Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2019, 8(7): 48-58

Evaluation of Nursing Students' Knowledge, Belief, and Practice of Hand Hygiene

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ABSTRACT

Objective: *The study was carried out descriptively in order to evaluate the belief, practice, and importance of nursing students about hand hygiene.* ***Materials and methods:*** *The Hand Hygiene Questionnaire (HHQ) was used to collect data regarding personal characteristics with 13 questions. The study was conducted with 655 students who accepted to participate in the study. Data were evaluated with the estimation of percentage and mean, standard deviation, independent t-test, and ANOVA in SPSS version 24.0 package.* ***Results:*** *Of the nursing students participating in the study, 64.9% were females, 55.9% were in the age group of 21-23 years, 28.1% were in the 4th year, and 90.7% had formal education in hand hygiene. The mean of the total score of the HHQ was 150.90 ± 12.07 and the Cronbach-alpha coefficient was 0.85. Statistically, a significant difference was found between HHQ total score means with respect to students' gender, age, and hand hygiene education ($p<0.05$).* ***Conclusion:*** *We determined that students have theoretical knowledge about hand hygiene and do practice it to a degree. Nonetheless, results demonstrated a lack of clinical practice. The mean score of the students on the hand hygiene questionnaire was affected by gender, age, and the education they received. We, therefore, concluded that determining the sources of inadequacy in hand hygiene practices, repetition of training at certain intervals, taking necessary precautions, and increasing student awareness will be beneficial.*

Keywords: Hand hygiene, Knowledge, Attitude, Education, Nursing students

INTRODUCTION

Despite advances in hospital services, hospital infections (HI) are an important problem in Turkey as well as all over the world. HI can cause functional impairment, emotional stress, decreased quality of life or death in patients. The length of hospitalization, the loss of workforce, and the increase in drug along with the use of extra diagnostic methods collectively result in elevation of the economic burden [1-3].

Health care workers' hands are the most important way of transferring HI, and therefore Hand hygiene (HH) is the most effective method to prevent hospital infections [4]. Hand hygiene is the most effective, the oldest, the simplest, and the cheapest medical method to prevent HI. With the application of this method, it has been shown that hospital infections can be reduced by approximately 30%-50% [5,6].

Many studies in the literature have focused on the HH rates of health care providers. According to research, HH rates of healthcare providers vary between 5% and 81% [7]. Evidence-based guidelines have been published for specific HH measures related to general HH and health care [7,8]. The most important factor in the pathogen transmission from patient to patient by the hands of health workers is the lack of hand washing or hand antisepsis [9]. Training health professionals is the most critical step in strategies aimed at increasing handwash compliance [10].

In addition, regular and continuous training programs are of great importance in increasing compliance. Erasmus, et al., reviewed 96 studies targeting on compliance with HH guidelines in patient care, revealed that health personnel compliance with HH was around 40% and that there was a need for research and training to increase compliance with HH [11]. Although the Centers for Disease Control and Prevention and the Association of Infection Control and Epidemiologists state that hand washing is the most important approach to prevent hospital infections, handwash compliance rate among health professionals is lower than 50% [12,13]. Although hand washing rates are different

in many studies, the common point of all research reports is that the healthcare workers, especially physicians, have lower hand washing rates than expected [9,14-16].

The reasons behind this low hand washing compatibility include the lack of application of hand washing behavior. Factors that can influence the compliance behaviour of the individual HH can be listed as individual preferences of health workers, knowledge deficiencies in HH, professional experience, gender, perception of HH benefits, perception of the severity of infectious diseases and role of the HH in preventing them, work intensity, dermatological effects of HH, lack of a role model, etc. [9,17-19].

HH compliance behavior is a complex issue with different factors. Many of these are individual factors such as knowledge, attitudes, practices, beliefs, and perceptions, and targeting them could have an important role in increasing compliance with HH [9,20,21].

Çelik, et al., investigated the handwashing practices of the nursing students and reported that 80.2% washed hands before and after the contact with a patient, 26.9% before and after the meals, and 17.6% washed hands when they remember. The same study also compared the number of contacts with the patient during the care providing activities and the hand washing frequency and reported that the nursing students washed their hands less frequently than the number of patients they had a contact with and the results were statistically significant [22].

