NHSJ Nursing and Health Sciences Journal

Volume 3, Number 2 (June 2023)
e-ISSN: 2798-5067
p-ISSN: 2798-5059

A Comparison of Nurses' and Patients' Recognition of High-touch Surfaces in a Hospital Room

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Article Info:
Submitted:
13-02-2023
Revised:
28-04-2023
Accepted:
02-05-2023

DOI:
https://doi.org/10.53713/nhsj.v3i2.242

ABSTRACT

This study was conducted to identify and compare areas perceived to be high-touch surfaces in patient hospital rooms by ward nurses and inpatients to prioritize cleaning and disinfection of these areas and also to improve hospital environment management. The participants were 122 nurses who worked in general hospital wards and 56 patients hospitalized at a 299-bed general hospital in Seoul. We selected 38 items from the high-touch surfaces identified by patients in previous studies and guidelines and classified them into 4 categories. For each item, the contact frequency was investigated with a self-report questionnaire on a graphic rating scale that contained 11 points. Data were collected from April 1, 2020, to April 30, 2020. The average recognition score of the frequency of high-touch surfaces was significantly higher in nurses than in patients. (5.96 ± 1.47 vs. 2.35 ± 1.98, $p<0.001$). The top seven high-touch surfaces included intravenous poles, bedrails, bed height remote controls, bedside tables, restroom door handles, bedside personal locks, and restroom seats, and the ranking of these surfaces was different between nurses and patients. While nurses and patients showed a consensus when identifying major high-touch surfaces, there was a big difference in their perception of these areas' touch frequency. This study will help to understand and establish categories and criteria for high-touch surfaces in the future.

Keywords: patients' rooms; environment; disinfection; nurses; patients

INTRODUCTION

Current evidence suggests that nursing care quality is affected by the NWE through pathways that may involve UNC, EHR implementation, and JS. It is important to examine the collective effects and interdependencies of these quality drivers to understand better how the environment of care affects the quality of care. This study examined how the NWE, UNC, EHR, and JS collectively affect nursing care quality.

The hospital environment can cause healthcare-associated infections, and environmental infection management plays an important role in preventing the spread of pathogens (Sehulster et al., 2003). Hospital room surfaces near patients are often touched, and commonly used medical devices are more frequently contaminated with microbes (Russotto et al., 2015; Saadi et al., 2021). By improving the cleaning processes and implementing various infection-control strategies, the rate of microbial contamination in the hospital environment has been reduced (Huang et al., 2020; Wong et al., 2018). In addition, multidrug-resistant bacterial infections (Anderson et al., 2017; Eichelberger & Zirges, 2019; Mitchell et al., 2019), implantable device-related infections (Ellingson et al., 2020), and intensive care infections (Nagaraja et al., 2015, Vianna et al., 2016) have decreased.

"High-touch surfaces" that are frequently used by patients and healthcare workers in a healthcare environment as well as surfaces that are frequently contaminated, should be cleaned more often than other places to prevent the spread of infection (Sehulster et al., 2003; Ling et al., 2015; Government of South Australia, 2017; Korea Disease Control and Prevention Agency & Korean Society for Healthcare-associated Infection Control and Prevention, 2017). Previous studies have identified the most common high-touch surfaces in medical institutions (Cheng et al., 2015; Huslage et al., 2010; Jinadatha et al., 2017; Smith et al., 2012). However, the criteria for identifying these high-touch surfaces suggested in previous guidelines and studies are either abstract or vary widely (Table 1). Therefore, it was necessary to develop a standardized system to identify the high-touch surfaces in a hospital room.

