Knowledge of hand hygiene and prevention practice of healthcare-associated infections among healthcare workers in Dhaka City, Bangladesh

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ABSTRACT

INTRODUCTION Hand hygiene is one of the most practical and cost-effective ways to prevent healthcare-associated infections (HCAIs), which is a significant worldwide healthcare issue. This study aimed to assess the knowledge of hand hygiene and prevention practices of healthcare-associated infection among healthcare workers in different hospitals in Dhaka city.

METHODS This cross-sectional study was carried out among 185 healthcare workers in two private healthcare centers in Dhaka City, Bangladesh, with data collected between September and October 2018. First, direct, non-participant, structured observations of healthcare professionals' hand hygiene practices were conducted then a structured questionnaire was used to collect data by convenience sampling technique. The WHO hand hygiene knowledge questionnaire was used to assess the knowledge of hand hygiene. Bloom's cut-off points (good, 80–100%; moderate, 60–79%; and poor, <60%) were used to assess the knowledge level. An independent chi-squared test was performed to assess the association between knowledge level and prevention practice of healthcare-associated infections. The significance level was set at $p<0.05$.

RESULTS The results have shown that during 53.2% of the 312 observations, participants followed the aseptic procedure to clean their hands. The knowledge of hand hygiene was moderate (49.7%) among the total study population. A significant relationship has been found between knowledge level and receiving structured training on hand hygiene ($p<0.001$). Gender ($\chi^2=17.38$, $p<0.001$), age ($\chi^2=12.96$, $p<0.001$), profession ($\chi^2=32.76$, $p<0.001$), and training on hand hygiene ($\chi^2=21.39$, $p<0.001$), were found as significant factors in the use of routine use of alcohol-based hand rub.

CONCLUSIONS The findings of the study show the importance of structured training on hand hygiene to improve knowledge among healthcare workers, which could substantially reduce healthcare-associated infections. Further research with a more recent sample is needed to assess potential changes in hand hygiene training.

INTRODUCTION

Patient safety is greatly impacted by healthcare workers' (HCWs) hand hygiene (HH) practices. Healthcare facilities are high-risk areas where patients and caregivers are both exposed to a wide range of microorganisms[1]. Healthcare-associated infections (HCAIs) like nosocomial infections, have frequently been caused by violations of hygiene protocols. This affects the cost and quality of healthcare services, as well as significantly increasing morbidity and mortality[2]. In developing countries, the incidence rate of HCAIs ranges from 2 to 20 times higher than in developed countries[3]. Another study estimated that seven patients

in developed countries and ten in developing countries were affected by HCAI[4]. It is more difficult to follow hand hygiene guidelines in low- and middle-income countries (LMICs) due to issues including congestion, access to water sources, lack of awareness, and training[5]. According to the World Health Organization (WHO), there are several ways to achieve HH, either through alcohol-based hand rubbing (ABHR), using antimicrobial soap, antiseptic agents, or any other hand hygiene products[6,7]. Using alcohol-based hand rubs by health workers could lower HCAI rates by 40%[1]. To comply with hand hygiene regulations[1], one must wash one's hands with ABHR or soap and water, and use the right technique to get rid of microorganisms. If carried out properly, it is the most effective and economical intervention that can be used in medical facilities[8]. WHO also recommends a five-component hand hygiene improvement strategy encompassing infrastructure, training, monitoring, reminders, and institutional culture[1]. However, there are many factors related to hand hygiene practices among healthcare workers including skin conditions, allergies and irritants to the hand washing agents, and insufficient equipment supplies, materials, and resources for good hand hygiene maintenance[1,9,10]. Moreover, knowledge and attitude regarding hand hygiene were identified as the most significant predictors of practices or adherence to hand hygiene in healthcare institutions[1,11-14] . Therefore, it was essential to analyze healthcare workers' knowledge and hand-washing behavior to develop appropriate strategies to promote hand hygiene adherence.

This study has been carried out to examine knowledge and performance and their associations among healthcare workers regarding hand hygiene in two major hospitals in Dhaka City, Bangladesh, so as to serve as the baseline for its potential reassessment.

METHODS

Study design and study setting

A hospital-based cross-sectional study was designed to collect data. Two reputed private hospitals were chosen purposively – Uttara Crescent Hospital and Ibn Sina Diagnostic and Imaging Center, Dhaka, Bangladesh. The Uttara Crescent Hospital provides its services through its emergency department, mother and child care center, indoor services including the Intensive Care Unit (ICU), High Dependency Care Unit (HDU), and outpatient department. The Ibn Sina Diagnostic and Imaging Center is well well-reputed diagnostic center in Dhaka city. More than 1000 patients receive medical care from the two reputed healthcare facilities per day. We received the approval from two medical centers, Uttara Crescent Hospital and Ibn Sina Diagnostic and Imaging Center.