Although HH knowledge and compliance behaviors of working nurses and nursing students were studied extensively, their perceptions and beliefs about HH have not been studied in depth. In the present study, we aimed to determine the importance of HH beliefs, HH applications, and the knowledge of HH among nursing students.

Research questions were as follows:

- What are the beliefs of students regarding HH?
- In which cases do students wash hands in clinical areas?
- How important is the HH in the student perspective?

MATERIALS AND METHODS

Type and Place of Study

The research was conducted as a discrete and descriptive study to evaluate the HH knowledge, belief, and practices of nursing students. The data were collected between 15 November 2018 and 15 December 2018 at the Department of Nursing, Faculty of Health Sciences, Muğla Sıtkı Koçman University, Turkey.

Population and Sample of the Study

The population of the study was students of the Nursing Department at the Faculty of Health Sciences, Muğla Sıtkı Koçman University. The sample was composed of 141 first year, 158 second year, 172 third year, and 184 fourth-year students a total of 655 attendees who accepted to participate in the study.

Data Collection Tools

A personal information form and a questionnaire consisting of Hand hygiene belief, practice, and the perception of importance (HHQ) were used as data collection tools. Personal information form included questions targeting the students' personal data. Personal data were independent variables in the study gathered from a total of 12 questions and consisted of variables gender, age, year of study, the place where they lived the longest, high school, family type, parents' education status, the place where they stay, education level on hand hygiene, and family income-expenditure status.

The HHQ used in data collection was developed in 2009 by Thea van de Mortel [23]. The reliability of the scale in Turkish was conducted by Birgili, et al. The HBS section of the questionnaire (19 items) targeted the HH belief, HHPI section targeted application inventory (14 items) of HH, and the HIS section (3 items) targeted of importance of perception of the HH, all with a 5-point Likert-type scale consisting of a total of 36 items. HBS items were scaled as 1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5=strongly agree, HPPI items were scaled as 1=never, 2=rear, 3=sometime, 4=often, 5=always, whereas HIS items were scaled as 1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5=strongly agree.

Cronbach's alpha coefficient ranged from 0.74-0.80 in the original HHQ for the HBS, HHPI, HIS sections [23], which ranged from 0.77-0.95 in the Turkish the validity test of the scale, and ranged from 0.68-0.95 in the present study [24].

Data Analysis

SPSS (Statistical Package for Social Sciences) for Windows 24.0 program was used to analyze the data. Cronbach's-alpha coefficient, independent sample t-test and One-way analysis of variance (ANOVA) were used to evaluate the descriptive data. The normality test reveals a normal distribution and therefore parametric tests were used to evaluate and interpret the data. In the Kruskal-Wallis variance analysis, LSD multiple comparison tests were used when there was a difference among groups [25].

Ethics of the Research

Ethics committee permission was obtained from Muğla Sıtkı Koçman University Scientific Research and Publication Ethics Board and written permission were obtained from the institution where the research was conducted. Written and oral consent was obtained from the students. The application lasted 15-20 minutes.

RESULTS

The mean score of the nursing students for HBS section was 71.31 ± 6.60, for HHPI section was 65.78 ± 6.43, HIS section was 13.81 ± 1.75, and mean HHQ total score was 150.90 ± 12.07 implying a high score. The alpha coefficient of the questionnaire was 0.850 and those for the sections ranged between 0.688 and 0.951.

Of the nursing students participating in the study, 64.9% were females, 55.9% were in the age group of 21-23, 49% were living in the province centers, 48.5% were teacher/science high school graduates, and 38.2% were living in apartments with roommates, 28.1%. was studying in the fourth year, 81.7% had a nuclear family, 67.6% had a family with the equivalency of income and spending, and 42.4% had a mother and 32.1% had a father with primary school education. It was determined that 90.7% of the students were educated about hand hygiene and 88.4% of them received this education as a part of the university curriculum (Table 1).

