

Effect of the coronavirus disease 2019 pandemic on beliefs and practices regarding hand hygiene among intensive care nurses

A repeated cross-sectional study

Yasemin Ay Karadas, MSc^a, Sibel Yılmaz Sahin, PhD, MSc^{b,*}, Elif Dönmez, PhD, MSc^c, Gamze Temiz, PhD, MSc^d

Abstract

Hand hygiene is an important factor in the prevention of healthcare-associated infections. Studies show healthcare professionals' hand hygiene practices vary and are not at sufficient levels. This study aimed to examine the effect of the COVID-19 pandemic on the beliefs and practices of nurses working in intensive care units (ICU) towards hand hygiene. This was longitudinal, repeated, and cross-sectional study. The study was conducted in 2 phases between January 2, 2020 and March 10, 2021 in the intensive care unit of a university hospital in northern Turkey. No sampling method was used. The objective was to reach the entire population. The first phase of this study was completed with 119 (76% of the population) ICU nurses and the second phase with 85 (70% of the population) ICU nurses. The data were collected with the personal information form, hand hygiene belief scale (HHBS), hand hygiene practices inventory (HHPI) and the views of the intensive care nurses related to COVID-19. Descriptive statistics such as mean and standard deviations, frequency, and percentages and analytical statistics such as *t*-test, Mann–Whitney *U* test, Kruskal–Wallis test were used for data analysis at the significance level of $P < .05$. The majority of the nurses who participated in the study were female (75.6%; 69.4%), with a mean age of 30.82 ± 5.51 and 30.58 ± 5.51 years, respectively. There was a significant difference ($P < .05$) between the median HHBS ($P = .002$) and HHPI ($P = .001$) scores before and after COVID-19. All nurses (100%) reported that the pandemic was effective in hand hygiene practices. In this study, it was determined that the hand hygiene beliefs and practices of nurses were high, and the scores of nurses' hand hygiene beliefs and practices after COVID-19 increased significantly. Healthcare professionals must always adhere to stringent standards of hand hygiene, rather than merely during periods of heightened challenges. To ensure the sustainability of optimal hand hygiene practices, it is recommended that motivational interventions that strengthen beliefs and practices related to hand hygiene should be implemented and that studies should be conducted to evaluate their effectiveness.

Abbreviations: CDC = Centers for Disease Control, COVID-19 = coronavirus disease 2019, HAI = healthcare-associated infections, HHBS = hand hygiene belief scale, HHP = hand hygiene performance, HHPI = hand hygiene practices inventory, ICU = intensive care unit, IPC = infection prevention and control, SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2, WHO = World Health Organization.

Keywords: COVID-19, hand hygiene, infection control, intensive care units, nursing

The authors have no funding and conflicts of interest to disclose.

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

The ethical aspect of research This study was approved by the Ethics Committee for Clinical Research of Ondokuz Mayıs University, before and after the COVID-19 pandemic (Date: December 29, 2019, Number: B.30.2.ODM.0.20.08/932; Date: July 24, 2020, Number: B.30.2.ODM.0.20.08/495). Institutional approval (Date: December 16, 2019, Number: 15374210-302.08.01-E.149374) was obtained from the hospital where the research was conducted, and research approval was obtained from the COVID-19 Scientific Research Evaluation Commission at the General Directorate of Health Services of the Ministry of Health (2020-08-24T00_53_09). Written informed consent was obtained from all participants invited to participate in the study in phase 1. Verbal and web-based informed consent was obtained in phase 2 of the study.

We hereby assign all copyright in the enclosed manuscript to "Medicine."

^a Department of Medical Services and Techniques, Bayburt University Vocational School of Health Services, Bayburt, Turkey; ^b Department of Surgical Diseases Nursing, University of Health Sciences, Hamidiye Faculty of Nursing, Istanbul, Turkey; ^c Hamidiye Faculty of Nursing, Oncology Nursing Department, University

of Health Sciences, Istanbul, Turkey; ^d Hamidiye Faculty of Nursing, Oncology Nursing Department, University of Health Sciences, Istanbul, Turkey.

* Correspondence: Sibel Yılmaz Sahin, Hamidiye Faculty of Nursing, Department of Surgical Diseases Nursing, University of Health Sciences, Istanbul, Turkey (e-mail: sibelyilmaz.sahin@sbu.edu.tr).

Copyright © 2025 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Ay Karadas Y, Yılmaz Sahin S, Dönmez E, Temiz G. Effect of the coronavirus disease 2019 pandemic on beliefs and practices regarding hand hygiene among intensive care nurses: A repeated cross-sectional study. *Medicine* 2025;104:12(e41903).

