

# BMJ Open Knowledge and practice of hand hygiene among hospitalised patients in a tertiary general hospital in China and their attitudes: a cross-sectional survey

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## ABSTRACT

**Objectives** We aimed to gain a better understanding of patients' practice of hand hygiene (HH) and their knowledge and attitudes.

**Design** A cross-sectional survey.

**Setting** A 3500-bed university-affiliated medical hospital in China.

**Participants** Inpatients and their family members or caregivers.

**Methods** An anonymous, self-reported questionnaire were used to collect data.

**Results** A total of 376 questionnaires were issued, and 310 respondents completed it. Of the 310 respondents, 47.4% had received HH education, and 13.5% had a completing understanding of HH. A majority of patients believed that handwashing was important for disease recovery, and that it could prevent infection development. A total of 62.3% of patients washed their hands <5 times a day and 49.0% spent <1 min every time. With regards to the seven steps of handwashing, 96.45% of the respondents adhered to the first step (washing the palms), but only 20.6% adhered to the fifth step (thumbs) and 17.7% to the sixth step (fingertips). Most respondents washed their hands only when visibly dirty. Few patients washed their hands before drinking fluids, and before and after interacting with visitors. HH compliance was lower among intensive care unit patients than medical patients. **Conclusions** In conclusion, this study demonstrated that patients had a positive attitude towards HH. However, their levels of knowledge and practice were unsatisfactory. A systematical education about patient HH is needed in future to correct this knowledge and behaviour.

## INTRODUCTION

Healthcare-associated infections (HAIs) are major risk factors for the development of sepsis,<sup>1</sup> which affects >30 million patients every year worldwide, leading to 6 million potential deaths.<sup>2</sup> Both the Centres for Disease Control and Prevention (CDC) and WHO consider hand hygiene (HH) to be the most important factor in the prevention of HAIs and the spread of pathogens.<sup>3,4</sup> The practice of effective HH plays a key role in the prevention of healthcare-associated sepsis.<sup>5</sup> Great efforts

## Strengths and limitations of this study

- We measured the hand hygiene knowledge, attitude and performance from the prospects of patient view.
- We designed the questionnaire combines both WHO and Centres for Disease Control and Prevention patient hand hygiene-related policies.
- A stratified random sampling method was used in order to make the sample representative.
- This is a single-centre cross-sectional survey, our results may not be applicable to all other institutions.
- There is a need for further observational studies including quantitative hand bacterial cultures to verify the results of this study.

have been made to improve the performance of 'my 5 moments for hand hygiene' among healthcare workers (HCWs), and this has had a global improvement. However, the role of patient hand hygiene (PHH) has been underestimated. Emerging evidence suggests that most infections occur as a result of bacteria present within a patient's own flora as well as bacteria present on surfaces within the healthcare environment<sup>6-8</sup>; improving the HH of patients has important clinical significance in reducing nosocomial infection, improving the quality of life of patients and reducing the rate of hospitalisation and mortality.<sup>9</sup> The CDC has therefore proposed nine moments for patients to practice HH in clinical institutions.<sup>10</sup> However, PHH has been neglected in most medical institutions in China, there were no information provided for patient when they admitted. And also there were few studies have investigated PHH in China, with some of them only focusing on the role of patients as monitors or auditors in the improvement of HCW HH compliance.<sup>11</sup> Thus, the purpose of this cross-sectional study was to investigate inpatient knowledge, as well as the attitudes towards and practice of PHH during hospital

stay with non-provision of PHH information. We also aim to characterise and identify some factors influencing practice compliance, which may contribute to the design of effective PHH promotion strategies.

## METHODS

This cross-sectional, single-centre study was performed at a 3500-bed university-affiliated medical hospital between November 2017 and December 2017.

In this study, PHH was defined as HH practices performed by a patient on his or her own hands, including handwashing, and the use of alcohol-based hand rubs (ABHRs) and disinfecting wipes.<sup>9</sup> In certain situations, this care may have to be provided to patients by professional caregivers or family members.

### Participants

The study was conducted in 71 clinical wards, including the departments of internal medicine, surgery, obstetrics and gynaecology, paediatrics and infectious diseases, and intensive care units (ICUs). Outpatient wards, operating rooms, psychiatric wards, isolation wards and emergency rooms were excluded.