Table 1 Distribution of student personal data

Variable	n	%	Variable	N	%
Gender			**Family Type**		
Male	425	64.9%	Nuclear family	535	81.7%
Female	230	35.1%	Extended family	114	17.4%
			Separated family	6	0.9%
Age (Years)			**Income Status**		
18-20	205	31.3%	More income	101	15.4%
21-23	366	55.9%	Income spending balance	443	67.6%
24 and above	84	12.8%	More spending	111	16.9%
$\bar{x}$=21.4458 ± 1.94489					
Location of residency			**Education level of the mother**		
Province centers	321	49.0%	Illiterate	78	11.9%
District	232	35.4%	Literate	49	7.5%
Village	102	15.6%	Elementary school graduate	278	42.4%
			Middle school graduate	97	14.8%
			High school graduate	120	18.3%
			University graduate	33	5.0%
High School Graduated			**Education level of Father**		
Anadolu	280	42.7%	Illiterate	12	1.8%
Teacher/Science	318	48.5%	Literate	28	4.3%
Private	14	2.1%	Elementary school graduate	210	32.1%
Vocational	43	6.6%	Middle school graduate	174	26.6%
			High school graduate	174	26.6%
			University graduate	99	15.1%

Living in			**Hand Hygiene Education**		
Government dormitory	230	35.1%	Received	594	90.7%
Private dormitory/Apart	103	15.7%	Did not receive	61	9.3%
Alone in Family Prop.	36	5.5%			
Living with family	36	5.5%			
Living with roommate	250	38.2%			
Year in University			**Source of Hand Hygiene Education**		
1st year	141	21.5%	University	579	88.4%
2nd year	158	24.1%	Home/kindergarten	15	2.3%
3rd year	172	26.3%	No education	61	9.3%
4th year	184	28.1%			
Total	**655**	**100.0%**	**Total**	**655**	**100.0%**

Analyses of data from nursing students revealed that the difference between mean scores of genders for the HBS section ($t = -0.764$, $p=0.445$) was not statistically significant but difference between mean scores of genders for the HHPI ($t=4.331$, $p<0.001$) and HIS (3.518, $p<0.001$) sections as well as for overall HHQ ($t=2.373$, $p=0.018$) was found to be statistically significant ($p<0.05$). While female students' HHPI (66.57 ± 5.62), HIS (13.98 ± 1.57) section and overall HHQ score (151.72 ± 11.00) were higher, HBS mean score of male students (71.58 ± 6.84) found to be higher (Table 2).

Analyses of age indicated that the difference between mean scores of age groups for the HBS section ($F=1.301$, $p=0.273$) was not statistically significant. However, significant differences between mean scores of age groups for the HHPI ($F=3.885$, $p=0.021$) and HIS ($F=0.099$, $p=0.012$) sections, and for overall HHQ ($F=3.583$, $p=0.028$) were detected ($p<0.05$). HBS (71.63 ± 6.88), HHPI (66.31 ± 5.99) sections and overall HHQ (151.80 ± 11.87) scores were higher in the age group 21-23 years while HIS mean score (13.83 ± 1.73) was found to be higher in the age group 18-20 years (Table 2). LSD multiple comparison test for the difference between the average HHQ scores of the students according to their age group revealed that students who were in the 24 years and above age group had a lower mean score than the other groups ($p=0.028$).

Analyses of the difference in the longest-lived location type indicated that the difference between locations was not significant for the HBS ($F=0.591$, $p=0.554$), HHPI ($F=0.389$, $p=0.678$), HIS ($F=0.099$, $p=0.906$) sections as well as overall HHQ ($F=0.513$, $p=0.599$). HBS (71.64 ± 6.86), HHPI (66.05 ± 6.64) section and overall HHQ (151.46 ± 12.57) scores of student who lived in a district longer than any other location was higher than other groups whereas HIS (13.75 ± 1.80) section mean score of the same group was lower than means of other groups (Table 2).

Analyses of the difference in the high school type the students graduated from were not significant for the HBS ($F=1.852$, $p=0.136$), HHPI ($F=1.462$, $p=0.222$), HIS ($F=0.601$, $p=0.614$) sections or for the overall HHQ ($F=1.590$, $p=0.191$). HBS (75.07 ± 4.99), HHPI (68.42 ± 3.34), HIS (14.35 ± 1.15) section and overall HHQ mean score of a student who graduated from a private high school (157.85 ± 5.23) was higher than means of other groups (Table 2).

Analyses of the difference in the places that the students currently live was not significant for the HBS ($F=0.120$, $p=0.975$), HHPI ($F=1.632$, $p=0.164$), HIS ($F=2.368$, $p=0.055$) sections or for the overall HHQ ($F=0.758$, $p=0.558$) ($p>0.05$). HBS (71.97 ± 5.19), HHPI (67.19 ± 4.40) section mean scores and HHQ (152.33 ± 8.50) overall mean score of the students who live alone was found to be higher than other groups, while HIS (14.04 ± 1.67) section mean score of student who lives in a private dormitory or apartment complex was higher (Table 2).