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e-ISSN: 2798-5067
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Table 1. Selected High Touch Environments Identified by Various Observational Researches & Evidence-Based Guidelines: Various Scope and Definitions were Applied

Observational researches			
Cheng et al (2015)†	Huslage et al (2010)‡	Jinadatha et al (2017)‡	Smith et al (2012)‡
Hospital items including patients' bodies	During patient care Excluding bathroom	Patient room	Near-patient surfaces (in room) Clinical equipment (in room) Far-patient surfaces (outside room)
Bedside rail	Bed rails	Computer on wheels	Near-patient surfaces (in room) Note§ Bed frame§
Bedside table	Bed surface	Bedrail	Clinical equipment (in room) IV Drip§
Patients' body Patients' file Linen Curtain Bed frame Locker BP cuff Syringe	Supply cart Over-bed table Intravenous pump	IV pump Bed surface Tray table Vital machine Wall shelf Door In-room computer	Far-patient surfaces (outside room) Computer§ Notes trolley§
Evidence-based guidelines: Patient's room-related high touch surfaces			
KCDC & KOSNIC (Korea Disease Control and Prevention Agency & Korean Society for Healthcare-associated Infection Control and Prevention, 2017) Patient rooms	APSIC (Ling et al., 2015) Patient care areas	CDC (Sehulster et al., 2003) Patient care areas	SA (Government of South Australia, 2017) Patient care areas and bathroom surfaces
Bed height remote control Bedrails Bedside tables Bedside personal lockers Call bell Chair Sink Doorknobs IV pole Light switch Telephone Restroom door handle Restroom light switch Safety handle Shower handle flush button Restroom sink Restroom seat Intravenous pump Monitor Regulator Touchscreen for monitor adjustment Monitor cable Ventilator regulator	Bedrails Call bell Computer keyboard Edges of privacy curtains Doorknobs Elevator button Hemodialysis machine Light switch Monitoring equipment Telephone Wall around restroom	Bedrails Carts faucet handles Edges of privacy curtains Doorknobs Light switches faucet handles Surfaces in and around toilets Bedside commodes	Patient care areas: Bedrails Over-way tables Call bell Edges of privacy curtains Doorknobs Light switches Telephone Bathroom surfaces: toilet seat flush button Taps

BP cuff, blood pressure cuff; IV pump, Intravenous pump; IV Drip, Intravenous Drip; IV pole, Intravenous pole; KCDC, Korea Centers for Disease Control and Prevention; KOSNIC, Korean Society for Healthcare-associated Infection Control and Prevention; APSIC, Asia Pacific Society of Infection Control; CDC, Centers for Disease Control and Prevention; SA, Government of South Australia.
†Patient, Visitor, Healthcare Worker Observation Study. ‡Healthcare Worker Observation Study.
§Items exceeded 10.0 % of the total number of times handled.

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p-ISSN: 2798-5059

Establishing and managing environmental management guidelines forwards and patient rooms is one of the nurses' duties, so the nurses' awareness is very important for managing high-touch surfaces. Our comparison of the nurses' and patients' responses when asked to identify the hospital surfaces with the highest amount of frequent contact and our examination of the surfaces frequently touched by the patient will help establish a standard for high-touch surfaces that require regular disinfection. Although many previous studies have used the observation method, it is difficult to confirm any consistency in high-touch surface recognition between patients and nurses using the observation method, and it is also impossible to observe a place such as a bathroom due to privacy concerns.

Therefore, we investigated the patients' ability to recognize high-touch surfaces based on the same criteria in this study. We included both healthcare workers and patients to determine whether there was a difference between the responses of nurses and patients.

METHOD

Study Design

This was a cross-sectional, self-reported survey of nurses and patients simultaneously examining differences in recognitions of frequently touched surfaces by patients.

Participants and Setting

Questionnaires were distributed to all 122 nurses who worked in the wards of a 299-bed general hospital in Seoul; 113 were completed and returned, and the nurse questionnaire recovery rate was 92.6%. Of the 299 inpatients in the general ward of the study hospital, 56 patients understood the purpose of the study and voluntarily participated. Of the hospitalized patients, 45 were unable to respond due to physical and cognitive functioning, and 198 patients did not wish to contact the researcher due to the emergence and spread of COVID-19 in South Korea.