Received: 26 October 2024 / Received in final form: 27 February 2025 /

Accepted: 28 February 2025

<http://dx.doi.org/10.1097/MD.00000000000041903>

1. Introduction

Hospital intensive care units (ICUs) are associated with a higher risk for healthcare-associated infections (HAIs) than other units.^[1] While the incidence of HAIs varies between 5% and 10% throughout the hospital, this rate can be as high as 20% to 25% in ICUs.^[2] The World Health Organization (WHO) and Centers for Disease Control (CDC) report that hand hygiene is the most important and easiest way to prevent and control HAIs.^[3] Nurses are key members of the healthcare team in preventing ICU infections due to their role in patient care. Therefore, nurses should possess sufficient knowledge and skills regarding hand hygiene.^[4] Hand hygiene helps minimize the colonization of transient flora on the hands by rubbing the hands with antiseptics and/or washing hands with water, thereby preventing cross-contamination and reducing the incidence of infections among healthcare workers.^[5]

The recent pandemic has led to significant changes in living habits, with a notable increase in the importance of hand hygiene for society and healthcare professionals. Coronavirus disease 2019 (COVID-19), caused by infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is a positive-susceptibility RNA virus. The CDC has reported that SARS-CoV-2 can be transmitted through direct, indirect, and droplet contacts.^[6–8] The CDC recommends washing hands with soap and water or using hand antiseptic for 20 seconds to prevent the spread of the virus.^[8,9] Hand hygiene is a key factor in preventing HAIs. However, international studies have highlighted that healthcare workers often exhibit inadequate hand hygiene habits. The WHO has consistently highlighted the importance of hand hygiene in preventing the transmission of the novel coronavirus, particularly during the ongoing pandemic.^[10,11] Many studies have been conducted worldwide, particularly prompted by the increasing focus on the importance of hand hygiene. It has been reported that healthcare workers have altered their hand hygiene behavior during the pandemic; however, this change has not been sustained.^[12–19] Working conditions for healthcare providers change during emergencies and disasters. Inconsistencies, scarce resources and caring for diverse and chronically ill patients create a challenging environment for nurses. A pandemic is a type of biological disaster. Many countries are already planning and taking action to manage disaster risks. Disaster risk management aims to minimize the impact of disasters on health, facilitate the use of health resources and improve preparedness, response and recovery. It is important that organizations can use the lessons learned from COVID-19 management to better examine their performance, methodically record and analyze concerns and challenges, and address procedures to avoid future performance risk.^[20,21] It is essential that healthcare personnel adhere to high standards of hand hygiene, not only during a pandemic, but consistently throughout their work. Further research should be conducted to determine methods to enhance compliance with infection prevention and control (IPC) procedures.

Individual factors, such as knowledge, attitude, practice, beliefs, and perceptions, play an important role in improving hand hygiene compliance behaviors.^[22] Information regarding hand hygiene compliance and practices is available in the literature; however, data regarding hand hygiene beliefs are limited. Assessing health workers' beliefs and practices regarding hand hygiene and identifying gaps will guide improvements to eliminate inaccurate beliefs and practices. Results of the present study are intended to guide the development of strategies to improve ICU nurses' beliefs and practices regarding hand hygiene. This study investigated the effect of the COVID-19 outbreak on the beliefs and practices of ICU nurses regarding hand hygiene. Therefore, this study aimed to find answers to the following questions:

- What were the hand hygiene beliefs and practices of ICN nurses before and after the COVID-19 pandemic?

- Was there a difference between the levels of hand hygiene beliefs and practices of ICN nurses before and after the COVID-19 pandemic?
- How did the hand hygiene practices of ICN nurses change after the COVID-19 pandemic?

2. Materials and methods

The present investigation was a longitudinal, repeated cross-sectional study. Cross-sectional survey data were obtained from a single point in time. Repeat cross-sectional data are data in which a survey is conducted on a new sample of respondents at successive points in time.^[23] Longitudinal research can take many forms, including repeated cross-sectional studies, in which the participants are largely or entirely different each time the analysis is performed.^[24]

2.1. Participants

This study was conducted in the ICU of a university hospital in the province of Samsun, northern Türkiye, 1 of the largest and most important hospitals in this region. The hospital's ICU include anesthesia and resuscitation, internal medicine, cardiovascular surgery, neonatal intensive care, and pediatric intensive care. This analysis used a 2-phase study design. Phase 1 commenced on January 2, 2020, and concluded March 10, 2020. Phase 2, which was conducted during the first wave of the pandemic, commenced on September 10, 2020, and concluded March 10, 2021. The study population consisted of 156 nurses in Phase 1 and 120 nurses in Phase 2 who work in tertiary care units. In this study, no sampling method was used, and the objective was to reach the entire population. Nurses who had worked in the ICU for ≥ 1 month(s) and volunteered were included in the study. ICU nurses who were on leave on the study dates and those who did not agree to participate were excluded. A total of 119 ICU nurses (76% of the population) participated in Phase 1 of the study and 85 (70% of the population) in Phase 2. Data were collected through in-person interviews in phase 1. In phase 2, data were collected online using *Google Forms* for COVID-19 pandemic precautions. On average, it took 25 to 30 minutes to collect the data.

2.2. Data collection tools

The “Descriptive Information Form,” including demographic characteristics of patients, “hand hygiene belief scale (HHBS),” and “hand hygiene practices inventory (HHPI)” were used to collect data in both phases. A “COVID-19 Related Intensive Care Nurses’ Opinions Form” was also used in phase 2.

2.3. Descriptive information form

This descriptive information form was developed based on the literature.^[5,25] It consists of 11 questions addressing the socio-demographic and professional characteristics of the nurses who participated in the present study.

