HAND HYGIENE AWARENESS, SELF-REPORTED BEHAVIORS, AND OBSERVED AVAILABILITY OF HANDWASHING MATERIALS AMONG RESIDENTS OF KORAIL SLUMS, DHAKA, BANGLADESH

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ABSTRACT

Background: Rapid urbanization in Bangladesh has led to the expansion of informal settlements, such as the Korail Slum in Dhaka, characterized by poor living conditions and inadequate water, sanitation, and hygiene (WASH) infrastructure. However, data are scarce regarding hand hygiene awareness, self-reported behaviors, and observed (objectively verified) availability of handwashing materials in households in Korail Slum. *Objective*: To describe hand hygiene awareness, self-reported hand hygiene behaviors at key moments for hand hygiene, and observed conditions of household handwashing place among residents of Korail Slums, Dhaka, Bangladesh *Methods*: We conducted a cross-sectional study among 404 adult residents of Korail Slum. We selected our participants using systematic random sampling and collected data by structured interviews and rapid observations. We analyzed data using descriptive statistics. *Results*: Most of our participants were married women with a mean age of 34 years. Nearly all participants (96.3%) identified toilet use as a key moment for hand hygiene, but only 16.6% reported always washing hands with soap and water after using the toilet. Rapid observation data showed that 27.6% of households had both water and soap/detergent at handwashing stations. Participants from households with both water and soap/detergent at handwashing stations were significantly more likely to report always washing hands at key moments compared to participants from households without the water and soap/detergent (all p-values < 0.001). *Conclusion*: Significant disparities exist between awareness of hand hygiene and reported behaviors. The findings provide basic information and basis for future development of targeted interventions. Limitation regarding generalizability should be considered as caveats in the interpretation of the study findings.

Keywords: Hand hygiene, WASH, Behavior, Observtion, Urban Health, Infectious Disease, Bangladesh

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INTRODUCTION

The economy of Bangladesh has significantly grown in the past decade (Islam et al., 2023), the country experienced an epidemiological transition (Biswas et al., 2017). The population of Bangladesh rapidly urbanized, and with urbanization came the rapid expansion of informal urban settlements or slums (Hasan et al., 2024a). Bangladeshi slums are characterized by overcrowded living conditions, inadequate sanitation, limited access to essential services, and poor environmental health infrastructure. Infectious diseases are common in the slums, thus the burden of infectious diseases remain high among marginalized populations in Bangladesh, such as slum residents, despite the economic growth and epidemiological transition.

Improvement in infrastructures related to water, sanitation, and hygiene (WASH) can be an effective means to prevent and reduce the burden of infectious diseases in urban slums, including the Korail Slum in Dhaka, one of the biggest slums in South Asia. However, despite its size, data are not frequently updated with regards to access and practices pertaining to hygiene in Korail Slum. Accurate and up-to-date data on hand hygiene behaviors and facilities are crucial for stakeholders involved in global health, particularly those focused on community development and disease presentation (Kraker et al., 2022). Therefore, the objective of this study is to describe hand hygiene awareness, self-reported hand hygiene behaviors at key moments for hand hygiene, and observed conditions of household handwashing place among residents of Korail Slums, Dhaka, Bangladesh.

LITERATURE REVIEWS

Bangladeshi slums are characterized by overcrowded living conditions, inadequate sanitation, limited access to essential services, and poor environmental health infrastructure. Infectious diseases are also common in the slums due to this lack of access to basic water, sanitation, and hygiene (WASH) services (Rahaman et al., 2023). Thus, despite the epidemiological transition, infectious diseases remain a persistent threat among marginalized and vulnerable populations living in slums (Tadesse et al., 2023). This burden is disproportionate compared to populations outside the slum areas (Anugwom & Anugwom, 2023)

Water, sanitation, and hygiene (WASH) access and practices are essential to maintain good health. For example, diarrheal diseases and respiratory infections are closely linked to inadequate sanitation and hygiene practices (Prüss-Ustün et al., 2019; Ross et al., 2023). Effective hand hygiene, especially handwashing with soap, is one of the most critical interventions to prevent the transmission of such infections (CDC, 2024). Handwashing 5 key moments such as after using the toilet, before eating, before preparing food, before feeding a child, and after cleaning a child, can significantly reduce the incidence of diseases. However, despite the importance of hygiene to health, hygiene practices are often suboptimal in urban slums. Previous studies showed low level of hand hygiene at key moments other than after toilet use among urban populations in Bangladesh (Wichaidit, Biswas, et al., 2019), as well as disparities between the reported and observed handwashing behaviors (Moffa et al., 2021).