Data collection tools

The study collected the following information about the nurses: age, sex, amount of clinical experience, current work department, whether they have received training in environmental management methods for the past year, the degree of their knowledge of environmental management methods, and their perception of the necessity of an environmental management education. The following general characteristics of the patients were investigated: age, sex, current inpatient ward type, current inpatient department, and whether they could ambulate unassisted.

We extracted 58 items, including all items mentioned at least once in prior studies (Cheng et al., 2015; Huslage et al., 2010; Jinadatha et al., 2017; Smith et al., 2012) and guidelines (Sehulster et al., 2003; Ling et al., 2015; Government of South Australia, 2017; Korea Disease Control and Prevention Agency & Korean Society for Healthcare-associated Infection Control and Prevention, 2017) related to the environment of patient rooms or patient care areas. Among the 58 items mentioned, we excluded all types of medical equipment mainly used only by nurses and items not typically placed in the ward (e.g., blood pressure cuff, thermometer, ventilator regulator, hemodialysis machine), which left 46 remaining items. These 46 items were verified for content validity by experts. Five nursing professors, three infection-control nurses, and one ward head nurse were asked to determine these items' Content Validity Index (CVI). At first, 40 items were selected, excluding linens, floors, ceilings, bed surfaces, paper towel dispensers, and trash cans; these items had a CVI of < .8 and involved minimal hand contact. A preliminary survey was conducted with five patients and five nurses, and any names of items that needed to be understood were corrected. Telephones and thermostats were excluded because they were not provided in the hospital rooms of the study participants. Finally, 38 items were included in our questionnaire. These 38 items were categorized into 5 items related to medical equipment, 13 items related to bathrooms, 10 items related to ward facilities, and 10 items related to the patient's bed and household items. For each item, an 11-point graphic rating scale was created where 0 points indicated "minimal hand contact," 5 points represented "moderate hand contact," and 10 points suggested "frequent hand contact." The higher the score, the more frequent the patient's contact with the surface.

Data collection

After obtaining approval from the University of Ulsan Bioethics Review Committee (2020R0002-003) and the research hospital, data were collected from April 1, 2020, to April 30, 2020. Questionnaires and informed consent forms were distributed to the nurses by ward. The nurses completed and individually sealed them, which were collected five days later. After the researcher interviewed the patient, obtained informed consent, and filled out the general characteristic questions, the patients completed the high-touch surface questionnaire. The nurse self-reported the entire questionnaire. It took about 5 to 10 minutes to complete the questionnaire, and a small gift was given to the respondents in appreciation of their cooperation.

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e-ISSN: 2798-5067
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Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences, version 24.0 (IBM, NY, USA), and all statistical significance levels were set to $p<0.05$. The participant characteristics were presented as numbers, percentages, means, and standard deviations. The differences between the high-touch surfaces in hospital rooms recognized by nurses and patients were analyzed using a t-test.

RESULT

The characteristics of the nurses and patients

The mean age of the study participants was 28.05 ± 5.66 years for the nurses and 47.46 ± 19.70 years for the patients. The average total clinical experience of the nurses was 4.00 ± 5.47 years, and 67 nurses (59.3%) worked in internal medicine wards. Regarding infection control education within the past year, 93 nurses (82.3%) had received training on environmental management methods, and 45 (39.8%) responded that they "mostly" knew about environmental management methods. In addition, 102 (90.3%) said: "environmental management education is necessary." The current inpatient type of hospital room included 52 patients (92.9%) in rooms with three or more beds and 42 patients (75.0%) in the surgery department. Finally, 51 respondents (91.1%) answered that they were able to leave the bed unassisted (Table 2).