2.4. COVID-19-related ICU nurses’ opinions form

This form consisted of questions addressing whether the ICU nurses themselves or someone in their family has/had COVID-19, and whether there was a change in their hand hygiene habits.

2.5. HHBS and HHPI

The HHBS, originally developed by van de Mortel^[26] in 2009, is a 5-point Likert-type scale consisting of 23 items including

Table 1**Descriptive characteristics of critical care nurses.**

	Before COVID-19 pandemic (n = 119)		After COVID-19 pandemic (n = 85)		
Mean age (Mean \pm SD [Min–Max])	30.82 \pm 5.51 (21–52)		30.58 \pm 5.51 (23–43)		
Total working time in nursing (mo) (Med [Min–Max])	72 (1–360)		72 (1–276)		
Total working time in the intensive care unit (mo) (Med [Min–Max])	54 (1–360)		48 (2–360)		
	n	%	n	%	P
Gender					
Female	90	75.6	59	69.4	.408*
Male	29	24.4	26	30.6	
Educational status					
High school	1	0.8			.042**
Associate degree	4	3.4			
Bachelor's degree	107	89.9 ^a	72	84.7 ^a	
Master's degree	7	5.9 ^b	13	15.3 ^b	
Overtime work status					
Yes	43	36.1	61	71.8	<.001**
No	76	63.9	24	28.2	
Usage of liquid soap and alcohol-based antiseptic solutions					
Yes	117	98.3	82	96.5	.651***
No	2	1.7	3	3.5	
Allergic reactions to liquid soap and alcohol-based antiseptic solutions					
Yes	40	33.6	45	52.9	.006**
No	79	66.4	40	47.1	
Previous training in hand hygiene					
Yes	118	99.2	24	28.2	<.001**
No	1	.8	61	71.8	
The main barriers to providing hand hygiene [†]					
Workload	86	72.3	69	81.2	.233**
Products used for hand washing (soap, antiseptics) causing hand allergy	85	71.4	62	72.9	
Lack of sufficient and easily accessible sinks	18	15.1	27	31.8	
Lack of sufficient amount of soap or antiseptic in the work environment	17	14.3	14	16.5	

COVID-19 = coronavirus disease 2019, Max = largest value, Med = Median, Min = smallest value, SD = standard deviation.

[†]Multiple answers are allowed.

*Yates correction.

**Pearson chi-square test.

***Fisher exact test.

beliefs regarding hand hygiene and perceptions of the importance of hand hygiene, and the HHPI consists of 14 items. Karada et al^[5] assessed the Turkish validity and reliability of the HHBS and HHPI. The Cronbach alpha value was found to be 0.76 for the HHBS and 0.85 for the HHPI.^[5] In the present study, Cronbach alpha values for the HHBS and HHPI were 0.709 to 0.778 in phase 1 and 0.849 to 0.921 in phase 2.

2.6. Ethics approval

This study was approved by the Ethics Committee for Clinical Research of Ondokuz Mayıs University, before and after the COVID-19 pandemic (date: 29/12/2019, number: B.30.2.ODM.0.20.08/932; date: 24/07/2020, number: B.30.2.ODM.0.20.08/495). Institutional approval (date: 16/12/2019, number: 15374210-302.08.01-E.149374) was obtained from the hospital where the research was conducted, and research approval was obtained from the COVID-19 Scientific Research Evaluation Commission at the General Directorate of Health Services of the Ministry of Health (2020-08-24T00_53_09). Written informed consent was obtained from all participants invited to participate in the study in phase 1. Verbal and web-based informed consent was obtained in phase 2 of the study.

2.7. Data analysis

Data were analyzed using SPSS version 23 (IBM Corporation, Armonk). Shapiro–Wilk and Kolmogorov–Smirnov tests were

used to analyze whether the data conformed to a normal distribution. For paired groups, the independent samples *t*-test was used to compare data that conformed to normal distribution, while the Mann–Whitney *U* test was used to compare data that did not conform to normal distribution. For group sizes ≥ 3 with data not conforming to a normal distribution, comparisons were performed using the Kruskal–Wallis test, and multiple comparisons were made using Duncan test. Differences with $P < .05$ were considered to be statistically significant.

3. Results

The majority nurses participating in this study, conducted in 2 phases, were female (stage 1, 75.6%; stage 2, 69.4%). The mean (\pm SD) age of participants in phase 1 was 30.82 \pm 5.51 years and 30.58 \pm 5.51 years in phase 2. The median total working time in nursing in phases 1 and 2 was 72 and 72 months, respectively, and the median working times in the ICU were 54 and 48 months, respectively (Table 1).

When comparing the use of liquid soap and alcohol-based antiseptics by participating nurses, no differences were found between the 2 phases. There was a significantly higher rate of allergic reactions in phase 2 (52.9%) than in phase 1 (33.6%) for liquid soaps and alcohol-based antiseptic solutions ($P < .05$). In the present study, the proportion of nurses who reported receiving hand hygiene training was higher in phase 1 (99.2%) than in phase 2 (28.2%). In both phases, participants reported that the main barriers to hand hygiene were workload, products used for hand washing (soap, antiseptics)

causing hand allergy, sufficient and easily accessible sinks, and sufficient amounts of soap or antiseptics in the work environment (Table 1).