Analyses of the difference in the students' university enrolment year revealed that the differences among enrolment year were significant for the HBS ($F=0.636$, $p=0.592$), HHPI ($F=0.8992$, $p=0.441$), HIS ($F=1.662$, $p=0.174$) sections and for the overall HHQ ($F=0.355$, $p=0.800$) ($p>0.05$). HBS section mean score (71.93 ± 6.95) was higher among the second year students, HHPI section mean score (66.36 ± 6.27) and HHQ overall mean score (151.45 ± 11.34) of the fourth year students were higher than other groups, and HIS section mean score (14.05 ± 1.59) of first-year students was higher than means of other groups (Table 2).

When we consider the difference in the nursing students' family types, we detected that the differences between groups were not significant for the HBS (F=0.139, p=0.870), HHPI (F=2.276, p=0.104), HIS (F=0.409, p=0.665) sections or overall HHQ (F=0.513, p=0.599) mean score. A student who had separated families had a higher mean score for HBS (72.50 ± 2.88), HHPI (67.50 ± 2.73) sections, as well as HHQ overall, mean score (153.16 ± 11.72). However, the mean score of the students with the separated family group had the lowest average HIS section score (13.16 ± 1.47) (Table 2).

Analyses of the family financial situation revealed that the differences among the 3 groups were not significant for the HBS (F=0.694, p=0.500), HIS (F=1.119, p=0.327) sections and for the overall HHQ (F=1.835, p=0.160) (p>0.05), but a significant difference was observed in HHPI (F=3.361, p=0.035) section. HBS section mean score (712.95 ± 6.46) and HHQ overall mean score (151.37 ± 10.60) was higher among the students whose family had a balanced income, HHPI section mean score (66.14 ± 6.44) and HIS section mean score (13.88 ± 1.69) of students whose family had more spending than income was higher than means of other groups (Table 2).

Analyses of the difference in mothers' education level indicated that the difference was not significant for the HBS (F=0.788, p=0.558), HIS (F=1.899, p=0.093) sections and for the overall HHQ (F=2.135, p=0.060) (p>0.05), but a significant difference was observed in HHPI (F=3.238, p=0.007) section. HBS section mean score (72.53 ± 5.53) and HHQ overall mean score (153.00 ± 9.81) was higher among the students whose mother was literate, and HHPI section mean score (67.03 ± 5.02) and HIS section mean score (14.03 ± 1.57) of students whose mother was a secondary school graduate was higher than means of other groups. Analyses of the difference in fathers' education level revealed that the difference was not significant for the HBS (F=0.908, p=0.475), HHPI (F=1.087, p=0.366), HIS (F=1.471, p=0.197) sections and for the overall HHQ (F=0.704, p=0.621) (p>0.05). HBS section mean score (72.71 ± 6.74) was higher among the students whose father was literate, HHQ overall mean score (152.25 ± 10.82) was higher among the students whose father was university graduate, and HHPI section mean score (66.46 ± 5.65) and HIS section mean score (14.15 ± 1.49) of students whose father was a secondary school graduate was higher than means of other groups (Table 2).

We finally conducted the analyses of the HH education and detected that the differences among the 2 groups were not significant for the HBS (t=0.088, p=0.930) section and for the overall HHQ (t=1.843, p=0.066), but a significant difference was observed in HIS (t=3.743, p=0.000) and HHPI (t=2.361, p=0.019) sections. HBS (71.32 ± 6.47), HHPI (65.97 ± 6.34), HIS (13.89 ± 1.69) sections mean scores and HHQ overall mean score (151.19 ± 11.91) was higher among the students who received an education (Table 2).