Table 1. Descriptive Statistics of the Sample and Main Analysis Variables (N=835-950)

Characteristics	Categories	n (%) or M±SD
Nurses (n=113)		
Age (yr)	≤29	81 (71.7)
	30-39	26 (23.0)
	≥40	6 (5.3)
	M±SD	28.05 ± 5.66
Gender	Male	4 (3.5)
	Female	109 (96.5)
Marital status	Unmarried	102 (90.3)
	Married	11 (9.7)
Educational background	College	39 (34.5)
	University or Graduate school	74 (65.5)
Total clinical experience (yr)	≤2	59 (52.2)
	3-5	21 (18.6)
	≥6	33 (29.2)
	M±SD	4.00 ± 5.47
Current department	Medical ward	67 (59.3)
	Surgical ward	46 (40.7)
Current department experience (yr)	≤2	82 (72.6)
	3-5	21 (18.6)
	≥6	10 (8.8)
	M±SD	2.00 ± 2.05
Work position	Staff	89 (78.8)
	Senior staff	18 (15.9)
	Unit manager	6 (5.3)
Educated experience about environmental management	Yes	93 (82.3)
	No	20 (17.7)
Self reported knowledge about environmental management	Know very well	12 (10.6)
	Know well	45 (39.8)
	Know	43 (38.1)
	Don't know	13 (11.5)
Necessity for environmental management education	Necessary	102 (90.3)
	Not necessary	11 (9.7)
Total		113 (100.0)

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p-ISSN: 2798-5059

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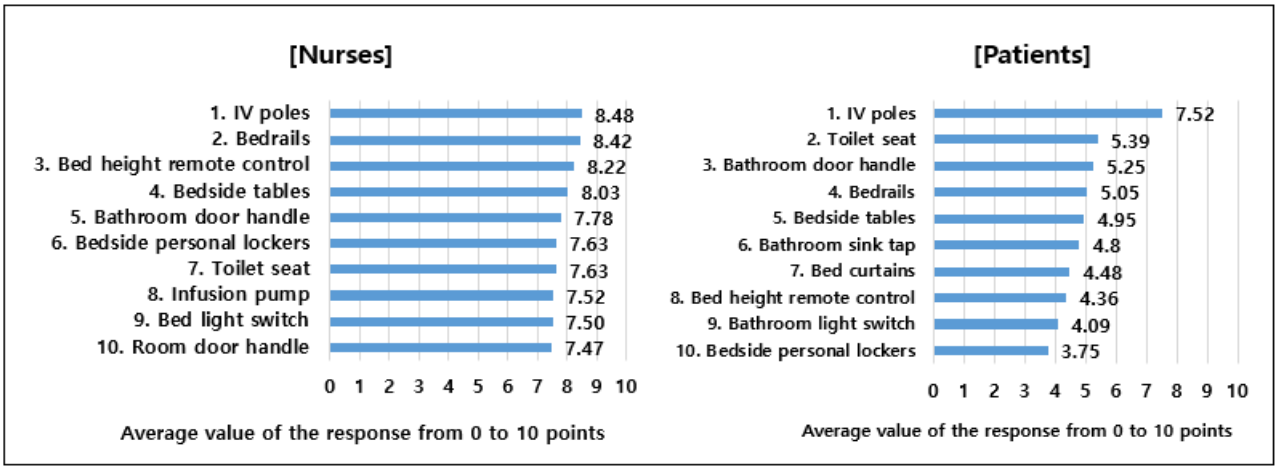
Characteristics	Categories	n (%) or M±SD
Patients (n=56)		
Age (yr)	≤39	23 (41.1)
	40-49	5 (8.9)
	50-59	12 (21.4)
	≥60	16 (28.6)
	M±SD	47.46 ± 19.70
Gender	Male	29 (51.8)
	Female	27 (48.2)
Hospital room type	One bed	0 (0.0)
	Two beds	4 (7.1)
	More than three beds	52 (92.9)
Department	Medicine	14 (25.0)
	Surgery	42 (75.0)
Ambulation status	Move alone	51 (91.1)
	Need help from others	3 (5.3)
	Lying in bed	2 (3.6)
Total		56 (100.0)

A comparison of the top 10 ranked high-touch surfaces

Among the top 10 high-touch surfaces reported by nurses and patients in hospital rooms, 7 items (intravenous [IV] poles, bedrails, bed height remote control, bedside tables, bathroom door handles, bedside personal locks, and toilet seats) matched. However, there was a difference in their rankings. For the other high-touch surfaces in the room, the nurses responded with infusion pumps, bed light switches, and room door handles, while the patients thought the bathroom sink tap, bed curtains, and bathroom light switches had the highest amount of surface contact (Figure 1).