There was a significant difference between the median HHBS ($P = .002$) and HHPI ($P = .001$) scores before and after COVID-19 ($P < .05$). The mean HHBS score before the pandemic was 84.43 ± 7.57 , the mean score after the pandemic was 63.80 ± 4.81 . The mean HHPI score before the pandemic was 63.80 ± 4.81 , the mean score after the pandemic was 65.11 ± 7.36 (Table 2).

When ICU nurses' opinions regarding COVID-19 were examined after the pandemic was declared, most reported caring for patients with suspected or diagnosed COVID-19 (80%). A total of 36.5% reported that they themselves and 34.1% reported that a member of their family had COVID-19. All nurses (100%) agreed that the COVID-19 pandemic had affected their hand hygiene practices. The rate of increased frequency of hand washing was 96.5%, the rate of increased duration of hand washing was 83.5%, the rate of increased frequency of glove use was 76.5%, the rate of decreased duration of wearing gloves was 48.2%, the rate of increased frequency of antiseptic use was 92.9%, and the rate of increased duration of hand rubbing with antiseptic was 87.1% (Table 3).

The median HHBS and HHPI scores were significantly higher among those who cared for patients with suspected or diagnosed COVID-19, and those with a family history of COVID-19 ($P = .001$). A statistically significant difference was found between the median HHBS scores for the duration of hand washing, frequency of using gloves, duration of wearing gloves, frequency of use of antiseptics, and duration of rubbing hands with antiseptics (Table 4). When the reason for these differences was investigated, the median HHBS and HHPI scores were higher in those for whom handwashing duration increased than in those for whom it did not change (85) ($P = .002$). The median HHBS scores were higher among those whose glove use frequency did not change than among those whose glove use frequency increased ($P = .003$). The median HHBS score was lower among those whose glove-wearing time decreased than among those in which it did not change ($P = .001$) (Table 3).

4. Discussion

The present study investigated the impact of the COVID-19 pandemic on hand hygiene beliefs and practices among nurses working in ICUs using a repeated cross-sectional design. The COVID-19 pandemic is a clear and present reminder of the critical importance of hand hygiene. The spread of infections, even in healthcare settings, can harm patients, healthcare workers, and visitors if insufficient attention is devoted to IPC.

In 2019, Lambe et al^[11] reviewed 61 studies that evaluated hand hygiene compliance in ICUs and reported that the average rate was quite low compared with international targets, with 67% in neonates, 41.2% in children, and 58.2% in adults, depending on ICU type. Guerrero-Soler et al^[16] conducted a repeated cross-sectional study directly observing hand

hygiene compliance among healthcare workers, which was the most important healthcare-associated IPC measure during the COVID-19 outbreak. A meta-analysis by Wang et al^[12] in 2022 that compared the hand hygiene compliance status of healthcare workers before and after the COVID-19 outbreak reported that compliance rates were high after the COVID-19 outbreak. In a study by Huang et al^[13] examining healthcare workers' hand hygiene behavior during the COVID-19 outbreak, hand hygiene compliance increased by 13.73% when entering and exiting the patient room in the first wave of the pandemic, decreased by 9.87% after quarantine, and increased again by 2.82% in the second wave. It has been reported that healthcare workers changed their hand hygiene behavior during the outbreak, but this change was not sustained. In a study addressing improvements in hand hygiene performance (HHP) during the coronavirus outbreak, Israel et al (2020) reported that after years of attempting different methods to improve HHP, there was an increase in average HHP from 35% to 71% between January 2019 and January 2020 (before the pandemic), and an increase from 46% to 89% between January and April 2020 (during the outbreak). Israel et al^[18] found that hand hygiene compliance among healthcare workers increased both "before patient contact" and "after patient contact." Healthcare workers generally base the high increase in hand hygiene rates after patient contact on concerns about the risk for acquiring infections and resistant bacteria from patients. In a study examining the impact of the COVID-19 outbreak on HHP in hospitals, Moor et al^[19] reported that, based on data from an automated hand hygiene monitoring system in hospitals, average HHP rates increased from 46% to 56% in the months before pandemic-related school closures (January 5 to March 8), followed by a 6% increase when school closures occurred, and HHP rates decreased to 54% by the end of the study period (May 23). In this study, ICU nurses' hand hygiene before and after declaration of the pandemic (84.43 ± 7.57 and 86.56 ± 12.91 , respectively) was found to be at a moderate level, and their practices (63.80 ± 4.81 and 65.11 ± 7.36 , respectively) were at a high level and increased ($P < .05$). The results of a study by Eskici and Tastan,^[17] involving surgical nurses in 2021 were similar to the results of this study, while the participants' mean HHBS scores (81.33 ± 7.67) were at a moderate level, their HHPI scores (69.15 ± 1.94) were at a quite satisfactory level. Achieving the desired rates of prevention and control of HAIs has always been problematic. The COVID-19 pandemic has increased the importance of hand hygiene practices; however, this increase has been uneven. According to Guerrero-Soler et al,^[16] the assessment of the current situation after COVID-19 provides an opportunity to determine the impact of the pandemic on hand hygiene compliance and to make healthcare workers more aware of its importance for the quality of patient care, thus promoting better compliance with the WHO guidelines. Research aimed at identifying barriers to maintaining high compliance with hand hygiene practices would be beneficial.