Sampling

A sample size of 126 was calculated using Cochran's formula[15] by considering the 9% prevalence of expected hand hygiene practice by healthcare workers from the Bangladesh National Hygiene Baseline Survey 2016[16]. A 95% confidence level and 5% margin of error between the sample and the underlying population was employed. The facilities and available resources permitted a doubling of the sample size to 252. Finally, 185 participants were included in the study. The response rate was 73.4%. The participants were selected conveniently based on their roaster duty. An equal percentage of staff was chosen from each medical facility.

Data collection

Data were collected in two stages from September 2018 to October 2018. In the first month of the data collection, observations were conducted without the participation of participants to reduce biases. All hand hygiene opportunities and practices during the observation period were recorded using the WHO five moments of the hand hygiene guidelines. After consulting with subject experts and reviewing the literature, observation checklists were developed[1]. The observation checklist includes information about basic hand hygiene procedures that healthcare workers must follow, such as hand cleanliness after and before patient contact, equipment handling, body fluid contact, and after removing gloves (Table 1). Later, a list of observed participants was developed to collect data on their social demographic characteristics, hand hygiene knowledge, and prevention practices of HCAIs. A structured close-ended questionnaire (Supplementary file) was used to collect data by obtaining the written consent of the respondent. Confidentiality was maintained at every step of observation.

Knowledge testing

Healthcare workers were approached during their shift report time as the data collector team obtained permission from the hospital's authority. The research team embedded their data collection activities within the hospitals' schedules. The purpose of the study was explained to all participants and a consent form was signed. The questions were asked to them and noted carefully. This process was repeated at different shifts, for five consecutive days, to capture different health workers who work at different times. The questionnaire included participants' social demographic characteristics, hand hygiene knowledge, and prevention practices of HCAIs toward hand hygiene. The knowledge, practice, and handwashing questions were adopted from the WHO hand hygiene knowledge questionnaire and other previously published research[1,17]. The WHO hand hygiene knowledge questionnaire includes information on training courses, the use of alcohol hand rub, sources of HCAIs' germs and transmission route, hand hygiene methods and situations, and the effect of hand hygiene on HCAI prevention and patient outcome. The knowledge level was determined by nine questions with a true or false response. The correct answer was scored as '1' and the wrong answer as '0'. Overall scores were expressed in percentage and categorized using

Table 1. Hand hygiene observations among healthcare workers in two medical facilities in Dhaka city (N=312)

Characteristics	Categories	Number of opportunities observed n	Hand hygiene performed n (%)
Profession	Nurse/student nurse	111	66 (59.5)
	Doctor	60	38 (63.3)
	Therapist	30	16 (53.3)
	Ward assistant	76	27 (35.5)
	Medical technologist	35	19 (54.3)
Five moments (8 steps) of hand hygiene	Before cleaning and aseptic procedures	22	14 (63.6)
	After contact with body fluids	23	20 (87.0)
	After removing gloves	18	11 (61.1)
	Before patient contact	66	19 (28.8)
	After patient contact	66	45 (68.2)
	Before patient equipment contact	48	25 (52.1)
	After patient equipment contact	45	17 (37.8)
	Gloves are used whenever potential for hand contact with body fluids	25	15 (60.0)

Bloom's cut-off point into good (80–100%), moderate (60–79%), and poor (<60%)[18].

Data analysis

The IBM Statistical Package for Social Sciences (SPSS) version 22 was used to analyze the data, and all categorical variables were summarized using frequencies (n) and percentages (%). To test for a relationship between categorical variables, the chi-squared test of independent association was performed. This chi-squared was used for bivariate analysis. The significance level was chosen at $p<0.05$.

Ethical statement

Ethical approval was obtained from the Noakhali Science and Technology University Ethics Committee (NSTUEC). Written informed consent was obtained from all the respondents. Confidentiality and voluntary participation were assured.

RESULTS

Sociodemographic characteristics of respondents

A total of 185 participants were included in the study. The majority of the respondents were aged <30 years and their mean age was 27.12 ± 4.73 years. Most of the participants were female 136 (73.5%) and regarding their profession, a higher proportion 105 (56.8%) were nurses (Supplementary file Table 1).