*IV poles: Intravenous poles

Figure 1. Comparison of the Top 10 Ranks High Touch Surfaces of Hospital Rooms Answered by Nurses and Patients.

A comparison of the recognition of high-touch surfaces in hospital rooms

The score for the frequency of contact for all items was 5.96 ± 1.47 points for nurses and 2.35 ± 1.98 points for patients, which was significantly higher for nurses than it was for patients ($t = 13.34$, $p < .001$). Among 38 items in 5 categories, the nurse response score was statistically significantly higher than that reported by the patient in all 35 items except for 3 items: infusion pump, monitoring equipment, and suction apparatus. Of the 5 medical equipment items, there was no difference in the recognition score between the two groups for the infusion pump, and the difference between the two groups could not be compared because only one patient required monitoring equipment and a suction apparatus (Table 3).

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Table 3. A Comparison of Nurses' and Patients' Recognition of High-touch Surfaces in a Hospital Room (N=169)

Categories	Items	M±SD		t (p)
		Nurse (n=113)	Patient (n=56)	
Medical equipment†	IV poles	8.48 ± 1.71	7.52 ± 2.89	2.26 (0.027)
	Infusion pump	7.52 ± 2.89	0.50 ± 0.71	1.66 (0.098)
	Monitor equipment	4.50 ± 2.91	1.00 ± 0.00	NA
	Oxygen flow meters	3.48 ± 2.79	0.00 ± 0.00	13.47 (<0.001)
	Suction apparatus	3.03 ± 2.51	0.00 ± 0.00	NA
Patient bathroom	Restroom light switch	6.98 ± 2.58	4.09 ± 3.18	6.34 (<0.001)
	Restroom door handle	7.78 ± 2.38	5.25 ± 3.17	5.27 (<0.001)
	Wall around bathroom door	5.55 ± 2.77	0.54 ± 1.81	14.11 (<0.001)
	Bathroom call bell	5.42 ± 2.82	0.18 ± 0.74	18.55 (<0.001)
	Bathroom sink surface	5.34 ± 2.67	1.16 ± 2.22	10.74 (<0.001)
	Wall around bathroom sink	4.92 ± 2.76	0.34 ± 1.12	15.30 (<0.001)
	Bathroom sink mirror	4.46 ± 2.71	0.14 ± 0.72	15.81 (<0.001)
	Bathroom sink tap	6.71 ± 2.70	4.80 ± 3.01	4.15 (<0.001)
	Bathroom sink soap pump	6.77 ± 2.63	2.68 ± 3.34	8.02 (<0.001)
	Bathroom safety handles	5.56 ± 2.70	1.71 ± 2.81	8.59 (<0.001)
	Bathroom shower head	5.04 ± 2.65	1.30 ± 2.40	8.88 (<0.001)
	Toilet seat	7.63 ± 2.66	5.39 ± 3.14	4.84 (<0.001)
	Wall around toilet seat	5.42 ± 2.85	0.34 ± 1.30	15.90 (<0.001)
Around doors and sinks	Alcohol hand sanitizer pump	7.05 ± 2.41	2.43 ± 3.05	10.74 (<0.001)
	Room light switch	6.42 ± 2.40	0.80 ± 1.63	17.89 (<0.001)
	Window or blind handle	5.39 ± 2.55	1.18 ± 2.12	11.35 (<0.001)
	Room door handle	7.47 ± 2.51	1.77 ± 2.85	13.27 (<0.001)
	Wall round room door	5.65 ± 2.71	0.29 ± 1.00	18.34 (<0.001)
	Room sink surface	6.01 ± 2.66	0.73 ± 1.58	16.12 (<0.001)
	Wall around room sink	4.80 ± 2.69	0.21 ± 1.00	16.01 (<0.001)
	Room sink mirror	4.22 ± 2.51	0.09 ± 0.39	17.08 (<0.001)
	Room sink tap	6.72 ± 2.72	3.41 ± 3.15	7.04 (<0.001)
	Room sink soap pump	6.68 ± 2.70	2.07 ± 3.03	10.02 (<0.001)
Bed side furniture	Refrigerator door handle	6.84 ± 2.90	3.34 ± 3.14	7.18 (<0.001)
	Call bell	7.34 ± 2.34	1.79 ± 2.55	14.08 (<0.001)
	Bed light switch	7.50 ± 2.05	2.07 ± 2.33	15.45 (<0.001)
	Bedrails	8.42 ± 1.77	5.05 ± 3.78	6.34 (<0.001)
	Bedside tables	8.03 ± 2.06	4.95 ± 2.53	8.46 (<0.001)
	Bed height remote control	8.22 ± 1.80	4.36 ± 3.69	7.41 (<0.001)
	Bedside personal lockers	7.63 ± 2.28	3.75 ± 3.14	8.24 (<0.001)
	Patient files in front of the bed	4.17 ± 2.56	0.23 ± 0.83	14.82 (<0.001)
	Bed curtains	7.40 ± 2.10	4.48 ± 3.43	5.84 (<0.001)
	Chair protector‡	5.76 ± 2.54	1.41 ± 1.97	8.56 (<0.001)
All items		5.96 ± 1.47	2.35 ± 1.98	13.34 (<0.001)