This study found that the proportion of nurses working overtime increased in phase 2 compared with phase 1, with almost all using liquid soap and alcohol-based antiseptic solutions in

Table 2
Distribution of mean HHBS and HHPI scores before and after the COVID-19 pandemic.

	Min-max scores that can be obtained from scales	Before COVID-19 pandemic (n = 119)		After COVID-19 pandemic (n = 85)		P*
		Mean \pm SD	(Min–Max)	Mean \pm SD	(Min–Max)	
Hand hygiene belief scale	22 to 110	84.43 ± 7.57	(66–102)	86.56 ± 12.91	(36–104)	.002
Hand hygiene practices inventory	14 to 70	63.80 ± 4.81	(52–70)	65.11 ± 7.36	(28–70)	.001

COVID-19 = coronavirus disease 2019, HHBS = hand hygiene belief scale, HHPI = hand hygiene practices inventory, Max = largest value, Min = smallest value, SD = standard deviation.

*Mann–Whitney U Test.

Table 3**Intensive care nurses' characteristics and opinions related to COVID-19.**

	n	%
Caring for patients with suspected or diagnosed with COVID-19		
Yes	68	80.0
No	17	20.0
Nurses had COVID-19 themselves		
Yes	31	36.5
No	54	63.5
A family member of nurse had COVID-19		
Yes	29	34.1
No	56	65.9
COVID-19 pandemic affected hand hygiene practices		
Yes	85	100.0
No	–	–
Frequency of hand washing		
Increased	82	96.5
Unchanged	2	2.4
Decreased	1	1.2
Duration of hand washing		
Increased	71	83.5
Unchanged	13	15.3
Decreased	1	1.2
Frequency of glove use		
Increased	65	76.5
Unchanged	19	22.4
Decreased	1	1.2
Duration of wearing gloves		
Increased	19	22.4
Unchanged	25	29.4
Decreased	41	48.2
Frequency of antiseptic use		
Increased	79	92.9
Unchanged	6	7.1
Decreased	–	–
Duration of hand rubbing with antiseptic		
Increased	74	87.1
Unchanged	11	12.9
Decreased	–	–

COVID-19 = coronavirus disease 2019.

both the first (98.3%) and second (96.5%) phases; however, the proportion of ICU nurses who were allergic to these products increased significantly in phase 2. This study found that barriers to hand hygiene in both phases included high workload (phase 1, 72.3%; phase 2, 81.2%), products causing hand allergies (phase 1, 71.4%; phase 2, 72.9%), and difficulty in accessing sink (phase 1, 15.1%; phase 2, 31.8%). These results are similar to those reported previously. In a pre-pandemic study by Akyol et al,^[25] nurses reported that they needed to wash their hands frequently but were unable to do so because of intense working conditions, lack of necessary materials, and dryness and pain in their hands due to frequent washing. After declaration of the pandemic, there were many similar barriers to hand hygiene reported, such as heavy workloads,^[27,28] overcrowded health care facilities,^[14,27] insufficient staff,^[14] allergic reactions to products used for hand hygiene,^[27–29] lack of hand hygiene materials,^[27,28] and negative effects on the HHP of healthcare workers due to the restructuring of services.^[14] Health workers should maintain hand hygiene standards at all times, not only during a pandemic(s). Compliance with hand hygiene and general infection control in healthcare settings should be supported through multidisciplinary and long-term campaigns. Healthcare providers should benefit from the research findings to provide quality care. Furthermore, cost-effectiveness studies should be conducted in the future.

This study found that the mean scores of nurses who cared for patients with suspected or diagnosed COVID-19 were significantly higher than those who did not ($P < .05$). Harper et al^[15] reported a positive change in hand hygiene behavior due

to fear of COVID-19 in participants, and that those with higher fear scores devoted attention to hand hygiene and social isolation measures. Eskici and Taştan^[17] reported that as Fear of COVID-19 Scale (i.e., “FCV-19S”) scores increased among surgical nurses, HHBS scores decreased and HHPI scores increased. In a study by Akman et al,^[30] examining the relationship between COVID-19 phobia scores and nurses' hygiene behaviors, it was found that the higher the nurses' phobia scores, the more important it became to implement personal and general hygiene measures. The potentially devastating consequences of the pandemic and the limitations imposed by disease control strategies have led to mental health problems. During the pandemic, many concerns arise, such as the need for constant self-protection, changes in regular daily routines, and unexpected cessation of activities outside the home.^[31] Healthcare workers' compliance with hand hygiene increased due to the increased risk for contracting the disease and the possibility of transmitting the virus to other patients and/or their families during the epidemic period.

