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ARTICLE



# Trend of COVID-19 spreads and status of household handwashing practice and its determinants in Bangladesh – situation analysis using national representative data

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## ABSTRACT

The objective of the study was to assess the prevalence and factors associated with household (HH) handwashing practice in Bangladesh and draw a trend of COVID-19 spreads and compare that with the country-wide HH handwashing practice. The study is based on the two national representative publicly available datasets (MICS 2019, and confirmed cases of COVID-19). Of 61,209 (weighted) HH, the overall prevalence of HH handwashing was found 56.3%, and the prevalence was significantly varied across the socio-economic status of the HH. Map comparison suggested that the gradual increasing trend of COVID-19 cases in areas where HH handwashing practice is low. The northern part of Bangladesh had the highest handwashing practice, whereas it had less effected by COVID-19 cases. However, central Bangladesh had the hardest hit by COVID-19 cases, and it had around 50% handwashing practice coverage. Large-scale observational study is necessary to establish the causality.

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## KEYWORDS

Hand hygiene; households;  
COVID-19; Bangladesh

## Introduction

The Coronavirus disease-2019 (COVID-19) is a contagious disease caused by a newly identified coronavirus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (World Health Organization 2020a). It is believed that COVID-19 have been originated in a wet market in Wuhan, Hubei province, China at the end of 2019 (Xiang et al. 2020) which has currently expanded and shifted from an epidemic to global pandemic with emerging clinical outcomes (Huang et al. 2020; Guan et al. 2020). COVID-19 is highly infectious, spreading quickly worldwide, and asymptomatic individuals have been identified as potential sources of infection (Ryu and Chun 2020). The number of confirmed COVID-19 cases are increasing rapidly in Bangladesh (Institute of Epidemiology Disease Control and Research (IEDCR) 2020). As no vaccine is available for the treatment of COVID-19, frequent handwashing with soap for 20 seconds is the most effective prevention measures to reduce the incidence of this global pandemic (World Health Organization 2020b). Additionally, wearing masks and maintaining social distancing can also slow down the outbreak (World Health Organization 2020b).

Bangladesh is a low-middle income country where ensuring adequate access to water, sanitation, and hygiene is a big challenge (Rabbi and Dey 2013; The World Bank 2020). Recent statistics

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Supplemental data for this article can be accessed [here](#).

showed that 98%, 64%, and 75% of the households (HHs) in Bangladesh had at least basic drinking water, sanitation, and hygiene facilities, respectively (Bangladesh Bureau of Statistics (BBS) and UNICEF Bangladesh 2019). Previous studies suggested that a HH is more likely to practice handwashing which has a designated place for handwashing with adequate water and soap (Biran et al. 2008; Luby and Halder 2008; To et al. 2016). Most recent evidence from nationwide survey 'Bangladesh Multiple Indicator Cluster Survey (MICS, 2019)' shows that about 86.8% of HHs in Bangladesh have a specific place for handwashing with water; however, only 57.6% of the HHs were observed having soap at the place of handwashing (Bangladesh Bureau of Statistics (BBS) and UNICEF Bangladesh 2019). Measuring those indicators could be a good proxy to assess the handwashing practice of a HH (To et al. 2016; Kumar et al. 2017).

The most recent national representative handwashing data came through MICS 2019, and there are widespread COVID-19 cases in Bangladesh as of 1 July 2020 (DGHS 2020). To comply with the WHO recommendation on handwashing to contain COVID-19 spreads, we hypothesized that results from national representative HH handwashing and COVID-19 cases datasets would help immediate public health action if pockets of Bangladesh are identified where handwashing practice lower but suffering from a high incidence of COVID-19 cases. Earlier national representative survey 'Bangladesh National Hygiene Baseline Survey-2014' reported 40% of HH had a handwashing location with water and soap available for post-defecation use, and there is no update on the status of handwashing till last year (Alam et al. 2014).

Identifying the preventable factors of handwashing from the 2019 handwashing data would help policymakers focus on and mobilize resources. Therefore, we set the study objectives to assess the prevalence and factors associated with handwashing in Bangladesh and compare the countrywide distribution of trends of COVID-19 cases with the prevalence of handwashing practice across Bangladesh at the district level. To the best of our knowledge, no earlier studies reported handwashing and COVID-19 situation in Bangladesh.