Patients were enrolled through a random sampling method using a random number table. First, data on the number of beds in each ward were obtained from the hospital management department, and a total of 3000 of these beds met our inclusion criteria in terms of ward type. Second, according to the largest sample size formula of simple random sampling, with values of  $\Pi=0.5$ ,  $\alpha=0.05$  and  $\delta=0.05$ , a total sample size of 385 was obtained. After correction, the required sample size was 342, but taking into consideration a no-response rate of 10%, a total of 376 patients were required. Finally, patients from each ward were randomly selected using an 8:1 proportion.

Hospitalised patients who provided verbal informed consent and agreed to voluntarily participate in this study were included. Exclusion criteria were patients with an admission time <24 hours, patients who did not return to their bed due to surgery or transfer to the ICU, and those with mental status changes. Family members or caregivers were enrolled to represent patients to provide patients' demographic information, attitude and the HH care they have provided to patients in the case of patients with impaired consciousness, who were critically ill or who were under the age of 14 years. Only family members who stayed with the patients in the wards for >1 day were enrolled. Visitors, friends and family members who had only short visits with the patients were excluded. The nurses who were in charge of the eligible patients were selected.

### Questionnaires

In this study, the survey instrument was a self-designed structured questionnaire that was based on 'when should you wash your hands' released by the CDC in 2016,<sup>10</sup>

and the 'standard for hand hygiene for health care workers in health care settings' issued by the National Health Commission of the People's Republic of China in 2009.<sup>12</sup> Experts from the Department of Infectious Diseases were also consulted in this regard. The questionnaire comprised two parts. The first part was designed to allow for the primary nurse to assess the elicited patient disease information, such as diagnosis, whether surgery was performed, or if there was any infection during the hospital stay.

The second part pertaining to PHH was designed for patients and their families or caregivers, and comprises four sections. Section 1 pertained to patients' demographic data, including ward type, bed number, place of residence, income and number of hospitalisations. Section 2 pertained to caregiver information, such as if the respondent is a family member or caregiver, his/her relationship with the patient, length of hospital stay, education and occupation. Section 3 addressed PHH knowledge and attitudes, while section 4 evaluated patients' practice of HH, including handwashing moments, steps, number of wash times daily, minutes taken every time and ways in which hands were dried. The PHH moments were scaled as 'seldom', 'sometimes', 'often' and 'always'. 'Not applicable' was selected for those who reported that they did not perform the procedure and therefore did not encounter that moment.

### Implementation

The survey was conducted by eight research assistants, all of whom were team members who participated in all study meetings and discussions, who had knowledge on HH and its association with HCAI and who had received unified training on how to fill out the questionnaire. The research assistants first obtained approval from the head nurses in the study wards, and then obtained informed consent from the participants who were selected according to our design. Participants were informed that the questionnaire content would not involve invasive measurements or invade privacy, and would not cause injury to the body or mind. All eligible patients and their families/caregivers were informed that participation in the study was voluntarily, and that refusal to participate or withdrawal from the study at any point for any reason would not influence medical decisions. The participants were assured that their information would only be used for research and that strict confidentiality would be maintained, as well as that their data would not be used for business or other purposes without their permission. The questionnaires were distributed to patients who were agreed to voluntary participation in research, and were completed by respondents themselves under the instructions of researchers. The questionnaires were distributed and collected on the spot through the questionnaire online platform named "Wen Juan Xin". A small gift (a piece of soap) valued at ~US\$0.50 was given to each respondent who completed the questionnaire.

## Statistical analysis

Questionnaire data are presented as the number of participants and percentages. A Kruskal-Wallis H test was applied to analyse the PHH implementation rate in the different departments. Binary logistic regression analysis was used to identify the demographic predictors for the respondents who had performed HH in the moment 'after using the toilet, bedpan or commode'. Only those who responded always were included in the analysis. Univariate analysis by non-conditional logistic regression was used to compare each demographic variable in the different groups. Variables with a  $p < 0.10$  were further tested in the multivariate logistic regression analysis by the enter method. A two-tailed  $p$  value of 0.05 was considered statistically significant.