Table 2 Mean score of student personal data according to HBS, HHPI, HIS, and HHQ

Variable		Section			Scale Total
		HBS	HHPI	HIS	HHQ
		$\bar{X}$ ± SS	$\bar{X}$ ± SS	$\bar{X}$ ± SS	$\bar{X}$ ± SS
Gender	Female	71.16 ± 6.47	66.57 ± 5.62	13.98 ± 1.57	151.72 ± 11.00
	Male	71.58 ± 6.84	64.32 ± 7.49	13.48 ± 2.01	149.39 ± 13.74
	t-value	-0.764	4.331	3.518	2.373
	p-value	0.445	0.000	0.000	0.018
Age	18-20	71.11 ± 6.12	65.43 ± 6.27	13.83 ± 1.73	150.50 ± 11.33
	21-23	71.63 ± 6.88	66.31 ± 5.99	13.77 ± 1.81	151.80 ± 11.87
	24 and above	70.41 ± 6.44	64.28 ± 8.21	13.82 ± 1.70	148.00 ± 14.19
		$\bar{X}$=21.44 ± 1.94			
	F-value	1.301	3.885	4.426	3.583
	p-value	0.273	0.021	0.012	0.028
The longest lived place is a	Province center	71.22 ± 6.55	65.70 ± 6.45	13.83 ± 1.72	150.76 ± 12.15
	District	71.64 ± 6.86	66.05 ± 6.64	13.75 ± 1.80	151.46 ± 12.57
	Village	70.83 ± 6.17	65.42 ± 5.87	13.83 ± 1.74	150.07 ± 10.65
	F-value	0.591	0.389	0.099	0.513
	p-value	0.554	0.678	0.906	0.599

Highschool graduated	Anadolu	71.37 ± 6.75	65.47 ± 6.77	13.84 ± 1.67	150.68 ± 12.69
	Teacher/Science	71.01 ± 6.54	66.05 ± 6.22	13.75 ± 1.84	150.83 ± 11.90
	Private	75.07 ± 4.99	68.42 ± 3.34	14.35 ± 1.15	157.85 ± 5.23
	Vocational	71.90 ± 6.25	64.90 ± 6.24	13.86 ± 1.71	150.67 ± 10.39
	F-value	1.852	1.469	0.601	1.590
	p-value	0.136	0.222	0.614	0.191
Living	G. dormitory	71.16 ± 6.87	65.13 ± 7.36	13.67 ± 1.89	149.97 ± 13.58
	P. dormitory	71.36 ± 7.85	66.56 ± 6.95	14.04 ± 1.67	151.98 ± 14.47
	Alone	71.97 ± 5.19	67.19 ± 4.40	13.16 ± 2.63	152.33 ± 8.50
	With family	71.30 ± 5.91	66.80 ± 4.85	13.94 ± 1.65	152.05 ± 10.45
	With roommate	71.33 ± 6.09	65.70 ± 5.64	13.91 ± 1.46	150.95 ± 10.01
	F-value	0.120	1.632	2.368	0.758
	p-value	0.975	0.164	0.055	0.558
Year in University	1st year	71.02 ± 6.08	65.87 ± 6.00	14.05 ± 1.59	150.95 ± 10.99
	2nd year	71.93 ± 6.95	65.32 ± 7.33	13.75 ± 1.82	151.01 ± 14.13
	3rd year	71.06 ± 7.17	65.50 ± 6.03	13.62 ± 1.87	150.18 ± 11.70
	4th year	71.23 ± 6.13	66.36 ± 6.27	13.84 ± 1.69	151.45 ± 11.34
	F-value	0.636	0.899	1.662	0.335
	p-value	0.592	0.441	0.174	0.800
Family Type	Nuclear family	71.33 ± 6.39	65.00 ± 6.01	13.81 ± 1.69	151.15 ± 11.20
	Extended family	71.14 ± 7.64	64.65 ± 8.15	13.81 ± 2.03	149.61 ± 15.78
	Separated family	72.50 ± 2.88	67.50 ± 2.73	13.16 ± 1.47	153.16 ± 11.72
	F-value	0.139	2.276	0.409	0.874
	p-value	0.870	0.104	0.665	0.418
Income Status	Balanced	71.95 ± 6.46	65.70 ± 5.53	13.72 ± 1.90	151.37 ± 10.60
	More spending	71.27 ± 6.52	66.14 ± 6.44	13.88 ± 1.69	151.30 ± 11.93
	More income	70.90 ± 7.06	64.38 ± 6.99	13.62 ± 1.86	148.90 ± 13.71
	F-value	0.694	3.361	1.119	1.835
	p-value	0.500	0.035	0.327	0.160
Education level of mother	Illiterate	70.98 ± 7.18	63.51 ± 9.19	13.75 ± 1.35	147.94 ± 16.43
	Literate	72.53 ± 5.53	66.34 ± 4.96	13.40 ± 2.42	153.00 ± 9.81
	Elementary	71.19 ± 7.22	65.55 ± 6.49	13.72 ± 1.70	150.47 ± 12.85
	Middle school	71.71 ± 5.68	67.03 ± 5.02	14.03 ± 1.57	152.77 ± 8.76
	High school	71.40 ± 6.29	66.57 ± 5.47	14.01 ± 1.47	151.99 ± 10.46
	University	69.84 ± 4.47	65.63 ± 5.67	13.75 ± 1.61	149.03 ± 8.50
	F-value	0.788	3.238	1.899	2.135
	p-value	0.558	0.007	0.093	0.060
Education level of Father	Illiterate	72.58 ± 7.25	64.75 ± 6.98	13.75 ± 1.35	151.08 ± 11.09
	Literate	72.71 ± 6.74	64.00 ± 7.98	13.42 ± 2.37	150.14 ± 14.40
	Elementary	71.27 ± 6.51	65.50 ± 6.52	13.71 ± 1.81	150.48 ± 12.00
	Middle school	71.30 ± 6.76	66.46 ± 5.65	14.15 ± 1.49	151.92 ± 11.09
	High school	70.66 ± 6.64	65.60 ± 6.92	13.72 ± 1.84	149.99 ± 13.21
	University	72.02 ± 6.41	65.40 ± 5.72	13.82 ± 1.60	152.25 ± 10.82
	F-value	0.908	1.087	1.471	0.704
	p-value	0.475	0.366	0.197	0.621
Hand Hygiene Education	Received	71.32 ± 6.47	65.97 ± 6.34	13.89 ± 1.69	151.19 ± 11.91
	Did not receive	71.24 ± 7.76	64.00 ± 7.00	13.04 ± 2.06	148.29 ± 13.33
	t-value	0.088	2.361	3.743	1.843
	p-value	0.930	0.019	0.000	0.066