IV poles, Intravenous poles. †The number of responded patients were 54 in IV poles, 2 in infusion pump, 1 in monitor equipment, 3 in oxygen flow meters, 1 in suction apparatus. ‡The number of responded patients was 29.

DISCUSSION

The nurses perceived that the patients had more contact with the ward surface or equipment than the patients, but it was difficult to identify a clear cause for this belief by only checking the recognition of the contact frequency. In fact, a previous study that used observation found that nurses had more contact with the surface of the ward environment and medical devices than patients (Cheng et al., 2015).

There was a difference in the ranking of high-touch surfaces of hospital patients perceived by nurses and patients, but most of the items in each group's top 10 coincided. In a previous study (Cheng et al., 2015), the results obtained while observing patients and healthcare workers simultaneously were consistent with the study's results in that the items were similar. The identification of high-touch surfaces, therefore, indicated that nurses' and patients' recognitions were consistent.

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e-ISSN: 2798-5067
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When comparing the high-touch surface items listed in the top 10 with domestic and international guidelines and previous studies, our top 10 items almost coincided with domestic guidelines but differed from foreign guidelines and previous studies. In the domestic environmental management guidelines (Korea Disease Control and Prevention Agency & Korean Society for Healthcare-associated Infection Control and Prevention, 2017), 7 items were consistent with this study. The high-touch surfaces commonly suggested in foreign environmental management guidelines included bedrails, bathroom door handles, toilet seats (Sehulster et al., 2003), bedrails, toilet handles (Ling et al., 2015), and bedrails, bedside tables, bathroom door handles, and toilet seats (Government of South Australia, 2017) all matched. In the preceding study, bedrails, bedside tables, bedside personal lockers (Cheng et al., 2015), and bedrails and bedside tables (Huslage et al., 2010; Jinadatha et al., 2017) were consistent. In this study, nurses placed infusion pumps, bed light switches, and room door handles in the top 10, while patients included the bathroom sink tap, the bed curtains, and the bathroom light switch. There are many multi-patient rooms in general wards in South Korea, which is different from the current situation in foreign hospitals with a majority of single rooms. The variations were also thought to be due to differences in the high-touch surface items included in the survey and in the observational and self-report survey methods. When presenting high-touch surfaces in future environmental management guidelines, it will be necessary to reflect each country or hospital's spatial composition and facility standards.