## **Methods and materials**

### ***Study design and data***

We used two publicly available national representative cross-sectional datasets. One is the Bangladesh Multiple Indicator Cluster Survey (MICS) 2019 (Bangladesh Bureau of Statistics (BBS) and UNICEF Bangladesh 2019). The survey was a part of global MICS, conducted by the Bangladesh Bureau of Statistics (BBS), supported by UNICEF, from January 2019 to June 2019. This survey aimed to attain national-level estimates for various health indicators on the situation of children and women of the eight administrative divisions and 64 districts in Bangladesh. Data were collected from the HH level by following a two-stage stratified cluster sampling method, and the number of sampled HH was 64,400. Details of the sampling process, data collection procedure, and questionnaire are available in the final report of 2019 MICS (Bangladesh Bureau of Statistics (BBS) and UNICEF Bangladesh 2019). In this study, we used the HH data file and analyzed data of 61,209 (weighted) HHs. Other data were the confirmed cases of COVID-19 throughout Bangladesh from the Dashboard of Director General of Health Service (DGHS), Bangladesh (DGHS 2020).

### ***Variable assessed***

The dependent variable for this study was 'HH handwashing practice'. A HH was considered to be practicing handwashing if (1) there was a specific place where HH members most often wash their hands, (2) water available at the place for handwashing, and (3) soap or detergent present at the place of handwashing. This was assessed by direct observation during data collection (Bangladesh Bureau of Statistics (BBS) and UNICEF Bangladesh. 2019). This method was also used in earlier studies to assess the handwashing practice of a HH using MICS data (To et al. 2016; Kumar et al.

2017). The demographics and socio-economic characteristics (SES) of the HHs were considered an independent variable for this study. The variables include eight administrative divisions, area, wealth index, family member, under-five children, education of HH head, ethnicity, and status of having improved water source, improved toilet facility, and television. Additionally, confirmed active cases of COVID-19 were used for graphical presentation at 6 date points, each at every 15 days interval, from 15 April 2020 to 1 July 2020. This provides a countrywide geographical trend of COVID-19 spreads in Bangladesh.

### Statistical analysis

We used 'Household sample weight' provided by MICS in the data set to ensure the actual representation of the survey results at national level. Both descriptive and inferential statistics were performed. Descriptive statistics were run to calculate the the number and frequencies. Chi-square tests were performed to compare the prevalence of handwashing behavior across different independent variables. We performed univariate and multivariate binary logistic regression analysis to estimate the crude odds ratio (COR) and adjusted odds ratio (AOR), respectively, with 95% confidence interval (CI) Socio-demographics variables such as administrative division, area, wealth index, no. of family members, no. of children under 5, education of the HH head, ethnicity, HH water, and toilet facility, and existence of HH television were adjusted in the multivariate binary logistic regression model. All statistical tests were considered significant at a 5% level of significance. Data were analysed using Stata v14.2 (StataCopr, College Station, TX, USA). We took into account the stratified survey design by using Stata 'svy' command.. We used Arc GIS v10.5 software for the graphical distribution of confirmed COVID-19 cases and the prevalence of handwashing practice across the 64 districts of Bangladesh.

### Results

Table 1 presents the distribution of HH handwashing practices by the SES and administrative areas of Bangladesh. The overall prevalence of HH handwashing was found 56.3% (95% CI: 55.6–57.0%). Northern division Rangpur had the highest (69.3%), and southern division Barishal had the lowest (34%) HH handwashing practice. Urban residents had a significantly higher percentage of HH handwashing practice than rural residents (67.1% vs 53.1%, respectively). HH with the richest wealth index and HH head with higher education grades than secondary had significantly higher HH handwashing practices (85.6% and 83.8%, respectively). HH with improved water sources (56.8%), toilet facility (59.3%), and had television (68.6%) significantly contributed a higher proportion of HH handwashing practice.

Likelihood of SES with not practicing HH handwashing presents in Table 2. Although significant, administrative boundaries and habitat status did not influence HH handwashing practice meaningfully. However, higher wealth index status had a major impact on the HH handwashing practice. Poorest HH had 20.4 times high likelihood (AOR = 20.41; CI: 17.68–23.57) not to practice handwashing compare to the richest HH. A similar trend was observed on the education of the HH heads; lower the education, higher the odds (AOR = 2.33; CI: 2.11–2.57). HH with no improved water source facility had the 2.8 times higher odds of not practicing HH handwashing compared to those with improved water source facility.

Figure 1 illustrates that COVID-19 cases have substantially increased at a higher pace where the prevalence of HH handwashing practice is low. Meherpur district experienced the highest coverage of HH handwashing (86.8%), whereas it has the lowest COVID-19 cases ( $n = 40$ ) as of 1 July 2020. We also observed that Northern Bangladesh had the highest handwashing practice, whereas it had less effected by COVID-19 cases. However, central Bangladesh had the hardest hit by COVID-19 cases, and it had around 50% handwashing practice coverage. Details of the trend of COVID-19 cases and HH handwashing practices are presented in supplement 1.