The Korail Slum is one of the biggest slums in South Asia and is home to over 150,00 people living in precarious conditions (Castellano et al., 2021). In densely populated slums such as Korail, limited access to clean water, insufficient sanitation infrastructure, overcrowded living conditions, and socioeconomic hardships create substantial barriers to maintaining proper hygiene (Khan, 2022). Hand hygiene is also socially desirable and subjected to over-reporting, thus proxy indications of hand hygiene practice, such as observation of handwashing places, also helps to provide a more balanced representation of hygiene situation (Wichaidit, Steinacher, et al., 2019).

RESEARCH METHODOLOGY

Study Design and Setting

We conducted a cross-sectional study with interviews and non-participatory observations among households in Korail Slums, Dhaka, Bangladesh. Korail Slum spans approximately 100 acres and around 16,500 households with and estimated population 151,500 people. The slum is characterized by overcrowded housing, narrow roads, and limited infrastructure, contributing to significant public health challenges.

Population & Sample

The study population included adult residents of Korail. Inclusion criteria were: 1) Age 18 years or older; 2) Having resided in Korail for 1 year or longer; 3) Able to communicate in Bengali. We excluded adults whose health conditions might preclude participation in the study. As no previous data on access to basic WASH facilities in Korail slum existed, we assumed that the proportion of the urban poor with access to WASH facilities in Korail Slums was the same as that in found in a previous study among resource-poor population in Bangladesh at 27% (p=0.27)(Ahmed et al., 2021). At 95% confidence and 5% arbitrary margin of error, we used the following formula to calculate the sample size.

$$n = \frac{Z^2_{\alpha/2} \times p \times (1-p)}{E^2}$$

Where

N = The size of the target population

P = A prior proportion

Zα/2 = Z value for α level of significance

d = The allowable margin of error

Thus, we calculated that we would need to interview 303 residents of Korail slum (and observed their housing conditions, where possible). We assumed that an arbitrary 25% of potential participants would refuse to participate in the study, thus we estimated that we would need to collect data from to n = 303/ (1-0.25) ≈ 404 residents.

Study Variables and Data Collection

We collected data by face-to-face interviews and rapid observation of WASH infrastructures in the participants' household premises. Our study instruments included a smartphone-based face-to-face structured interview questionnaire and a smartphone-based rapid observation questionnaire. We used the KoboToolbox web-based platform and KoboCollect application to host the study instruments. We used systematic random sampling based on a list of households obtained from the Health and Demographic Surveillance System (HDSS). The structured interviews were conducted in Bengali using a pre-tested JMP questionnaire with non-participatory housing observations. Interviewers were trained to ensure consistency in administering the questionnaire for reliability and validity prior to data collection.

Operational definitions of the study variables were as follow:

1) Self-reported hand hygiene behaviors:

We asked the participants to self-report the frequency of their hand hygiene practice during 5 key moments: after using the toilet, before eating, before preparing food, before feeding a child, and after cleaning a child. We used the following structure for the questions: "*Within the past week, how often do you wash your hands with water and bar soap / detergent / liquid soap* [insert the key moment here]*?*". On all questions, possible responses were: 1) "*Always (100% of the time)*"; 2) "*Mostly (80-100%)*"; 3) "*Frequently (60-79.99%)*"; 4) "*Sometimes (40-59.99%)*"; 5) "*Seldom (20-39.99%)*"; 6) "*Never or almost never (0-19.99%)*", and; 88) "*Not applicable*". We excluded participants who said "Don't know", "Not applicable", or "Refuse to answer" from the analyses.

We also asked participants about the materials they commonly used for handwashing in general. Participants who reported using soap or other material but did not report use of water

were assumed to also use water for handwashing. We decided to consider participants who reported that they didn't wash their hands but also reported using other materials to be those who did not wash their hands in order to obtain a conservative estimate of handwashing behaviors. We also excluded participants who said that they were "Not sure" or "Refuse to answer" from the analysis.