## RESULTS

### Population characteristics

A total of 376 questionnaires were issued, and 310 respondents, including 242 patients (78.1%) and 68 family members/caregivers (21.9%), completed the questionnaire. The total response rate was 82.4% (310 of 376). The Cronbach's alpha of the questionnaire is 0.867, which indicate a good reliability of this self-designed questionnaire. The respondents' characteristics are summarised in [table 1](#). A total of 46.8% of the participants were women, and most of them (86.8%) were married. The majority (79.7%) had a high school education or lower. More than half of the participants (64.5%) were urban or town dwellers, and a similar proportion (66.5%) had an annual income  $< 50\,000\text{¥}$  (~US\$7987). Most respondents (62.3%) had been hospitalised previously, and 27.7% reported having an infection at present.

### Patients' performance of HH and their knowledge and attitudes

Most of the participants (72.2%) reported that they did not know about HH knowledge or knew very little about it. Less than half (47.4%) of the respondents had received HH education before; of them, HCWs (95, 35.6%) and television (76, 28.5%) were the main resources. A majority (94.2%) of the participants believed that handwashing was important for disease recovery, and almost the same percentage (93.2%) of them believed that handwashing could prevent infection spread among patients.

More than half (62.2%) of the patients washed their hands  $< 5$  times a day, and approximately half (49.0%) of them spent  $< 1$  min washing their hands every time. Washing hands under flowing water (64.7%) was the main route of washing, compared with washing in a basin or using ABHRs; however, only 13.4% and 25.6% of the patients used hand sanitizers and soap, respectively. A total of 41.9% of the respondents reported that they had a dedicated hand towel, but only 20.0% and 21.6%, respectively, chose a dedicated hand towel or tissue to wipe their hands ([table 2](#)).

**Table 1** Demographic characteristics of the 310 included patients

Characteristic	Participants (%)
<b>Identity of the respondents</b>	
Patients	242 (78.1)
Family members/caregivers	68 (21.9)
<b>Sex</b>	
Female	145 (46.8)
Male	165 (53.2)
<b>Age, years</b>	
<30	57 (18.4)
30–39	34 (11.0)
40–49	56 (18.1)
50–59	72 (23.2)
$\geq 60$	91 (29.4)
<b>Education level</b>	
Primary or below	77 (24.8)
Junior high school	88 (28.4)
Senior high school	62 (20.0)
Technical secondary school	20 (6.5)
College	34 (11.0)
Undergraduate	28 (9.0)
Postgraduate or above	1 (0.3)
<b>Occupation</b>	
Farmer	67 (21.6)
Workman	27 (8.7)
Clerk	47 (15.2)
Medical staff	2 (0.6)
Teacher	3 (1.0)
Student	13 (4.2)
Freelancer	34 (11.0)
Unemployed	45 (14.5)
Retiree	72 (23.2)
<b>Place of residence</b>	
Urban	147 (47.4)
Town	53 (17.1)
Village	110 (35.5)
<b>Income (¥/year)*</b>	
<50 000	206 (66.5)
50 000~100 000	80 (25.8)
100 000~200 000	18 (5.8)
>200 000	6 (1.9)
<b>No of hospitalisations</b>	
1	117 (37.7)
2	74 (23.9)
$\geq 3$	119 (38.4)
<b>The length of hospital stay at the time the questionnaire was completed (days)</b>	
1–3	67 (21.6)
4–6	107 (34.5)

Continued

**Table 1** Continued

Characteristic	Participants (%)
7–9	49 (15.8)
10–13	51 (16.5)
≥14	36 (11.6)
Ward	
Medical ward	110 (35.5)
Surgical ward	144 (46.5)
Obstetrics/gynaecology ward	23 (7.4)
Paediatric ward	9 (2.9)
Infectious diseases ward	15 (4.8)
Intensive care unit	9 (2.9)
Was surgery performed this time?	
Yes	132 (42.6)
No	178 (57.4)
Is there any infection?	
Yes	86 (27.7)
No	224 (72.3)

\*50 000¥≈US\$7209.

### Patients' practice of the 'seven steps to handwashing'

The results of patients' practice of the seven steps to handwashing are displayed in online supplementary figure 1. Most respondents washed their hands with adherence to the first step (rub palms together: 96.45%, 299 of 310). More than half of them practiced the second step (rub the back of both hands: 66.13%, 205 of 310) and third step (interlace fingers and rub hands together: 66.77%, 207 of 310). A slightly lower number of participants (56.77%, 176 of 310) adhered to the seventh step (rub both wrists in a rotating manner). The implementation rates of the fourth step (interlock fingers and rub the back of fingers of both hands: 26.77%, 83 of 310), and sixth step (rub fingers on palm for both hands: 20.65%, 64 of 310) were lower. However, the fifth step (rub thumb in a rotating manner followed by the area between index finger and thumb for both hands) had the worst execution rate (17.74%, 55 of 310).

