

## Short Communication

## Predictors of pre-and post-care handwashing among community healthcare providers: a cross-sectional survey in Bangladeshi community clinics

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## ABSTRACT

Lack of proper handwashing by healthcare providers is the major vector for the spread of nosocomial pathogens in healthcare settings. A cross-sectional study was conducted among 128 community healthcare providers (CHCPs) in the Kurigram district of Bangladesh to investigate predictors of handwashing before and after clinical care encounters. Data were collected between November and December 2019 via a paper-and-pen based survey using a semi-structured questionnaire. CHCP's pre-care handwashing with soap/antiseptic hand cleaner was predicted by a higher level of education (Unadjusted/Crude odds ratio (COR) = 7.16, 95% CI 2.39–21.40,  $p = 0.000$  and COR = 9.58, 95% Confidence Interval (CI) 3.28–27.92,  $p = 0.000$ , bachelors and masters, respectively), lengthier service (COR = 6.90, 95% CI 1.40–34.17,  $p = 0.015$  and COR = 7.8, 95% CI 1.49–40.98,  $p = 0.015$ , 5–8 and >8 years, respectively), and presence of handwashing facility (COR = 4.48, 95% CI 1.34–14.95,  $p = 0.015$ ). However, post-care handwashing was also associated with a higher level of education (COR = 13.36, 95% CI 1.54–115.63,  $p = 0.019$ , masters) and availability of soap (COR = 17.73, 95% CI 5.03–59.73,  $p = 0.000$ ), as well as by male sex (COR = 3.14, 95% CI 1.01–9.79,  $p = 0.049$ ). Implementation of an effective training program on hand hygiene combined with improved access to handwashing stations and adequate supply of soap or antiseptic hand cleaner is required to improve both pre-and post-care clinical encounter handwashing practices among CHCPs.

**Key words:** hand hygiene, healthcare, soap, water

## HIGHLIGHTS

- Frequency of handwashing with soap/antiseptic cleaner among community healthcare providers was significantly lower before compared to after patient care encounters.
- Healthcare providers' pre-care handwashing was associated with education, length of service, and handwashing facility and post-care handwashing was associated with sex, level of education, and availability of soap.

## INTRODUCTION

Poor hand hygiene practices are pervasively common among healthcare providers working in primary healthcare facilities worldwide. Lack of proper hand hygiene is one of the major vehicles for transmission and spread of healthcare-associated infections (HAIs) and can affect both the care seekers as well as the healthcare providers, resulting in many millions of people being at risk worldwide (Rahman *et al.* 2022). In developing countries, the risk of HAIs is 2–20-fold higher than in developed countries (Shahida *et al.* 2016). In hospital settings, healthcare workers' hands represent the principal route of transmission of nosocomial pathogens, which are typically transmitted by healthcare workers who fail to implement

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consistent and thorough handwashing practices (Kampf *et al.* 2009; Parmeggiani *et al.* 2010; Desta *et al.* 2018). The absence of adequate handwashing practices increases the risk of acquiring HAIs, including both common and less prevalent pathogens among healthcare providers and patients (Parmeggiani *et al.* 2010; Kahsay *et al.* 2014; Teshager *et al.* 2015; Geberemariyam *et al.* 2018). Such enhanced transmission and infection rates increase not only mortality, morbidity, and healthcare costs for patients and their families, but also impose a significant additional burden on the healthcare system (Uwaezuoke & Obu 2013; Desta *et al.* 2018; Geberemariyam *et al.* 2018). Handwashing practices are widely regarded as an efficient and affordable technique to lower the risk of HAIs, and optimal adherence with hand hygiene approaches can reduce HAIs rate by as much as 40% (Kampf *et al.* 2009).

In Bangladesh, the frequency of HAIs may exceed 30% in some healthcare institutions, and inadequate handwashing practices among healthcare providers clearly constitute a major and significant contributor to such a high prevalence of HAIs (Shahida *et al.* 2016; Rahman *et al.* 2022). In fact, a previous study conducted in Bangladesh showed that only 11% of healthcare providers performed recommended handwashing practices before patient care and only 26% did so after patient care (Horng *et al.* 2016).