2) Observed conditions of household handwashing place:

After our research assistants finished the interview, the assistants would ask the participants for permission to observe the conditions of WASH facilities in the household, including handwashing facilities. The observation included the availability of a fixed or mobile handwashing station, such as a sink, a bucket, or a jug, located either inside the dwelling or in the yard. Research assistants also noted the presence of essential hand hygiene materials, e.g., water, soap, or detergent, at the handwashing station.

3) Data Collection Procedures

We recruited research assistants for this study from social and health sciences students and graduates from local universities. The research assistants underwent two days of training on research protocols and interview techniques, and a field practice session in an area outside Korail Slum with a similar demographic and socioeconomic characteristics.

After receiving ethical approval from the Bangladesh Medical Research Council (BMRC), we sought permission from community leaders, then we asked for assistance from local community health workers to escort the research assistants to the study households. Our sampling frame was based on the household listing from the Bangladesh Health and Demographic Surveillance System (HDSS), which included approximately 15,000 households in Korail Slum. We used systematic random sampling with an interval of approximately 40 households and collected data until reaching the desired sample size. Before recruiting each participant, the research assistants would inform the participant about the study's purpose and procedures and ensure understanding regarding the voluntary nature of participation and confidentiality. We asked for verbal informed consent *in lieu* of written informed consent in order to accommodate to the context of Korail Slum where literacy level among the residents remained low.

After receiving verbal informed consent, research assistants then started the face-to-face interviews. After completing the face-to-face interview, research assistants then asked the participant for permission to observe WASH facilities used by the participant and their household members.

Data Management

We did not enter any personally identifiable data into the system to ensure the confidentiality of the study participants. We conducted regular checks to identify and resolve data-related issues. We also performed routine data cleaning and prepared the final dataset for statistical analysis.

Data Analysis

We analyzed the study data using descriptive statistics to summarize self-reported hand hygiene behaviors and observed household wash conditions. Additionally, we performed cross-tabulations to compare self-reported handwashing behaviors with the observed availability of water and soap at household locations. We performed all statistical analyses using R software.

Human Research Ethics

We received ethical approval for the study from the Bangladesh Medical Research Council (BMRC) (Ref: BMRC/NREC/2022-2025/561). Investigators requested from the BMRC the use of verbal informed consent in lieu of written informed consent to accommodate the low literacy levels in the study area, and the request received approval accordingly. During the information and informed consent process, investigators informed the participants that they were allowed to stop the interview or ask the investigation team to stop observing household

conditions at any time. Investigators would stop data collection (i.e., withdraw study participants) in case of emergency or when they deemed data collection to disrupt necessary activities within the household.

RESEARCH RESULTS

Our study included 404 participants (*Table 1*) with no refusal to partcipate (participation = 100%). Most participants were female, with the mean age of 34.2 years, married, and worked as housewives. Nearly all participants were Muslim. Education levels varied, with one-sixth reported having no schooling and another one-sixth reported having completed secondary or higher secondary education. Approximately two-fifths of the participants reported that their household earned between 20,000 Bangladeshi Taka (BDT) per month or less. More than half of the participants reported that their households had between 3 to 5 members.

Table 1 Characteristics of the Study Participants and the Participant's Household (n=404 Participants)

Characteristic	**Frequency (%), unless otherwise indicated**
Sex, (n/%)	
Male	94 (23.0%)
Female	310 (77.0%)
Age (years), (mean ±SD)	34.20 (11.63)
Occupation, (n/%)	
Rickshaw/Van/Cart puller	6 (1.5%)
Garments worker	2 (0.5%)
Construction worker	2 (0.5%)
Driver	5 (1.2%)
Business	25 (6.2%)
Service	60 (15%)
Hawker	1 (0.2%)
Porter/Day labour	3 (0.7%)
Servant/Maid servant	21 (5.2%)
Student	20 (5.0%)
Not working/Disabled	1 (0.2%)
Retired/ homemaker	9 (2.2%)
Housewife	244 (60.0%)
Others	5 (1.2%)
Religion	
Islam	403 (99.8%)
Buddhism	1 (0.2%)
Marital status, (n/%)	
Single/Never married	24 (5.9%)
Married	372 (92%)
Divorced	2 (0.5%)
Widowed/Separated	6 (1.5%)
Highest level of education completed	
Never went to school	64 (16.0%)
Primary school	72 (18.0%)
Junior high school	68 (17.0%)
High school	31 (7.7%)
SSC/equivalent	70 (17%)