### PHH moments

Three-quarters (75.8%; 235 of 310) of the respondents washed their hands after using the toilet/bedpan/commode, and 86.1% washed their hands when they were visibly dirty (table 3). Approximately half (47.7%) of the patients washed their hands before touching any breaks in the skin, whereas the implementation rates before any care procedures (19.0%, 59 of 310) and dialysis/contact with intravenous lines or other tubes (19.7%, 61 of 310) were low. The performance of handwashing before drinking fluids (11.0%, 34 of 310), as well as before and after interacting with visitors (11.9%, 37 of 310 vs 13.2%, 41 of 310) was also very low.

**Table 2** Performance of hand hygiene and knowledge and attitudes among the 310 included patients

Items	Total n (%)
Knowledge and attitude	
Have you received any education related to hand hygiene?	
Yes	147 (47.4)
No	163 (52.6)
Hand hygiene knowledge sources	
Television	76 (28.5)
Newspaper	20 (7.5)
Magazine	18 (6.7)
Internet	37 (13.9)
Medical staff	95 (35.6)
Other	21 (7.9)
Do you know anything about hand hygiene?	
Do not know	126 (40.6)
A little	98 (31.6)
Most	44 (14.2)
All	42 (13.5)
Is handwashing important for recovery from disease?	
Yes	292 (94.2)
No	18 (5.8)
Can handwashing prevent infection in patients?	
Yes	289 (93.2)
No	21 (6.8)
Performance	
How many times do you wash your hands every day?	
≤2	48 (15.5)
3–5	145 (46.8)
6–10	69 (22.3)
>10	48 (15.5)
How long does it take to wash your hands every time?	
<1 min	152 (49.0)
1–2 min	135 (43.5)
≥2 min	23 (7.4)
Handwashing ways*	
Wash basin	560 (18.9)
Flowing water	1913 (64.7)
Alcohol-based hand rub	484 (16.4)
Handwashing products*	
Tap water only	1797 (46.6)
Hand sanitizer	516 (13.4)
Soap	987 (25.6)
Alcohol-based hand rub	555 (14.4)
Ways in which you wipe your hands*	
Hand towel	976 (20.0)
Any towel	819 (17.5)

Continued

**Table 2** Continued

Items	Total n (%)
Disposable tissues	1012 (21.6)
Clothes on my body	410 (8.8)
Wave hands in the air	873 (18.7)
Face towel	588 (12.6)
Do you have a dedicated hand towel?	
Yes	130 (41.9)
No	180 (58.1)
Times of hand towel washes every day	
0	10 (7.7)
1	32 (24.6)
2	29 (22.3)
3	25 (19.2)
4	27 (20.8)
Wash once every few days	7 (5.4)

\*‘Handwashing ways’, ‘handwashing products’ and ‘ways in which you wipe your hands’ these three items are multiple topics, so each number of respondents is over the total number of respondents.

### PHH moments in different departments

Participants in the Department of Internal Medicine had a relatively high execution rate of HH when their hands were visibly dirty (96.4%, 106 of 110), before eating (82.7%, 91 of 110) and before touching any breaks in the skin (71.8%, 79 of 110). Those in the Department of Surgery tended to wash their hands after using the toilet/bedpan/commode (94.4%, 136 of 144) and after coughing, sneezing or touching the nose or mouth (50.7%, 73 of 144). Those in the Department of Infectious

Diseases had good performance rates of handwashing before interacting with visitors (40.0%, 6 of 15) (table 4). There were significant differences in this regard between the different departments in the Kruskal-Wallis H test ( $H=19.838$ ,  $p=0.001$ ).