Community clinics (CCs) are the most basic primary healthcare facilities in Bangladesh and provide an essential component of the healthcare system by aiming to enable access to diverse basic and essential healthcare services for rural residents (Alim *et al.* 2014; Yaya *et al.* 2017; Hanifi *et al.* 2020; Riaz *et al.* 2020). Accordingly, improved hand hygiene practices are essential to ensure quality healthcare in CC. However, we found no previous studies that investigated pre- and post-care hygiene practices in the CCs of Bangladesh. Thus, the present study was conducted to assess predictors of pre- and post-care handwashing practices among healthcare providers of CCs. This study provided baseline information about the pre- and post-care handwashing practices and predictors which will be helpful in the promulgation of national policy concerning hand hygiene practices in CCs.

## METHODS

### Participants and procedure

A cross-sectional survey was conducted among 128 community healthcare providers (CHCPs) employed in 128 CCs in five sub-districts of the Kurigram district in Bangladesh. The study participants were identified using a stratified random sampling procedure. First, based on their sub-district locations, all CCs in the study area were divided into five strata. The CHCPs were then selected using a proportionate simple random selection from each stratum.

### Materials and data collection

Data were collected from November to December 2019 via a paper-and-pen based survey using a three-section semi-structured questionnaire. The questionnaire was pretested among 13 CHCPs (10% of the intended sample size) who were identified and approached from the same study area, but were subsequently excluded from the actual study. The survey was developed by a team of three academic experts who are knowledgeable in the topic of infection transmission and handwashing practices. In the questionnaire, section 1 comprised questions related to socio-demographic information including, age, sex, marital status, religion, educational status, and length of service. Section 2 comprised questions about the respondent's community clinic handwashing facilities (tube well, and/or basin) and the availability of handwashing materials (soap and/or antiseptic hand cleaner). Section 3 comprised questions regarding CHCPs pre-service and in-service training and self-reported handwashing practices before and after patient care.

## STATISTICAL ANALYSIS

The data were tabulated into Excel and subsequently analyzed using statistical software (Statistical Package for the Social Sciences (SPSS) version 23.0; Chicago, USA). Frequencies, percentages, averages, and standard deviations were calculated using descriptive statistics for pertinent variables. In addition, bivariate logistic regressions were done between dependent and independent variables. Furthermore, variables that had *p*-values less than 0.2 in the binary logistic regression analysis were included in a multiple logistic regression procedure to adjust for potential confounders. For all comparisons, statistical significance was considered when the two-tailed *p*-value was less than 0.05 with a 95% confidence interval range (CI).

## Ethical considerations

The Biosafety, Biosecurity and Ethical Committee of the Jahangirnagar University granted approval for this study [ref. no: BBEC, JU/M20221 11 (4)], and all procedures were carried out in accordance with the Helsinki declaration and institutional research ethical standards. Prior to their participation in the study, all participants received a written informed consent form, and were told about the study's research goals. Strict confidentiality of the data and participant anonymity were guaranteed.

## RESULT AND DISCUSSION

### Socio-demographic characteristics

A total of 128 CHCPs were surveyed, with 57.8% being males. The average age of CHCPs was 32.6 years (SD = 3.7). Most of the respondents were Muslim (96.1%). Of those surveyed, 43.8, 33.6, and 22.7% had bachelor's, master's, and higher secondary levels of education, respectively. Most of the CHCPs' CCs had no handwashing guidelines, and no posters on handwashing practices. Only 85.9% of respondents reported consistent availability of soap. The majority of the respondents (59.4%) had community clinic experience between 5 and 8 years duration. All the CHCPs underwent basic primary health-care training by the government healthcare authority, but the latter was only 3 months long. Furthermore, none of the CHCPs was provided any in-service training focusing on hand hygiene.