**Table 1.** Demographic and socio-economic characteristics of the households and the prevalence of hand washing practice at household level (MICS 2019).

Variables	Frequency (%)	Household practice hand wash (%)	p-Value <sup>a</sup>
Division			
Barishal	3479 (5.6)	34.0	<0.001*
Chattogram	10,733 (17.5)	49.8	
Dhaka	15,502 (25.3)	56.8	
Khulna	7286 (11.9)	63.3	
Mymensingh	4560 (7.4)	47.3	
Rajshahi	8738 (14.2)	60.4	
Rangpur	7227 (11.8)	69.3	
Sylhet	3680 (6.0)	54.3	
Area			
Rural	47,660 (77.9)	53.1	<0.001*
Urban	13,549 (22.1)	67.1	
Wealth index			
Poorest	12,914 (21.1)	29.7	<0.001*
Poorer	12,445 (20.3)	46.8	
Middle	11,889 (19.4)	56.5	
Richer	12,009 (19.6)	65.1	
Richest	11,950 (19.5)	85.6	
Family member			
1–4	37,723 (61.6)	55.4	<0.001*
5+	23,486 (38.4)	57.6	
Under-five children			
0	40,103 (65.5)	56.3	<0.001*
1–2	20,841 (34.0)	55.9	
3+	265 (0.5)	70.7	
Education of household head			
Pre-primary or none	21,431 (35.0)	45.5	<0.001*
Primary	16,585 (27.1)	50.8	
Secondary	15,657 (25.6)	63.5	
Higher +	7536 (12.3)	83.8	
Ethnicity			
Non-Bengali	714 (1.2)	44.7	0.005*
Bengali	60,495 (98.8)	56.4	
Household has improved water source			
No	882 (1.5)	19.4	<0.001*
Yes	60,327 (98.5)	56.8	
Household has improved toilet facility			
No	7643 (12.5)	35.2	<0.001*
Yes	53,566 (87.5)	59.3	
Household has television <sup>b</sup>			
No	25,262 (45.0)	45.8	<0.001*
Yes	30,959 (55.0)	68.6	

<sup>a</sup>Chi-square test.<sup>b</sup>Variable has missing cases.\* Significant *p*-value (*p* < 0.05).

## Discussion

The paper analyzed two national representative datasets to find out pockets in Bangladesh where HH handwashing prevalence is low and drawn a trend of COVID-19 cases in Bangladesh. Given the importance of handwashing to contain COVID-19 cases, we assumed that countrywide illustration of geographical proportional distribution of HH handwashing practice and the trend of COVID-19 spreads could pose public health action focusing on handwashing. We additionally reported the prevalence of HH handwashing practices and factors associated with it. We observed an inverse linear trend meaning that COVID-19 cases are more prevalent where handwashing practices are low across Bangladesh using 6-point COVID-19 data. Although we did not have statistical inferences, this trend is supported by the WHO statement. This global body identified hand played a decisive role in COVID-19 spreads and stated that handwashing practice is one the most effective way to contain COVID-19 cases (World Health Organization 2020c). A recent study also reported

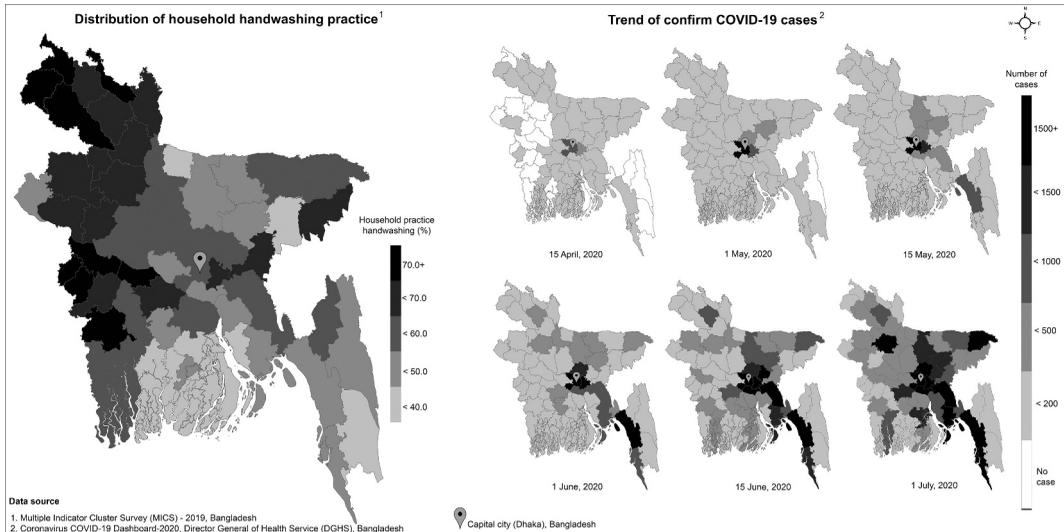
**Table 2.** Factors associated with not practicing hand washing in the households.