There were 19 questions in the HBS section of the scale, and the overall mean value was 3.75. When the answers of the nursing students to the questions were examined, it was seen that the highest score is given to "Cleansing hands after going to the toilet can reduce transmission of infectious disease" with a mean=4.70. The other higher scores were "Performing hand hygiene after caring for a wound can protect from infections" (mean=4.57), "Hand hygiene is a

habit for me in my personal life" (mean=4.53), "Prevention of hospital-acquired infection is a valuable part of a health care worker's role" (mean=4.50). The lowest scores were given to questions "It is an effort to remember to perform hand hygiene in the recommended situations" (mean=2.53), "I can't always perform hand hygiene in recommended situations because my patient's needs come first" (mean=2.62) (Table 3).

Table 3 Mean scores for items on the hand hygiene beliefs scale

Items Statement		Min.-Max.	$\bar{X} \pm SS$
1	I have a duty to act as a role model for other health care workers	1-5	4.30 ± 0.91
2	When busy it is more important to complete my tasks than to perform hand hygiene	1-5	2.48 ± 1.26
3	Performing hand hygiene in the recommended situations can reduce patient mortality	1-5	4.47 ± 0.71
4	Performing hand hygiene in the recommended situations can reduce medical costs associated with hospital-acquired infections	1-5	4.50 ± 0.72
5	I can't always perform hand hygiene in recommended situations because my patient's needs come first	1-5	2.62 ± 1.17
6	Prevention of hospital-acquired infection is a valuable part of a health care worker's role	1-5	4.50 ± 0.67
7	I follow the example of senior health care workers when deciding whether or not to perform hand hygiene	1-5	3.23 ± 1.27
8	I believe I have the power to change poor practices in the workplace	1-5	3.85 ± 0.92
9	Failure to perform hand hygiene in the recommended situations can be considered negligence	1-5	4.14 ± 0.94
10	Hand hygiene is a habit for me in my personal life	1-5	4.53 ± 0.64
11	I am confident I can effectively apply my knowledge of hand hygiene to my clinical practice	1-5	4.36 ± 0.78
12	It is an effort to remember to perform hand hygiene in the recommended situations	1-5	2.53 ± 1.16
13	I would feel uncomfortable reminding a health professional to hand wash	1-5	3.19 ± 1.26
14	If I disagree with a guideline I look for research findings to guide my practice	1-5	3.99 ± 0.89
15	Performing hand hygiene slows down building immunity to disease	1-5	2.76 ± 1.35
16	Dirty sinks can be a reason for not washing hands	1-5	3.22 ± 1.22
17	Lack of an acceptable soap product can be a reason for not cleansing hands	1-5	3.28 ± 1.27
18	Performing hand hygiene after caring for a wound can protect from infections	1-5	4.57 ± 0.71
19	Cleansing hands after going to the toilet can reduce transmission of infectious disease	1-5	4.70 ± 0.58
General mean			3.75
Scale: 1=strongly disagree to 5=strongly agree			