In the present study, all ICU nurses believed that the COVID-19 pandemic had affected their hand hygiene practices. In addition, although the frequency of hand washing did not change after declaration of the pandemic, the duration of hand washing increased, the duration of wearing gloves decreased with the increase in the frequency of using gloves, and the frequency of using antiseptic solution, and the duration of hand rubbing increased. These results suggest that the importance of hand hygiene among ICU nurses increased as a result of the COVID-19 pandemic. Similarly, in a study by Ragusa et al,^[14] the fear of COVID-19 infection led to an increase in the use of gloves before patient contact. When Karaoğlu et al^[32] investigated the personal attitudes of nurses toward hand hygiene practices, it was reported that nurses used antiseptic soap and water at a high rate, while rubbing with antiseptic solution was used at a very low rate when washing their hands. It has been suggested that the difference in hand hygiene behaviors may be related to the provision of materials needed for hand hygiene or irritation caused to the hands by these materials.

While hand hygiene education and training increased after declaration of the pandemic, the nurses in this study reported a strikingly low training rate in phase 2. While the rates of those who reported receiving hand hygiene training varied in studies conducted before the pandemic, some studies found a high rate of those who reported receiving hand hygiene training.^[28] This result may be explained by the fact that nurses' information needs are not adequately met and that they need more information about protective measures.

5. Conclusion

The COVID-19 pandemic has led to changes in hand hygiene beliefs, particularly among nurses, worldwide. This study determined that before and after the COVID-19 pandemic, ICU nurses' hand hygiene beliefs and importance were at a medium level, whereas their practices were at a high level. It was also found that the COVID-19 pandemic had an effect on increasing ICU nurses' hand hygiene beliefs and practices. The study also found that the high pace of work, allergic reactions to the liquid soaps used, and the lack of sinks made handwashing difficult. The results of this study, and the fluctuations regarding the increase and decrease in hand hygiene practices reported in the literature, suggest that nurses perform hand hygiene practices. However, from time to time, workload, the effect of hand hygiene practice on individual health, and the lack of sufficient and appropriate materials for hand hygiene practice affect the belief in and importance of hand hygiene. According to these findings, to ensure the continuity of hand hygiene practice, which is of primary importance in the prevention of HAIs, it is recommended that not only in-service training be increased, but

Table 4**Comparison of hand hygiene beliefs and practices of intensive care nurses with characteristics and opinions after COVID-19.**

	Hand Hygiene Belief Scale		p	Hand Hygiene Practices Inventory		P
	Mean ± SD	Med (Q1-Q3)		Mean ± SD	Med (Q1-Q3)	
Caring for patients with suspected or diagnosed with COVID-19						
Yes	88.54 ± 12.1	90 (84–96.5)	.001*	65.97 ± 6.88	70 (65–70)	.019*
No	78.65 ± 13.38	84 (77–85)		61.65 ± 8.38	66 (55–69)	
Nurses had COVID-19 themselves						
Yes	93.9 ± 10.25	95 (91–101)	<.001*	67.48 ± 7.77	70 (67–70)	<.001*
No	82.35 ± 12.46	85 (80–89)		63.74 ± 6.82	66 (58–70)	
A family member of nurse had COVID-19						
Yes	92.93 ± 7.75	93 (88–98)	<.001*	67.62 ± 4.13	70 (67–70)	.014*
No	83.27 ± 13.85	85 (80.5–91.5)		63.8 ± 8.31	66.5 (59–70)	
COVID-19 pandemic affected hand hygiene practices						
Yes	86.56 ± 12.91	88 (82–94)	–	65.11 ± 7.36	69 (62–70)	–
No						
Frequency of hand washing						
Increased	87.02 ± 12.5	88 (82–94)	.232**	65.48 ± 6.23	69 (62–70)	.197**
Unchanged	86 ± 2.83	86 (84–88)		68.5 ± 0.71	68.5 (68–69)	
Decreased	50 ± 0	50 (50–50)		28 ± 0	28 (28–28)	
Duration of hand washing						
Increased	88.31 ± 12.59	90 (84–96) ^b	.002**	66.35 ± 5.84	70 (66–70) ^b	.002**
Unchanged	79.85 ± 8.06	84 (75–85) ^a		61.15 ± 6.31	61 (55–66) ^a	
Decreased	50 ± 0	50 (50–50) ^{ab}		28 ± 0	28 (28–28) ^{ab}	
Frequency of glove use						
Increased	89.42 ± 10.55	91 (84–97) ^b	.003**	66.09 ± 6.15	70 (66–70)	.051**
Unchanged	78.74 ± 14.64	85 (71–88) ^a		63.68 ± 6.01	66 (59–70)	
Decreased	50 ± 0	50 (50–50) ^{ab}		28 ± 0	28 (28–28)	
Duration of wearing gloves						
Increased	86.74 ± 10.28	90 (82–92) ^{ab}	.001**	65.58 ± 7.73	70 (62–70)	.108**
Unchanged	80.44 ± 11.79	85 (78–88) ^b		64.56 ± 5.33	66 (61–69)	
Decreased	90.22 ± 13.5	93 (85–100) ^a		65.22 ± 8.34	70 (65–70)	
Frequency of antiseptic use						
Increased	87.29 ± 12.63	89 (82–95)	.029*	65.54 ± 6.32	69 (62–70)	.078*
Unchanged	77 ± 13.97	82 (75–85)		59.33 ± 15.62	65 (61–68)	
Decreased						
Duration of hand rubbing with antiseptic						
Increased	87.66 ± 12.85	89.5 (84–95)	.007*	65.68 ± 6.16	69 (62–70)	.164*
Unchanged	79.18 ± 11.29	82 (75–88)		61.27 ± 12.64	66 (54–70)	
Decreased						

^{a,b}There is no difference between groups with the same letter; Q1: First quartile; Q3: Third quartile.*Mann–Whitney *U* test.