Variables	Crude			Adjusted <sup>a</sup>		
	OR	95% CI	p-Value	OR	95% CI	p-Value
Division						
Barishal	2.30	1.98–2.68	<0.001*	1.63	1.40–1.90	<0.001*
Chattogram	1.20	1.04–1.37	<0.001*	1.70	1.49–1.95	<0.001*
Dhaka	0.90	0.78–1.03	0.159	1.50	1.30–1.73	<0.001*
Khulna	0.69	0.60–0.78	<0.001*	0.61	0.53–0.70	<0.001*
Mymensingh	1.32	1.14–1.54	<0.001*	0.95	0.81–1.11	0.545
Rajshahi	0.76	0.66–0.88	<0.001*	0.59	0.51–0.86	<0.001*
Rangpur	0.52	0.45–0.60	<0.001*	0.31	0.27–0.37	<0.001*
Sylhet			----- ref -----			
Area						
Rural	1.79	1.63–1.98	<0.001*	0.67	0.61–0.73	<0.001*
Urban			----- ref -----			
Wealth index						
Poorest	14.09	12.35–16.07	<0.001*	20.41	17.68–23.57	<0.001*
Poorer	6.76	5.94–7.70	<0.001*	10.06	8.83–11.46	<0.001*
Middle	4.58	4.03–5.22	<0.001*	6.10	5.40–6.90	<0.001*
Richer	3.19	2.80–3.63	<0.001*	3.79	3.36–4.29	<0.001*
Richest			----- ref -----			
Family member						
1–4	1.09	1.05–1.13	<0.001*	1.24	1.18–1.30	<0.001*
5+			----- ref -----			
Under-five children						
0	1.87	1.39–2.51	<0.001*	1.35	0.99–1.83	0.054
1–2	1.90	1.42–2.55	<0.001*	1.45	1.06–1.96	0.017*
3+			----- ref -----			
Education of household head						
Pre-primary or none	6.23	5.70–6.80	<0.001*	2.33	2.11–2.57	<0.001*
Primary	5.02	4.59–5.48	<0.001*	2.34	2.12–2.59	<0.001*
Secondary	2.99	2.73–3.26	<0.001*	1.92	1.74–2.12	<0.001*
Higher +			----- ref -----			
Ethnicity						
Non-Bengali	1.59	1.14–2.22	0.006*	0.41	0.27–0.62	<0.001*
Bengali			----- ref -----			
Household has improved water source						
No	5.45	4.45–6.67	<0.001*	2.81	2.08–3.81	<0.001*
Yes			----- ref -----			
Household has improved toilet facility						
No	2.67	2.51–2.85	<0.001*	1.11	1.03–1.20	0.004*
Yes			----- ref -----			
Household has television						
No	2.58	2.46–2.71	<0.001*	1.09	1.03–1.15	0.001*
Yes			----- ref -----			

<sup>a</sup>Adjusted for all the variables in the table.\* Significant *p*-value (*p* < 0.05).

that handwashing was associated with a lower risk of COVID-19 transmission (Beale et al. 2020). If this is the case for Bangladesh (which is more likely given the WHO evidence), it would mean that immediate public health resource mobilization is imminent to improve countrywide HH handwashing practice to reduce further COVID-19 spreads. Our district-level graphical trend reported a total of 6 points of countrywide COVID-19 confirmed cases beginning from April 15 at every 15 days till 1 July 2020. Added values to the existing evidence from this study are multi-folded. Our study combined three key components ‘water’, ‘soap’, and ‘place’ and reports as ‘HH handwashing practice’ in Bangladesh. Furthermore, this study identified pockets of low HH handwashing practice across all administrative districts in Bangladesh and presents the trend of COVID-19 cases where HH handwashing practice is alarmingly low.