Observations

A total of 312 hand hygiene observations were conducted throughout the surveyed healthcare facilities. Table 1 represents the summary of the hand hygiene observations made among healthcare workers in two healthcare facilities. Most observations were among nurses (35.58%), followed by doctors (19.2%), ward assistants (24.36%), and other allied staff (20.8%). Among the 312 observations, during 166 (53.2%) of the observations, hand washing was done with soap or liquid soap. The majority of the observations 132 (42.3%) were made before and after touching the patients among the '5 moments (8 steps) of hand hygiene'.

Knowledge of hand hygiene

Hand hygiene knowledge was poor among 16.2% of the entire study population. Approximately half of the participants (49.7%) had moderate knowledge (knowledge level 60–79%), with 34.1% having good knowledge of hand hygiene. The degree of knowledge was assessed using a set of nine questions (Table 2). Among the questions, 100% of participants agreed that hand cleanliness successfully prevents healthcare-associated infection. According to 74.6% of participants, hands are the primary means of cross-transmission of potentially hazardous microorganisms between patients in a healthcare facility.

Prevention practice of healthcare-associated infection of participants

The results of the prevention practice of healthcare-associated infection of participants are given in Supplementary file Table 2. Regarding their hand hygiene training, 59.5% of participants had received formal training on hand hygiene. Approximately 75% of participants reported that they routinely use alcohol-based hand rub (ABHR) for hand hygiene. A small number of participants

Table 2. Evaluation of participants' knowledge level of hand hygiene using WHO hand hygiene knowledge questions (N=185)

Questions	Yes n (%)	No n (%)
In general, is there any impact of a healthcare-associated infection on a patient?	169 (91.4)	16 (8.7)
Does hand hygiene prevent healthcare-associated infection effectively?	185 (100)	0 (0)
Is it vital for you to maintain good hand hygiene once you have touched your coworkers?	137 (74.1)	48 (25.9)
Is it vital for you to maintain good hand hygiene once you have touched your patients?	137 (74.1)	48 (25.9)
Do you think that the hands are the main route of cross-transmission of potentially harmful germs between patients in a healthcare facility?	138 (74.6)	47 (25.4)
Hand rubbing is more rapid for hand cleansing than hand washing	86 (46.5)	99 (53.5)
Hand rubbing causes skin dryness more than hand washing	121 (65.4)	64 (34.6)
Hand rubbing is more effective against germs than hand washing	126 (68.1)	59 (31.9)
Hand washing and hand rubbing should be performed in sequence as recommended	170 (91.9)	15 (8.1)

Table 3. Factors associated with the use of alcohol-based hand rub (ABHR) and knowledge of hand hygiene among health workers (N=185)

Variables	Routine use of ABHR n (%)		χ^2	p	Knowledge level n (%)			χ^2	p
	Yes	No			Poor	Moderate	Good		
Gender									
Male	26 (53.1)	23 (46.9)	17.38	<0.001	17 (34.7)	22 (44.9)	10 (20.4)	17.99	<0.001
Female	113 (83.1)	23 (16.9)			13 (9.6)	70 (51.5)	53 (39.0)		
Age (years)									
≤30	119 (81.0)	28 (19.0)	12.96	<0.001	18 (12.2)	72 (49.0)	57 (38.8)	11.73	0.003**
≥31	20 (52.6)	18 (47.4)			12 (31.6)	20 (52.6)	6 (15.8)		
Profession									
Nurse	92 (87.6)	13 (12.4)	32.76	<0.001	7 (6.7)	55 (52.4)	43 (41.0)	49.87	<0.001
Doctor	20 (66.7)	10 (33.3)			4 (13.3)	16 (53.3)	10 (33.3)		
Student nurse	7 (100)	0 (0)			0 (0.0)	3 (42.9)	4 (57.1)		
Therapist	3 (42.9)	4 (57.1)			4 (57.1)	2 (28.6)	1 (14.3)		
Ward assistant	15 (51.7)	14 (48.3)			15 (51.7)	10 (34.5)	4 (13.8)		
Technologist	2 (28.6)	5 (71.4)			0 (0)	6 (85.7)	1 (14.3)		
Hand hygiene training									
No	43 (57.3)	32 (42.7)	21.39	<0.001	24 (32.0)	31 (41.3)	20 (26.7)	23.19	<0.001
Yes	96 (87.3)	14 (12.7)			6 (5.5)	61 (55.5)	43 (39.1)		
Level of knowledge									
Poor	14 (46.7)	16 (53.3)	15.74	<0.001					
Moderate	73 (79.3)	19 (20.7)							
Good	52 (82.5)	11 (17.5)							

*p<0.001 (highly significant). **p<0.005.