**Kruskal–Wallis Test.

also strategies to increase belief and motivation in hand hygiene practice be implemented. Hospital managers should take precautions regarding appropriate physical conditions and material supply. Providing more equipment and minimizing professional difficulties can help prevent HAIs and improve the quality of care. Furthermore, implementing training programs to optimize existing resources is a low-cost, high-impact intervention strategy. In the future, motivational initiatives to increase beliefs and practices in hand hygiene should be implemented to ensure the sustainability of such behaviors. It is recommended that studies be conducted to evaluate the effectiveness of interventions and precautions to ensure the sustainability of optimal hand hygiene practices. In addition, it is recommended that cost-effectiveness studies be carried out in the future.

6. Limitations

The present study included nurses working in an ICU at a university hospital in only 1 province of Türkiye. As such, the results are not necessarily generalizable to all nurses working in ICUs.

Acknowledgments

We would like to thank all our colleagues who took part in the pandemic and participated in this research. We would like

to thank Editage (www.editage.com) for English language editing.

This study was previously presented as an oral presentation in the conference below:

“Yilmaz Sahin S., Ay Karadaş Y., The Effect of The Covid-19 Pandemic On The Beliefs and Practices of Nurses Working In Intensive Care Regarding Hand Hygiene [Covid-19 Pandemisinin Yoğun Bakımda Çalışan Hemşirelerin El Hijyenine Yönelik İnançları ve Uygulamaları Üzerine Etkisi], 2nd International 3rd National Health Care Services Congress May 17–18, 2022, Ankara, Turkey”

Author contributions

Conceptualization: Yasemin Ay Karadas, Sibel Yilmaz Sahin.

Data curation: Yasemin Ay Karadas, Sibel Yilmaz Sahin.

Formal analysis: Yasemin Ay Karadas, Sibel Yilmaz Sahin.

Investigation: Yasemin Ay Karadas, Sibel Yilmaz Sahin.

Methodology: Yasemin Ay Karadas, Sibel Yilmaz Sahin, Elif Dönmez, Gamze Temiz.

Project administration: Yasemin Ay Karadas, Sibel Yilmaz Sahin.

Resources: Yasemin Ay Karadas, Sibel Yilmaz Sahin, Gamze Temiz.

Software: Yasemin Ay Karadas, Sibel Yilmaz Sahin, Elif Dönmez, Gamze Temiz.

Supervision: Yasemin Ay Karadas, Sibel Yilmaz Sahin, Elif Dönmez, Gamze Temiz.

Validation: Yasemin Ay Karadas, Sibel Yilmaz Sahin, Elif Dönmez, Gamze Temiz.

Writing – original draft: Yasemin Ay Karadas, Sibel Yilmaz Sahin, Elif Dönmez, Gamze Temiz.

Writing – review & editing: Yasemin Ay Karadas, Sibel Yilmaz Sahin, Elif Dönmez, Gamze Temiz.