There were 14 questions in the HHPI subscale of the scale, and the overall average was found to be 4.69. When the answers of nursing students to the questions were examined, the highest score was given to the "After contact with blood or body fluids" (mean=4.81) statement. After that following statements were given higher scores: "After going to the toilet" (mean=4.78), "After caring for a wound "(mean=4.77), "After contact with a patient's secretions" (mean=4.76). The lowest score was given to the statements "Before patient contact" (mean=4.52), "After physical contact with a patient" (mean=4.61) (Table 4).

Table 4 Mean scores for items on the modified hand hygiene practices inventory

I Cleanse My Hands		Min.-Max.	$\bar{X} \pm SS$
1	After going to the toilet	1-5	4.78 ± 0.52
2	Before caring for a wound	1-5	4.72 ± 0.56
3	After caring for a wound	1-5	4.77 ± 0.53
4	After touching potentially contaminated objects	1-5	4.71 ± 0.57
5	If they look or feel dirty	1-5	4.74 ± 0.51
6	After contact with blood or body fluids	1-5	4.81 ± 0.48
7	After inserting an invasive device	1-5	4.71 ± 0.56
8	Before entering an isolation room	1-5	4.62 ± 0.65
9	After physical contact with a patient	1-5	4.61 ± 0.64
10	After exiting an isolation room	1-5	4.62 ± 0.65
11	Before endotracheal suctioning	1-5	4.67 ± 0.62

12	After contact with a patient's secretions	1-5	4.76 ± 0.50
13	Before patient contact	1-5	4.52 ± 0.73
14	After removing gloves	1-5	4.66 ± 0.60
General mean			4.69
Scale: 1=strongly disagree to 5=strongly agree			

There were 3 questions in the HIS section of the scale, and the overall average was found to be 4.60. When the answers of the nursing students to the questions were examined, the highest score was given to the statement of "The facilities in which I do clinical practicum emphasize the importance of hand hygiene" statement (mean=4.64). The lowest score is given to "The importance of hand hygiene is emphasized by my clinical supervisors" statement (mean=4.56) (Table 5).

Table 5 Mean scores for items on the hand hygiene importance scale

Statement		Min.-Max.	$\bar{X}$ ± SS
1	Hand hygiene is considered an important part of the curriculum	1-5	4.59 ± 0.35
2	The facilities in which I do clinical practicum emphasize the importance of hand hygiene	1-5	4.64 ± 0.62
3	The importance of hand hygiene is emphasized by my clinical supervisors	1-5	4.56 ± 0.67
General mean			4.6
Scale: 1=strongly disagree to 5=strongly agree			

DISCUSSION

Hand washing is one of the standard measures that have proven to be effective in reducing preventable HI. Hand hygiene is a simple procedure, but the factors affecting the compliance of health personnel are quite complex. Individual characteristics of health workers, working conditions (workload, availability of materials and facilities for hand hygiene, etc.), and cognitive perceptions affect compliance [9]. The mean score of nursing students on the HHQ questionnaire was 150.90 ± 12.07 and can be conspired as sufficient.

About 90.7% of the nursing students who participated in the study had HH education and the mean score of the students who received an education was higher in the HHQ scale. In addition, it was determined that there was no statistically significant difference between the HBS section and HHQ scale total score averages according to the HH education status of students ($p>0.05$). The mean HHPI, HIS subscale and HHQ scores of the students who received HH education in university education were found to be higher. As a result of the evaluation of the mean scores of the HIS, HHPI, HIS subscale, and HHQ scale, it is concluded that nursing students have positive beliefs regarding hand hygiene. Keşaplı, et al., found that the total hand washing rate of the health personnel working in the emergency room was 20.3% after all contacts, and the hand washing frequency after clean contacts was found to be statistically less than the dirty contacts [26].