26 (14.1%) said they need to be remembered by someone to wash their hands and only 4 (2.1%) participants claimed they were unaware of the hand hygiene practice. The most commonly cited barriers to HH practices among the studied HCWs were: not convenient, too busy with work, forgetting, and being unsure of need (36.2%, 24.3%, 20%, and 8.7%, respectively). The majority of participants (61.1%) used liquid soap, whereas 16.2% of participants used ABHR for hand hygiene. Most of the participants claimed that alcohol-based hand rub is well tolerated by their hands. More than 70% of participants stated that their institution is supporting hand hygiene to prevent healthcare-associated infection.

Association between sociodemographic characteristics with routine use of ABHR

A chi-squared test for independence with $\alpha=0.05$ was used to assess whether the sociodemographic characteristics were related to the routine use of ABHR. Routine use of ABHR was significantly associated with gender ($p<0.001$) and knowledge level ($p<0.001$) (Table 3). As seen in Table 3, the sociodemographic characteristics which were more likely to be related to knowledge level were the profession of the subject ($p<0.001$) and having received training ($p<0.001$).

DISCUSSION

The study noted the association between knowledge of hand hygiene and the prevention of healthcare-associated infection among healthcare workers in Bangladesh. The study also highlighted the importance of a structured training program on hand hygiene and the routine use of alcohol-based hand rub in healthcare facilities. In many healthcare settings, there is significant evidence of understanding how proper hand hygiene procedures help avoid the risk of HCAI[19]. One of the most pressing concerns in infection control today is providing behavioral change to healthcare workers[20]. The most fundamental reason for healthcare workers not practicing hand hygiene is a lack of information and education. The factors leading to noncompliance also include their ignorance of hand hygiene guidelines and the transmission of microorganisms[20].

In our study, although 59.5% of healthcare workers stated that they had received formal training on hand hygiene, the knowledge level was still insufficient. The results support the studies conducted in India. Studies conducted in India at two tertiary healthcare centers showed that only 9% of participants had a good knowledge of hand hygiene[13,17]. However, a high knowledge score has been linked with good practice of hand hygiene regarding the use of ABHR, which is consistent with a previous study conducted in southern Nigeria[21].

Lack of information is another common argument for poor infection control in LMICs, but that behavior reflects differences in motivation and priorities. Similar to previous studies, we found that knowledge was greater than observed behavior[16,22]. This study observed the action of hand washing where only 53.2% of observations were of hand washing practice with soap or liquid soap. Bangladesh's national hygiene survey also found a low percentage of hand washing action with soap. They found that HCWs infrequently washed their hands, with only water (10% of 919 opportunities), seldom used soap (7%), and alcohol sanitizer (6%)[16]. On the other hand, our study indicates that the healthcare workers in urban health facilities are practicing effective hand hygiene, which is also consistent with the previously reported study in Bangladesh[16]. More than a quarter of participants (28.8%) did not wash their hands before touching the patients, while in a study conducted by Krishnamoorthy et al.[5], it was 40.3%. In our study, nurses had the most observations (59.5%), whereas doctors had the highest recommended hand hygiene (63.3% of 60 observations).

This study also revealed that demographic characteristics such as gender, age, profession, receiving formal training on HH, and knowledge level, were significantly associated with the routine use of ABHR. The demographic characteristics were also significantly associated with the knowledge level of respondents. Receiving formal training on hand hygiene plays a vital role in increasing practice on HH and compliance with HH while considering other factors[23]. The most important reasons for noncompliance with hand hygiene were in this study: skin sensitivity to ABHR, workload, unawareness, and the institution not giving high priority to hand hygiene. These results support the study, which was conducted to assess compliance with hand hygiene in hospitals[20]. About 14.1% of respondents stated that they need to be reminded by someone to wash their hands indicating that hand hygiene practices in their institution would be improved by posting reminders, educating the public, and being promoted by seniors and leaders[24]. Therefore, regular HH training should be encouraged to enhance the ability of HCWs in HH practice and compliance.

Limitations

Study limitations relate to the significant time lag between data collection and the publication of this article, which does not allow an up-to-date provision of evidence, but which can be used, however, as a source of historical data that can be used as a baseline for the assessment of current practices post COVID-19. Other limitations include the sampling plan as only two private hospitals in Dhaka city were included in the study which does not allow us to extrapolate our findings to other health facilities like tertiary public healthcare centers, other diagnostic centers, and private clinics. This study did not investigate the placement of handwashing stations relative to access to handwashing opportunities.

CONCLUSIONS

The study suggests that prevention of healthcare-associated infection is significantly associated with better knowledge of hand hygiene. Structured training on hand hygiene could enhance better hand hygiene practices. These data can be used a baseline for the re-assessment of handwashing

practices post COVID-19 within this current setting.

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DATA AVAILABILITY
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