### Significant predictors of PHH moments

A majority of the respondents (75.8%, 235 of 310) always performed HH after using the toilet/bedpan/commode (table 5), and the univariate analysis identified one significant predictor: very few ICU patients practiced HH compared with medical patients (OR=0.08, 95% CI 0.02 to 0.41,  $p=0.002$ ). In the multivariate analysis, we found two significant variables: being a farmer rather than a clerk (adjusted OR=0.18, 95% CI 0.05 to 0.61,  $p=0.004$ ) and being a freelancer (adjusted OR=0.18, 95% CI 0.05 to 0.62,  $p=0.007$ ). Medical patients had a higher HH performance rate than those in the Department of Obstetrics-Gynaecology (adjusted OR=0.18, 95% CI 0.04 to 0.80,  $p=0.02$ ) and ICU (adjusted OR=0.06, 95% CI 0.01 to 0.45,  $p=0.006$ ).

### DISCUSSION

In the present study, we examined hospitalised patients’ knowledge of, attitudes towards and practice of HH. Our findings demonstrate that although patients had a positive attitude towards HH, their knowledge was insufficient, consistent with Cheng *et al*’s research.<sup>13</sup> The social desirability factor might be operating, the hospital we involved attaches great importance to HCW HH and has implemented the WHO’s multimodal HH improvement strategies<sup>14</sup>; therefore, the participants were in an atmosphere in which the importance of HH is highlighted daily, leading them to believe in its importance. However,

**Table 3** Patient hand hygiene moments

Moments	Seldom n (%)	Sometimes n (%)	Often n (%)	Always n (%)	Not applicable*
1. After using the toilet, bedpan or commode	21 (6.8)	15 (4.8)	39 (12.6)	235 (75.8)	0 (0.0)
2. When returning to the room after a test or procedure	91 (29.4)	43 (13.8)	54 (17.4)	120 (38.7)	0 (0.0)
3. Before eating	41 (13.2)	37 (11.9)	68 (21.9)	164 (52.9)	0 (0.0)
4. Before drinking fluids	160 (51.6)	63 (20.3)	53 (17.1)	34 (11.0)	0 (0.0)
5. Before taking medicine	130 (41.9)	49 (15.8)	62 (20.0)	66 (21.3)	3 (0.9)
6. When visibly dirty	11 (3.5)	9 (2.9)	23 (7.4)	267 (86.1)	0 (0.0)
7. Before touching any breaks in the skin (eg, wounds, dressing, tubes)	56 (18.1)	36 (11.6)	61 (19.7)	147 (47.4)	10 (3.1)
8. Before any care procedures (eg, dialysis, intravenous drug administration, injections)	145 (46.8)	54 (17.4)	52 (16.8)	59 (19.0)	0 (0.0)
9. Before dialysis, contact with intravenous lines or other tubes	139 (44.8)	60 (19.4)	44 (14.2)	61 (19.7)	6 (1.9)
10. After coughing, sneezing or touching nose or mouth	102 (32.9)	61 (19.7)	61 (19.7)	86 (27.7)	0 (0.0)
11. Before interacting with visitors	198 (63.8)	37 (11.9)	38 (12.3)	37 (11.9)	0 (0.0)
12. After visitors leave	190 (61.3)	46 (14.8)	33 (10.6)	41 (13.2)	0 (0.0)
13. When there is concern about whether hands are clean	78 (25.1)	57 (18.4)	83 (26.8)	87 (28.1)	5 (1.5%)

\*‘Not applicable’ represents patients who reported that they did not perform the procedure and therefore did not encounter that moment.