References

- [1] Rosenthal VD, Maki DG, Salomao R, et al; International Nosocomial Infection Control Consortium. Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. *Ann Intern Med*. 2006;145:582–91.
- [2] Yüceer S, Demir SG. Yoğun bakım ünitesinde nozokomiyal enfeksiyonların önlenmesi ve hemşirelik uygulamaları. *diclemedj*. 2009;36:226–32.
- [3] World Health Organization. Hand hygiene <https://www.who.int/teams/integrated-health-services/infection-prevention-control/hand-hygiene>. Accessed January 05, 2023.
- [4] Asadollahi M, Arshadi Bostanabad M, Jebraili M, Mahallei M, Seyyed Rasooli A, Abdolalipour M. Nurses' knowledge regarding hand hygiene and its individual and organizational predictors. *J Caring Sci*. 2015;4:45–53.
- [5] Karadağ M, Yıldırım N, Pekin İşeri O. El Hijyeni İnanç Ölçeği ve El Hijyeni Uygulamaları Envanterinin Geçerlilik ve Güvenirliliği. *Cukurova Med J*. 2016;41:271–84.
- [6] Hillier MD. Using effective hand hygiene practice to prevent and control infection. *Nurs Stand*. 2020;35:45–50.
- [7] Guo YR, Cao QD, Hong ZS, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak: an update on the status. *Mil Med Res*. 2020;7:11.
- [8] Centers for Disease Control and Prevention. Clean Hands, Handwashing Facts. https://www.cdc.gov/clean-hands/data-research/facts-stats/?CDC_AAref_Val=https://www.cdc.gov/handwashing/show-me-the-science-handwashing.html. Accessed March 18, 2025.
- [9] Rundle CW, Presley CL, Militello M, et al. Hand hygiene during COVID-19: recommendations from the American Contact Dermatitis Society. *J Am Acad Dermatol*. 2020;83:1730–7.
- [10] World Health Organization Global report on infection prevention and control. Geneva: Licence: CC BY-NC-SA 3.0 IGO. (2022). <https://www.who.int/publications/i/item/9789240051164>. Accessed November 02, 2024.
- [11] Lambe KA, Lydon S, Madden C, et al. Hand hygiene compliance in the ICU: a systematic review. *Crit Care Med*. 2019;47:1251–7.
- [12] Wang Y, Yang J, Qiao F, et al. Compared hand hygiene compliance among healthcare providers before and after the COVID-19 pandemic: a rapid review and meta-analysis. *Am J Infect Control*. 2022;50:563–71.
- [13] Huang F, Armando M, Dufau S, Florea O, Brouqui P, Boudjema S. COVID-19 outbreak and healthcare worker behavioural change toward hand hygiene practices. *J Hosp Infect*. 2021;111:27–34.
- [14] Ragusa R, Marranzano M, Lombardo A, Quattrocchi R, Bellia MA, Lupo L. Has the COVID 19 virus changed adherence to hand washing among healthcare workers? *Behav Sci (Basel)*. 2021;11:53.
- [15] Harper CA, Satchell LP, Fido D, Latzman RD. Functional fear predicts public health compliance in the COVID-19 pandemic. *Int J Ment Health Addict*. 2021;19:1875–88.
- [16] Guerrero-Soler M, Gras-Valenti P, Gómez-Sotero IL, et al. Impact of COVID-19 on the degree of compliance with hand hygiene: a repeated cross-sectional study. *Epidemiol Infect*. 2024;152:e69.
- [17] Eksici I, Tastan S. Analysis of the relationship between fear of coronavirus and hand hygiene beliefs and practices of surgical nurses: a descriptive and cross-sectional study. *Int J Nurs Pract*. 2024;30:e13266.
- [18] Israel S, Harpaz K, Radvogin E, et al. Dramatically improved hand hygiene performance rates at time of coronavirus pandemic. *Clin Microbiol Infect*. 2020;26:1566–8.
- [19] Moore LD, Robbins G, Quinn J, Arbogast JW. The impact of COVID-19 pandemic on hand hygiene performance in hospitals. *Am J Infect Control*. 2021;49:30–3.
- [20] Soltani Goki F, Farahmandnia H, Sabzi A, Taskiran Eskici G, Farokhzadian J. Iranian nurses' perceptions of core competencies required for disaster risk management. *BMC Emerg Med*. 2023;23:84.
- [21] Hadian M, Jabbari A, Abdollahi M, Hosseini E, Sheikhbardsiri H. Explore pre-hospital emergency challenges in the face of the COVID-19 pandemic: a quality content analysis in the Iranian context. *Front Public Health*. 2022;10:864019.
- [22] Pittet D, Simon A, Hugonnet S, Pessoa-Silva CL, Sauvan V, Perneger TV. Hand hygiene among physicians: performance, beliefs, and perceptions. *Ann Intern Med*. 2004;141:1–8.
- [23] Rafferty A, Walthery P, King-Hele S. Analysing change over time: repeated crosssectional and longitudinal survey data. 2015. University of Essex and University of Manchester. <https://dam.ukdataservice.ac.uk/media/455362/changevertime.pdf>. Accessed November 6, 2024.
- [24] Caruana EJ, Roman M, Hernández-Sánchez J, Solli P. Longitudinal studies. *J Thorac Dis*. 2015;7:E537–40.
- [25] Akyol AD. Hand hygiene among nurses in Turkey: opinions and practices. *J Clin Nurs*. 2007;16:431–7.
- [26] van de Mortel TF. Development of a questionnaire to assess health care students' hand hygiene knowledge, beliefs and practices. *Aust J Adv Nurs*. 2009;26:9–16.
- [27] Lotfinejad N, Peters A, Pittet D. Hand hygiene and the novel coronavirus pandemic: the role of healthcare workers. *J Hosp Infect*. 2020;105:776–7.
- [28] Kissal A, Vergi I. Evaluation of COVID-19 fear and hand hygiene practices of healthcare professionals in a university hospital. *Ordu Univ J Nurs Stud*. 2023;6:133–44.
- [29] Kalkan Uğurlu Y, Durgun H, Nemutlu E, Kurd O. COVID-19 salgını sırasında Türk toplumunun sosyal el yıkama bilgi ve tutumunun değerlendirilmesi. *J Contemp Med*. 2020;10:617–24.
- [30] Akman E, Gür S, Özbaş A. Determination of the relationship between the coronavirus-2019 phobia level and hygiene behaviors of nurses. *Mediterr Nurs Midwifery*. 2023;3:72–80.
- [31] Sheikhbardsiri H, Tavan A, Afshar PJ, Salahi S, Heidari-Jamebozorgi M. Investigating the burden of disease dimensions (time-dependent, developmental, physical, social and emotional) among family caregivers with COVID-19 patients in Iran. *BMC Prim Care*. 2022;23:165.
- [32] Karaoğlu M, Akın S. Hastane Enfeksiyonlarının Önlenmesinde El Hijyenine Uyum ve El Hijyeni Uyumunun Geliştirilmesi. *Sağlık ve Toplum*. 2018;28:3–10.