipment for Coronavirus Disease 2019 (COVID-19) and considerations during severe shortages: interim guidance*. https://www.who.int/publications/i/item/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages

Zhang, M., Zhou, M., Tang, F., Wang, Y., Nie, H., Zhang, L., & You, G. (2020). Knowledge, attitude and practice regarding COVID-19 among health care workers in Henan, China. *Journal of Hospital Infection*, *105*(2), 183–187. https://doi.org/10.1016/j.jhin.2020.04.012

Zhong, B. L., Luo, W., Li, H. M., Zhang, Q. Q., Liu, X. G., Li, W. T., & Li, Y. O. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *International Journal of Biological Sciences*, *16*(10), 1745–1752. https://doi.org/10.7150/ijbs.45221