**Table 4** Patients who 'always' or 'often' practiced hand hygiene in the different departments

Moments	Medical wards n/N (%)	Surgical wards n/N (%)	Obstetrics/gynaecology wards n/N (%)	Paediatric wards n/N (%)	Infectious diseases wards n/N (%)	ICU n/N (%)	Total n/N (%)
1. After using the toilet, bedpan or commode	99/110 (90.0)	136/144 (94.4)	19/23 (82.6)	7/9 (77.8)	10/15 (66.7)	3/9 (33.3)	274/310 (88.4)
2. When returning to the room after a test or procedure	71/110 (64.5)	75/144 (52.1)	12/23 (52.2)	7/9 (77.8)	7/15 (46.7)	2/9 (22.2)	174/310 (56.1)
3. Before eating	91/110 (82.7)	108/144 (75.0)	15/23 (65.2)	7/9 (77.8)	9/15 (60.0)	2/9 (22.2)	232/310 (74.8)
4. Before drinking fluids	35/110 (31.8)	38/144 (26.4)	4/23 (17.4)	4/9 (44.4)	5/15 (33.3)	1/9 (11.1)	87/310 (28.1)
5. Before taking medicine	45/110 (40.9)	59/144 (41.0)	12/23 (52.2)	6/9 (66.7)	4/15 (26.7)	2/9 (22.2)	128/310 (41.3)
6. When visibly dirty	106/110 (96.4)	138/144 (95.8)	22/23 (95.7)	7/9 (77.8)	12/15 (80.0)	5/9 (55.6)	290/310 (93.5)
7. Before touching any breaks in the skin (eg, wounds, dressing, tubes)	79/110 (71.8)	98/144 (68.1)	15/23 (65.2)	5/9 (55.6)	9/15 (60.0)	2/9 (22.2)	75/310 (24.2)
8. Before any care procedures (eg, dialysis, intravenous drug administration, injections)	41/110 (37.3)	51/144 (35.4)	8/23 (34.8)	4/9 (44.4)	5/15 (33.3)	2/9 (22.2)	111/310 (35.8)
9. Before dialysis, contact with intravenous lines or other tubes	37/110 (33.6)	49/144 (34.0)	9/23 (39.1)	4/9 (44.4)	4/15 (26.7)	2/9 (22.2)	105/310 (33.9)
10. After coughing, sneezing or touching the nose or mouth	51/110 (46.4)	73/144 (50.7)	10/23 (43.5)	4/9 (44.4)	7/15 (46.7)	2/9 (22.2)	147/310 (47.4)
11. Before interacting with visitors	23/110 (20.9)	34/144 (23.6)	8/23 (34.8)	3/9 (33.3)	6/15 (40.0)	1/9 (11.1)	75/310 (24.2)
12. After visitors leave	25/110 (22.7)	32/144 (22.2)	5/23 (21.7)	4/9 (44.4)	6/15 (40.0)	2/9 (22.2)	74/310 (23.9)
13. When there is concern about whether hands are clean	66/110 (60.0)	72/144 (50.0)	13/23 (56.5)	6/9 (66.7)	9/15 (60.0)	4/9 (44.4)	170/310 (54.8)
Kruskal-Wallis H	574.47	556.01	548.99	669.5	535.47	196.56	19.838
P value							0.001

ICU, intensive care unit.

**Table 5** Identity of participants who ‘always’ performed hand hygiene after using the toilet, bedpan or commode using the characteristics of the patients and their family members of caregivers

Characteristic	Always perform hand hygiene n/N (%)	Unadjusted OR		Adjusted OR	
		OR (95% CI)	P value	OR (95% CI)	P value
Identity of the respondents					
Patient	186/242 (76.9)	1			
Family members/caregivers	49/68 (72.1)	0.78 (0.42 to 1.43)	0.42		
Sex					
Male	125/165 (75.8)	1			
Female	110/145 (75.9)	0.99 (0.59 to 1.67)	0.98		
Age, years					
<30	39/57 (68.4)	1			
30–39	28/34 (82.4)	2.15 (0.76 to 6.12)	0.15		
40–49	43/56 (76.8)	1.53 (0.66 to 3.52)	0.32		
50–59	54/72 (75.0)	1.39 (0.64 to 3.00)	0.41		
≥60	71/91 (78.9)	1.64 (0.78 to 3.46)	0.20		
Education level					
Primary or below	59/77 (76.6)	1			
Junior high school	59/88 (67.0)	0.62 (0.31 to 1.24)	0.18		
Senior high school	51/62 (82.3)	1.41 (0.61 to 3.27)	0.42		
Technical secondary school	14/20 (70.0)	0.71 (0.24 to 2.12)	0.54		
College	28/34 (82.4)	1.42 (0.51 to 3.98)	0.50		
Undergraduate	23/28 (82.1)	1.40 (0.47 to 4.22)	0.55		
Postgraduate or above	1/1 (100)	/	1.00		
Occupation					
Farmer	56/67 (83.6)	1		1	
Workman	23/27 (85.2)	1.13 (0.33 to 3.92)	0.85	0.85 (0.21 to 3.39)	0.82
Clerk	34/47 (72.3)	0.51 (0.21 to 1.28)	0.15	0.18 (0.05 to 0.61)	0.006
Medical staff	2/2 (100)	/	1.00	/	1.00
Teacher	2/3 (66.7)	0.39 (0.03 to 4.72)	0.46	0.15 (0.01 to 2.26)	0.17
Student	8/13 (61.5)	0.31 (0.09 to 1.14)	0.08	0.22 (0.04 to 1.24)	0.09
Freelancers	23/34 (67.6)	0.41 (0.16 to 1.08)	0.07	0.18 (0.05 to 0.62)	0.007
Unemployed	34/45 (75.6)	0.61 (0.24 to 1.55)	0.30	0.58 (0.21 to 1.61)	0.29
Retiree	53/72 (73.6)	0.55 (0.24 to 1.26)	0.16	0.36 (0.12 to 1.08)	0.07
Place of residence					
Urban	117/147 (79.6)	1			
Town	37/53 (69.8)	0.59 (0.29 to 1.21)	0.15		
Village	81/110 (73.6)	0.72 (0.40 to 1.28)	0.26		
Income (¥/year)					
<50 000	153/206 (74.3)	1			
50 000–100 000	61/80 (76.3)	1.11 (0.61 to 2.03)	0.73		
100 000–200 000	16/18 (88.9)	2.77 (0.62 to 12.46)	0.18		
>200 000	5/6 (83.3)	1.73 (0.20 to 15.16)	0.62		
No of hospitalisations					
1	87/117 (74.4)	1			
2	59/74 (79.7)	1.36 (0.67 to 2.74)	0.40		
≥3	89/119 (74.8)	1.02 (0.57 to 1.84)	0.94		
The length of hospital stay at the time the questionnaire was completed (days)					
1–3	22/67 (32.8)	1			
4–6	32/107 (29.9)	0.87 (0.45 to 1.68)	0.69		