### Self-reported handwashing practices and associated factors

Among the responders, 57.9% reported washing their hands with soap/antiseptic before each patient encounter, and 88.3% washed their hands with soap after patient care. When examining comparable studies in emerging economies, a very heterogeneous set of practices emerged. Indeed, a previous study conducted among healthcare workers in Northwest Ethiopia revealed lower frequencies of handwashing with soap before patient care (44%) and after patient care (66.7%) (Desta *et al.* 2018). In another study, lower pre-care (42.2%) and higher post-care (100%) handwashing was reported among doctors in Birnin Kebbi (Aliyu *et al.* 2018), with similar frequencies being also reported by healthcare providers in Southwest Nigeria (pre-care handwashing: 61.4%; post-care handwashing: 97.7%). Interestingly, 68.4% used antiseptic soap and 26.5% used alcohol-based antiseptic hand cleaner (Ekwere & Okafor 2013). Taken together, several potential reasons may account for the differences including (i) divergent levels and type of education (ii) type of healthcare staff (CHCPs *vs.* others [Doctor/Nurse/Midwives, etc.]); (iii) availability of handwashing stations, materials, and access to running water; (iv) number of healthcare providers and density of healthcare seekers in each healthcare facility.

In Table 1, the unadjusted model showed that CHCPs who had bachelors and masters level education were seven times and nine times more likely to perform pre-care handwashing (COR = 7.16, 95% CI 2.39–21.40,  $p = 0.000$  and COR = 9.58, 95% CI 3.28–27.92,  $p = 0.000$ , respectively) compared to those who had only secondary level of education. The unadjusted model also revealed that CHCPs who had been providing service for 5–8 years in CCs were 6.90 times more likely to implement pre-care handwashing (COR = 6.90, 95% CI 1.40–34.17,  $p = 0.015$ ) and those who had been providing healthcare services >8 years were 7.8 times more likely to wash hands before patient care (COR = 7.8, 95% CI 1.49–40.98,  $p = 0.015$ ) when compared to those who had less than 5 years of clinical experience. Moreover, access to an adequate handwashing facility was associated with a 4.48-fold increase in the frequency of handwashing with soap/antiseptic hand rub before patient care (COR = 4.48, 95% CI 1.34–14.95,  $p = 0.015$ ). In the adjusted model, education level, length of service, and adequate handwashing facilities emerged as significant independent determinants associated with handwashing with soap/antiseptic hand cleaner before patient care ( $p < 0.05$ ). In the adjusted model, CHCPs who had bachelors and masters level education were 5.54 times and 10.97 times more likely to perform pre-care handwashing (AOR = 5.54, 95% CI 1.71–18.00,  $p = 0.004$  and AOR = 10.97, 95% CI 3.36–35.85,  $p = 0.000$ , respectively) compared to secondary level of education, while controlling for other confounding variables. Moreover, CHCPs who had access to adequate handwashing facilities were 4.36 times more likely to wash their hands prior to patient care ( $p < 0.05$ ) in the fully adjusted model (Table 1).

In Table 2, the unadjusted model shows that male CHCPs were three times more likely to wash their hands after patient care (COR = 3.14, 95% CI 1.01–9.79,  $p = 0.049$ ). Furthermore, CHCPs who had master's degrees were also significantly more likely to perform handwashing (COR = 13.36, 95% CI 1.54–115.63,  $p = 0.019$ ). Moreover, the constant availability of soap in CCs was 17.73 times more likely to result in handwashing with soap/antiseptic hand cleaner after patient care (COR = 17.73, 95% CI 5.03–59.73,  $p = 0.000$ ). In the adjusted model, CHCP's sex (AOR = 0.15, 95% CI 0.03–0.87,  $p = 0.034$ ) and availability of soap (AOR = 24.10, 95% CI 4.80–120.9,  $p = 0.000$ ) emerged as significant independent determinants associated with post-care handwashing practices (Table 2).