Erasmus, et al., systematically examined 96 studies on compliance with HH guidelines in patient care, and found that health personnel compliance with HH was 40%, and there was a need for research and training to improve compliance with HH [11]. Similar results were reported by Van de Mortel in Australia, van de Mortel, et al., in Greece and van de Mortel, et al., in Italy [23,27,28]. Çelik, et al., reported that 80.2% of the nursing students washed their hands before and after contact with the patient [22]. In another study, 97% of nursing students reported that they wash hands [29]. These results are higher than the results of our study. In the literature, hygienic hand washing before and after contact with the patient, before dealing with infected patients, before and after contact with wounds, urine, and similar catheters, after contact with secretions of patients, and before and after wearing gloves is emphasized [30]. According to this information, hand washing rate is low among nursing students. The beliefs about the results of the behaviors of individuals in increasing compliance with HH and the value of these results are the factors that affect the learning process. Recognition of beliefs about HH is thought to be particularly effective in ensuring students' knowledge, beliefs, and practices about HH, and to make them look more positive for HH practice culture.

At the university where the research is carried out, theoretical and practical courses on HH in social, hygienic and surgical hand washing are delivered. In addition, this training is revisited during the training seminars given to nursing students in clinical practice areas. The reasons behind the low hand washing rate in the study may be due to the difficulty in applying theoretical knowledge in clinical practice and the lack of sufficient attention to this subject

by nursing students. However, most nursing students believed that they had washed their hands well enough. In the studies, the main reasons for the low hand washing rate of the nurses included the increased workload with properly washing of the hands, inadequate hand washing places, and the inaccessibility of the hand washing agents [9,14,17,18]. These reasons are similar to the causes described by nursing students in our study.

HH is required before and after contact with microorganism sources (ie, body fluids and substances, mucous membranes, broken skin, or inanimate objects likely to be contaminated) and after removing gloves [31]. Demir, et al., reported that 84% compliance after contact with body fluids [32]. Similarly, in the study, the mean total score for "after contact with the blood or body fluids" was 4.81, "after going to the toilet" was 4.78, "after caring for a wound" was 4.77, and "after contact with a patient's secretions" was 4.76. It is noteworthy that contact with body fluids is a condition in which healthcare workers need very frequent hand washing. This shows that there is more tendency to wash hands invisible contamination. In the study, the mean of the total score of "before patient contact" was 4.52, "after physical contact with a patient" was 4.61 and both were the lowest of the mean score indicating the common belief that there is no need for hand washing. This can be considered as a serious problem in the control of HI.

In the study, it was determined that the difference between HHPI, HIS sections, and HHQ total score means were statistically significant for the gender of nursing students ($p<0.05$). While female students' HHPI, HIS section, and HHQ mean scores were higher, the mean score of the male students in the HBS section was higher. According to these results, it can be thought that female students are more compatible with HH beliefs and practices.

In the study, it was determined that the difference between HHPI, HIS sections, and HHQ total score means were statistically significant for age groups ($p<0.05$). While the mean scores of the HBS, HHPI sections and HHQ of the age group of 21-23 years were higher than the students in the other age group, the mean total score of the HIS section was found to be higher in the age group of 18-20 years. This finding suggests that the higher the age, the higher the level of consciousness and more attention was devoted to HH applications as the students progressed in their classes.

In the present study, the mean score of the nursing students was found to be highest in the HHPI section. We could argue that students are in compliance with HH in clinical practice, but the further increase is suggested. HIS section means scores of the students were found to be second highest. This result shows that the students are aware of the importance of HH and the value of including this subject in the education curriculum. The mean score of the HBS section was the lowest of all. Students' beliefs about HH should be further improved.

CONCLUSION AND RECOMMENDATIONS

In this study, nursing students' answers reflect a good level of knowledge regarding hand washing. Despite elevated theoretical knowledge on the subject, inadequacies in implementation were detected among nursing students participated in the study. In addition, it was determined that nursing students' beliefs about hand hygiene should be improved. Further research is recommended to investigate whether nursing students are able to practice hand washing in the clinical fields while working.

It is important that academic instructors and clinical nursing trainers maintain up-to-date knowledge on the subject. It is believed that to increase hand washing models and hand washing rates, a feedback mechanism along with improved conditions in clinical practice areas, checklists, development of the relevant protocols are necessary.

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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