Continued

Table 5 Continued

Characteristic	Always perform hand hygiene n/N (%)	Unadjusted OR		Adjusted OR	
		OR (95% CI)	P value	OR (95% CI)	P value
7–9	13/49 (26.5)	0.74 (0.33 to 1.67)	0.47		
10–13	15/51 (29.4)	0.85 (0.39 to 1.88)	0.69		
≥14	9/36 (25.0)	0.68 (0.27 to 1.70)	0.41		
Ward					
Medical ward	86/110 (78.2)	1		1	
Surgical ward	117/144 (81.3)	1.21 (0.65 to 2.24)	0.55	1.27 (0.58 to 2.80)	0.55
Obstetrics/gynaecology ward	14/23 (60.9)	0.43 (0.17 to 1.13)	0.09	0.18 (0.04 to 0.80)	0.02
Paediatric ward	6/9 (66.7)	0.56 (0.13 to 3.40)	0.43	0.95 (0.12 to 7.39)	0.96
Infectious diseases ward	10/15 (66.7)	0.56 (0.17 to 1.79)	0.33	0.51 (0.13 to 2.04)	0.34
ICU	2/9 (22.2)	0.08 (0.02 to 0.41)	0.002	0.06 (0.01 to 0.45)	0.006
Was surgery performed this time?					
No	135/178 (75.8)	1			
Yes	100/132 (75.8)	1.01 (0.59 to 1.70)	0.99		
Is there any infection?					
No	171/224 (76.3)	1			
Yes	64/86 (74.4)	1.11 (0.63 to 1.97)	0.72		

ICU, intensive care unit.

due to non-provision of any PHH information in daily life, nor in hospital after admitted, they were unaware of when and how to wash their hands in clinical practice.

Patients' performance of HH is poor, and the existing facilities and products are routinely underutilised, consistent with the findings of previous studies.<sup>15</sup> Although the WHO's multimodal HH improvement strategies have been implemented by our hospital's infection control committee with the provision of sinks and wash basins for the performance of soap-and-water cleaning in every patient's room, and the provision of ABHR for waterless hand cleaning in the rooms and corridors for all HCWs and patients,<sup>14</sup> the frequency and duration of handwashing were not satisfactory in this study. A systematical education about PHH seems necessary, not only for medical staff but also for patients themselves. It is of great significance for patients to realise their own behaviour for the prevention and control of nosocomial infection and the promotion of their own safety. Staff should receive education on the importance of PHH in the prevention of hospital-acquired infection; and staff need to be instructed to provide verbal PHH education to all newly admitted patients, and to provide reminders, assistance and encouragement for PHH practice.<sup>16 17</sup> In addition, it is also important to ensure that HH products—such as alcohol-based hand wipes or ABHR—are accessible to patients who are bedridden and are unable to get to the sink.<sup>18 19</sup> Staff or family members should be instructed to provide assistance to improve PHH opportunities.<sup>18</sup>