**Table 1** | Binary and multiple regression analysis of factors associated with pre-care handwashing practice

Variables	With soap/antiseptic hand cleaner		Unadjusted model		Adjusted model	
	Yes (%)	NO (%)	COR (95% CI)	p-value	AOR (95% CI)	p-value
<b>Age (years)</b>						
21–25	1 (0.8)	3 (2.3)	Reference		Reference	
26–30	22 (17.2)	11 (8.6)	6.00 (0.56–64.58)	0.139	0.41 (0.02–10.32)	0.586
31–35	40 (31.3)	24 (18.8)	5.00 (0.49–50.83)	0.174	0.20 (0.01–5.87)	0.347
>35	11 (8.6)	16 (12.5)	2.06 (0.19–22.51)	0.553	0.11 (0.00–3.41)	0.205
<b>Sex</b>						
Male	42 (32.8)	32 (25.0)	0.90 (0.44–1.84)	0.777	–	–
Female	32 (25.0)	22 (17.2)	Reference			
<b>Marital status</b>						
Married	71 (55.5)	52 (40.6)	0.92 (0.15–5.64)	0.920	–	–
Single	3 (2.3)	2 (1.6)	Reference			
<b>Education</b>						
Masters	28 (21.9)	15 (11.7)	7.16 (2.39–21.40)	<b>0.000</b>	5.54 (1.71–18.00)	<b>0.004</b>
Bachelor	40 (31.3)	16 (12.5)	9.58 (3.28–27.92)	<b>0.000</b>	10.97 (3.36–35.85)	<b>0.000</b>
Higher Secondary	6 (4.7)	23 (18.0)	Reference		Reference	
<b>Religion</b>						
Islam	72 (56.3)	51 (39.8)	2.12 (0.34–13.13)	0.420	–	–
Hindu	2 (1.6)	3 (2.3)	Reference			
<b>Length of service (years)</b>						
<5	2 (1.6)	9 (7.0)	Reference		Reference	
5–8	46 (35.9)	30 (23.4)	6.90 (1.40–34.17)	<b>0.018</b>	38.63 (3.34–446.82)	<b>0.003</b>
>8	26 (20.3)	15 (11.7)	7.80 (1.49–40.98)	<b>0.015</b>	48.94 (3.90–614.33)	<b>0.003</b>
<b>Guideline/evidence/poster on handwashing</b>						
Yes	6 (4.7)	3 (2.3)	1.50 (0.35–6.29)	0.579	–	–
No	68 (53.1)	51 (39.9)	Reference			
<b>Handwashing facility (tube well and/or basin)</b>						
Yes	70 (54.7)	43 (33.6)	4.48 (1.34–14.95)	<b>0.015</b>	4.36 (1.10–17.47)	<b>0.037</b>
No	4 (3.1)	11 (8.6)	Reference		Reference	
<b>Soap/antiseptic availability</b>						
Always	67 (52.3)	43 (33.6)	2.45 (0.88–6.80)	0.086	1.72 (0.48–6.19)	0.410
Sometimes	7 (5.5)	11 (8.6)	Reference		Reference	

Notes: COR, Unadjusted/Crude odds ratio; CI, Confidence interval; AOR, Adjusted odds ratio.

Previous studies have assessed healthcare providers' overall hand hygiene compliance and handwashing practices, and have examined potential associations with a multiplicity of factors including socio-demographic characteristics and basic resources for handwashing such as facilities, and access to running water and soap/antiseptic (Engdaw *et al.* 2019; Soboksa *et al.* 2021; Alene *et al.* 2022; Rahman *et al.* 2022). However, we found no studies that assessed predictors of healthcare providers' pre-and post-care handwashing practices separately. The discrepant rates of such practices as related to pre *vs.* post clinical encounters, and the similarity of the independent factors associated with implementation of handwashing before and after interactions with healthcare seekers suggests that interventions aimed at increased awareness and periodic education of CHCPs may result in the desirable outcomes of optimal or near optimal behaviors.