We found a wide variation of HH handwashing practices across Bangladesh in-terms of administrative boundaries. We noted that central Bangladesh, including capital Dhaka, is the hardest hit



**Figure 1.** Geographical distribution shows the comparison of 6 data points of COVID-19 spreads and HH handwashing practice across Bangladesh.

by COVID-19, where HH handwashing practice was about 50%. Based on the WHO directives, it may be possible that COVID-19 may become worse in central Bangladesh because of a lack of HH handwashing practice and/or failure of active COVID-19 containment approach. Another reason could be that this part of Bangladesh is relatively dense than other areas. Bangladesh adopted two major steps to contain COVID-19 (1) countrywide lockdown from 26 March to 30 May, and (2) social distancing followed by face mask for everyone. Another major campaign carried out by the government is handwashing practice. In Bangladesh, government and non-governmental including individual-level promoted handwashing through the print, online and electronic media. Regardless of all efforts, COVID-19 case detection is increasing each day by increasing the testing sites. We found the poorer HH are more likely not to follow handwashing practices compare to the wealthier HH. It may be a result of the lack of improved water sources at HH level. We found a similar trend in the HH without improved water sources were more likely not to practice HH handwashing. It is reasonable that the population without having the facility is not likely to comply with the public health directives. Although small odds, we found HH without having television are not likely to practice HH handwashing. It may indicate that these populations may not have access to the countrywide public health campaign broadcasted by the television.

The major question remains, what can Bangladesh practically do to contain COVID-19 situation in Bangladesh? Reliance on the existing health system to treat COVID-19 can be excluded at the first instance, since it has limited capability in terms of hospital medical equipment (World Health Organization 2020d). One possible approach could be the countrywide lockdown which does not seem practically feasible because it would pose a tremendous economic crisis. About one-fifth of the population (21.8%) lives below the poverty line and there are garments industries where over 4 million people work (Farhana et al. 2015; Asian Development Bank 2018). Bangladesh is one of the world's emerging economies (The World Bank 2020) and may not able to subsist the economic catastrophe. Bangladesh went to a complete lockdown from 26 March to 30 May and it has withdrawn the lockdown perhaps of thinking the economy of the country (Government of the Peoples Republic of Bangladesh 2020). Additionally, maintaining lockdown requires large-scale law enforcement personal mobilization and challenging to implement at the standard level. Another approach could be to maintain the social distancing and wearing a face mask by all population. It is because droplet and contact transmission are the major reason for COVID19 spreads (World Health Organization 2020c).

Practically, social distancing would be hard for Bangladesh because of the highly dense population; about 1240 people live per square kilometer of land area and the density is even higher in urban areas (The World Bank 2015). Face mask could be one of the potentials to contain COVID-19 spread; however, it is not practically possible to ensure quality face mask to 160 million people given the scarcity of the COVID-19 face mask (surgical grade N95) worldwide. Ensuring the HH handwashing practice may be a practical option to reduce the COVID-19 spreads in Bangladesh. It will not only prevent the spread of COVID-19 but also highly preventative to diarrheal diseases and respiratory illness (Jefferson et al. 2008).

Installation of low-cost durable handwashing stations is warranted for Bangladesh where there are non-existence handwashing stations with soap. Another study advised installing more than one handwashing station per HH (Hulland et al. 2013). Regardless the challenges of installing country-wide handwashing station in the non-existent HH, the key message of handwashing would be to use soap and scrubbing hand for at least 20 seconds (Public Health Agency of Canada 2020) (including palms, back of each hand, between fingers, thumbs and under nails); ideally 40–60 seconds stated by WHO (World Health Organization 2020c). Reaching out this key message to every HH in Bangladesh could significantly reduce COVID-19 cases in Bangladesh. There are 2554 NGOs (national and international), and the government has an extensive network of health workforce distributed throughout Bangladesh (Muneer 2017). For instance, there are more than 13,000 community clinics throughout Bangladesh, and each community clinic covers 6000 population (Director General of Health Service 2020). Given that, Bangladesh should mobilize all its resources such as NGOs and government health workers to carry out large-scale community-level HH handwashing practice campaigns and install HH level handwashing stations as appropriate across its territory.

The paper emphasized the trends of COVID-19 spreads and the situation of HH handwashing practice, which may shed light on the importance of improvement of HH handwashing in Bangladesh. The major limitation is the two-time point datasets (2019 and 2020) and failed to make statistical inferences; however, these are the latest statistics Bangladesh have to make the best use it. However, changing handwashing behavior is not easy and might have a little success (Biran et al. 2014). Regardless, we believe national representative handwashing data of 2019 is suitable enough to compare with the 2020 COVID-19 situation since handwashing behavior may have not changed in several months' timeframe. Another limitation is the failure to find an association between COVID-19 cases and HH handwashing practice between the two datasets. We advise caution while interpreting the results. Future research could focus on investigating the attribution of HH handwashing practice and COVID-19 spreads in Bangladesh or elsewhere.

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