Among the medical equipment-related items, the patients did not perceive infusion pumps to be high-touch surfaces in patient rooms, while the nurses did. In previous studies on healthcare workers (Huslage et al., 2010; Jinadatha et al., 2017; Smith et al., 2012), the infusion pump was listed as a high-touch surface in hospital rooms, similar to this study's results. Healthcare workers mainly handle medical equipment, so patients understandably only have a little contact with them.

In this study, the bed light switch and the hospital room door handle were perceived by nurses to be high-touch surfaces, which did not match the results of a study on healthcare workers, patients, and visitors (Cheng et al., 2015) or a study on healthcare workers (Huslage et al., 2010; Jinadatha et al., 2017; Smith et al., 2012). The reason for this discrepancy may be that there are many multi-person rooms in domestic medical institutions, so nurses often have to turn on the bed light switch in the patients' room at night to provide nursing care. In addition, in multi-person rooms, the door opens and closes more times than the doors in single rooms, so it is necessary to use the door handle more often. It is presumed that the respondents recognized that these surfaces' contact frequency is therefore high. However, since this is not an environment in which patients are in contact, caution is required to interpret these findings.

The bathroom sink faucet, bed curtain, and bathroom light switch were recognized as high-touch surfaces in this study but were matched only by the bed curtains in the study of Cheng et al (2015) that targeted healthcare workers, patients, and visitors. Cheng et al (2015)'s study collected data by direct observation, so it was assumed that there were differences between their data collection methods and ours because it is difficult to observe bathrooms due to personal privacy concerns.

Only the patients listed the bed curtains as one of the 10 high-touch surfaces in the hospital room, and this was one item where the nurse and the patient answers did not match. Foreign environmental management guidelines (Sehulster et al., 2003; Ling et al., 2015; Government of South Australia, 2017), and previous studies on healthcare workers, patients, and visitors (Cheng et al., 2015) have also identified bed curtains to be high-touch surfaces in hospital rooms. However, the current domestic environmental management guidelines (Korea Disease Control and Prevention Agency & Korean Society for Healthcare-associated Infection Control and Prevention, 2017) do not suggest bed curtains to be high-touch surfaces in hospital rooms and instead state that cleaning and disinfection of these bed curtains should only be performed when they become visibly dirty or contaminated, which was different from the results of this study. The degree of contamination of bed curtains by pathogenic bacteria increased over time (Lee et al., 2021; Shek et al., 2018) and increased as the number of beds in the hospital room increased (Lee et al., 2021). There are many multi-patient rooms in domestic hospitals, and bed curtains are installed on each bed to protect the patients' privacy. It is unknown how often the bed curtains in domestic hospitals are replaced and disinfected. To prevent the spread of infection, it is necessary to change the material of these curtains to a type that is easy to clean or a structure with fewer irregularities to harbor bacteria and replace used bed curtains when a patient is discharged or even to use disposable bed curtains.

This study had a few limitations. First, there was a possibility of recall error, overestimation, or underestimation by the nurses or patients who responded to our survey about recognizing high-touch surfaces and the likelihood of frequent hand contact. Second, it took a lot of work to generalize the findings of our study because the hospital ward environment management characteristics and target characteristics are simply the results of one survey at one hospital. Third, it was possible that the respondents should have paid attention to any high-touch surfaces other than the items listed by the researcher, which may have affected our findings.

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e-ISSN: 2798-5067
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CONCLUSION

In terms of the items recognized by patients as high-touch surfaces in a hospital room, the answers provided by nurses and patients mostly coincided, but there was a significant difference in recognition of contact frequency. Therefore, it is necessary to reconfirm these high-touch surfaces that experience extensive patient contact by direct observation and assess the current situation by comparing and analyzing the behavior of healthcare workers.

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e-ISSN: 2798-5067
p-ISSN: 2798-5059

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