**Table 2** | Binary and multiple regression analysis of factors associated with post-care handwashing practice

Variables	With soap/antiseptic hand cleaner		Unadjusted model		Adjusted model	
	Yes (%)	NO (%)	COR (95% CI)	p-value	AOR (95% CI)	p-value
<b>Age (years)</b>						
21–25	3 (2.3)	1 (0.8)	Reference		Reference	
26–30	32 (25.0)	1 (0.8)	5.17 (0.36–75.14)	0.229	9.97 (0.47–213.02)	0.141
31–35	56 (43.8)	8 (6.3)	2.33 (0.22–25.25)	0.486	6.51 (0.40–105.72)	0.188
>35	24 (18.8)	3 (2.3)	1.92 (0.16–23.35)	0.610	3.41 (0.173–68.32)	0.418
<b>Sex</b>						
Male	70 (54.7)	4(3.1)	3.14 (1.01–9.79)	<b>0.049</b>	0.15 (0.03–0.87)	<b>0.034</b>
Female	45 (35.2)	9 (7.0)	Reference		Reference	
<b>Marital status</b>						
Married	111 (86.7)	12 (9.4)	1.95 (0.20–18.67)	0.564	–	–
Single	4 (3.1)	1 (0.8)	Reference			
<b>Education</b>						
Masters	42 (32.8)	1 (0.8)	13.36 (1.54–115.63)	<b>0.019</b>	3.69 (0.32–42.91)	0.297
Bachelor	49 (38.3)	7 (5.5)	2.23 (0.70–7.12)	0.177	0.64 (0.13–3.28)	0.56
Higher secondary	23 (18.0)	6 (4.7)	Reference		Reference	
<b>Religion</b>						
Islam	109 (85.2)	14 (10.9)	1.95 (0.20–18.67)	0.564	–	–
Hindu	4 (3.1)	1 (0.8)	Reference			
<b>Length of service (years)</b>						
<5	10 (7.8)	1 (0.8)	Reference		–	–
5–8	70 (54.7)	6 (4.7)	0.99 (0.11–8.88)	0.990		
>8	35 (27.3)	6 (4.7)	0.49 (0.05–4.43)	0.522		
<b>Guideline/evidence/poster on handwashing</b>						
Yes	8 (6.3)	1 (0.8)	1.07 (0.12–9.18)	0.953	–	–
No	107 (83.6)	12 (9.4)	Reference			
<b>Handwashing facility (tube well and/or basin)</b>						
Yes	104 (81.3)	9 (7.0)	3.37 (0.92–12.40)	0.067	3.61 (0.50–26.21)	0.205
No	11 (8.6)	4 (3.1)	Reference		Reference	
<b>Soap/antiseptic availability</b>						
Always	106 (82.8)	4 (3.1)	17.33 (5.03–59.73)	<b>0.000</b>	24.10 (4.80–120.9)	<b>0.000</b>
Sometimes	9 (7.0)	9 (7.0)	Reference		Reference	

Notes: COR, Unadjusted/Crude odds ratio; CI, Confidence interval; AOR, Adjusted odds ratio.

## LIMITATIONS

The study had some limitations. First, it was cross-sectional which precludes any indication or inference of causality. Second, the study used self-reported data with the attendant biases of such data collection. Indeed, self-reported information may be affected by social desirability biases, and memory recall biases. Finally, the sample size was relatively small and restricted to five sub-districts in Bangladesh, and therefore, generalizability to other sub-districts and other regions in the country may be limited. Future studies should overcome such limitations by employing a longitudinal design with expanded representative samples.



## CONCLUSION

This study reported the frequencies and associated factors concerning pre-and post-care handwashing practices among CHCPs in Bangladesh. Findings illustrated that about half of the participants did not wash their hands with soap or antiseptic hand cleaner before patient care and that although such proportion was reduced after an encounter with a patient, there were still 11.7% of the participants who did not wash their hands after patient care. Here, we identified higher levels of education, length of service, and availability of handwashing facilities as independent factors associated with pre-care handwashing. However, post-care handwashing was also predicted by a higher level of education and availability of soap as well as by the male sex. Thus, the implementation of an effective training program for CHCPs that addresses these factors while providing periodic reinforcement of handwashing practices should yield the desirable results, i.e., reduced infection transmission.

## FUNDING

The study was supported by WaterAid Bangladesh under Young Researchers Fellowship Program 2019.

## AUTHORS CONTRIBUTIONS

Kamrul Hsan (KH), Mahfuza Mubarak (MM), Tareq Rahman (TR), Abu Bakkar Siddique (ABS), Mohammad Azizur Rahman (MAR), David Gozal (DG), Md. Marjad Mir Kameli (MMMK), Nurullah Awal (NA) and Md. Mahfuz Hossain (MMH): All authors contributed to the manuscript. Specifically, KH, NA and MMH designed the study; KH performed data collection; KH and TR analyzed the data; KH, ABS and TR performed the interpretation of data; KH, MM, MAR, DG, MMMK and MMH contributed to the validation; MM and MMH supervised the study. KH, ABS and TR drafted the final manuscript. All authors revised it critically, read and approved the final manuscript.

## DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

## CONFLICT OF INTEREST

The authors declare there is no conflict.

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First received 25 September 2022; accepted in revised form 16 June 2023. Available online 28 June 2023