Hands were washed most frequently when they were visibly dirty and after using the toilet, but less frequently before drinking fluids and taking medicine, which would

be the optimal time for the prevention of fecal–oral transmission. In this study, 75.8% of the participants washed their hands after using the toilet/bedpan/commode, but only 11.0% of them washed their hands before drinking fluids. Similar results have been observed in other study on patients in transplant units.<sup>20</sup> Hospital environments are often contaminated with hospital-acquired pathogens,<sup>16–18</sup> therefore, there is a need for education campaigns aimed at patient-initiated HH and HH, that is, directly observed before meals and the intake of medications during hospitalisation.<sup>21 22</sup>

Our results also revealed that only 11.9% of the patients washed their hands before interacting with visitors and 13.2% washed their hands after the visitors left. Visitors may be vectors of pathogenic organisms that are potentially dangerous, particularly to immunocompromised patients.<sup>23</sup> If visitors carry certain pathogenic organisms on their hands and do not perform HH on entry to the hospital, vulnerable patient populations may be at an increased risk for infection if they do not wash their hands after the visitors leave.<sup>24</sup> Thus, to win the battle against HCAs, there is a need for coordinated effort to enforce HH that includes patients, as well as their families, and visitors.<sup>25</sup> In addition to providing better signage and education among care providers,<sup>26 27</sup> other hospital approaches, such as the installation of more strict visiting infrastructure (ie, ICU doors that will not open if ABHR is not used) might be considered.<sup>23</sup>

This study resulted in some significant findings. Patients' performance about PHH are differences in different departments. Patients in 'medical department' showed significantly higher PHH performance compared with those in 'Department of Obstetrics/Gynaecology'.



Patients activity and severity of illness may be working, patients in medical department are mostly treated conservatively, their activity are less restricted than those in Department of Obstetrics/Gynaecology, who may need absolute bed rest because of gynaecological surgery or give birth to a child just now; In addition, Chinese traditional concept may be another factor, which holds that women should not be exposed to cold water after surgery or after childbirth, which may also reduce the practice of hand washing.

The most significant findings being that ICU patients rarely practice HH compared with those in other departments. This is not surprising as patients in the ICU are generally critically ill or unconsciousness, they cannot wash their hands by themselves. Even the assistance of professional caregivers does not seem to work. This suggests the importance of the role of caregivers in ensuring adequate HH in such functionally dependent patients. To the best of our knowledge, this study is the first to provide data on ICU PHH, since most previous studies on ICU HH focused on HCWs or patients' families.<sup>23–28</sup> Considering that multidrug-resistant *Acinetobacter baumannii* infection are highly in ICU<sup>29</sup> and ICU patients are the most susceptible populations to nosocomial infections,<sup>30</sup> attention must be given to improving their adherence to HH rules to reduce hospital infections.

Our study also identified occupation such as 'farmer' showed good PHH performance compared with 'clerk' or 'freelancer'. We did not found the similar findings in other studies, the reasons for which may be need to be further explored.

Our study has several limitations. First, since this is a single-centre cross-sectional survey, our results may not be applicable to all other institutions. Thus, it is recommended that a multicentre study with a large sample size be conducted in the future. Second, our inclusion of certain patients and wards may have resulted in selection bias. Physically weak patients were also recruited in the present study, and their families or caregivers filled out the questionnaire; therefore, there is a possibility that the family members of caregivers may have provided information on their own HH situation rather than that of the patients. Therefore, there is a need for further observational studies including quantitative hand bacterial cultures to verify the results of this study. Nonetheless, we believe that this study included a representative sample of inpatients. Third, the study was conducted using a convenience sampling method in the category of family members. Finally, although the survey findings are interesting, the patients appear to know that HH is important even though they know little about HH knowledge, the social desirability factor might be operating, the results are not an indicator of how patients may actually behave in real life.

## CONCLUSIONS

In conclusion, this study demonstrated that patients had a positive attitude towards HH. However, their levels of knowledge and practice were unsatisfactory. These results suggest that A systematical education about PHH is needed in future to correct this knowledge and behaviour. In addition, special attention should be given to those HH moments the compliance rates to which were the lowest, such as before drinking fluids, as well as before interacting with visitors and after they leave.

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