Characteristic	Frequency (%), unless otherwise indicated
HSC/equivalent	68 (17%)
Vocational certificate	2 (0.5%)
Degree/equivalent	22 (5.4%)
Masters/equivalent or higher	7 (1.7%)
Household Monthly Income	(n=403 participants)
No more than 5,000 Taka	2 (0.5%)
5,001 to 10,000 Taka	26 (6.5%)
10,001 to 20,000 Taka	134 (33.3%)
20,001 to 30,000 Taka	135 (33.5%)
30,001 to 40,000 Taka	66 (16.4%)
40,001 to 50,000 Taka	22 (5.5%)
More than 50,000 Taka	18 (4.5%)
Household members (number of persons), median (IQR)	4 (3, 5)
Relation with the head of household	
Respondent is the head of household	97 (24.0%)
Wife/husband/partner	250 (62.0%)
Son/daughter (unmarried)	18 (4.5%)
Son/daughter (married)	7 (1.7%)
Son/daughter-in-law	4 (1.0%)
Parent/Parent-in-law	21 (5.2%)
Sibling	5 (1.2%)
Other relatives	1 (0.2%)
Others	1 (0.2%)

With regard to hand hygiene behaviors (*Table 2*), most participants reported using a mobile object (e.g., bucket/jug or kettle) for handwashing, while only the minority had had fixed facilities in their dwelling or yard/plot. Regarding handwashing materials, the majority reported using water and soap or detergent. Participants commonly identified after using the toilet and before eating as key moments for handwashing. Only a minority identified attending to a child who defecated, preparing food, and feeding a child as key moments. We found inconsistencies between awareness and self-reported handwashing, and only a minority (between one-fourths and one-sixths) of the participants reported "always" washing hands after key moments. Rapid observations showed that only one-fourths of the observed households had both water and soap/detergent available at handwashing locations.

Table 2 Self-reported Hand Hygiene Behavior and Observed Household Conditions

Characteristic	Frequency (%), unless otherwise indicated
Self-reported hand hygiene behaviors	(n= 404 participants)
The most common handwashing location for the participant and household members	(n= 404 participants)
Fixed facility reported (sink/tap)-In dwelling	41 (10.1%)
Fixed facility reported (sink/tap)-In yard/plot	64 (15.8%)
Mobile object reported (bucket/jug/kettle)	268 (66.3%)
No handwashing place in dwelling/yard/plot	31 (7.7%)
Self-reported normal handwashing materials (exclude not sure or refuse to answer)	(n=404 participants)
Don't wash hands	8 (2.0%)

Characteristic	Frequency (%), unless otherwise indicated
Water only	17 (4.2%)
Water and soap or detergent	346 (85.6%)
Water and other materials (ash, mud, others)	21 (5.2%)
Water and soap and other materials (ash, mud, others)	12 (3.0%)
What are the important occasions when people need to wash their hands?	(n=403 participants)
After going to the toilet	388 (96.3%)
After attending to a child who has defecated	121 (30.0%)
Before preparing food	122 (30.3%)
Before feeding a child	103 (25.6%)
Before eating	285 (70.7%)
Self-reported frequency of handwashing with water and soap / detergent within the past week (Always vs. all other answers) *	
After going to the toilet	67 (16.6%)
After changing a child's soiled diaper (n=201)	45 (22.4%)
Before preparing food (n=368)	38 (10.3%)
Before feeding a child (n=211)	34 (16.1%)
Before eating (n=399)	40 (10.0%)
Observation of handwashing place in the household	**(n= 398 households)**
Fixed facility reported (sink/tap)-In dwelling	37 (9.3%)
Fixed facility reported (sink/tap)-In yard/plot	60 (15.1%)
Mobile object reported (bucket/jug/kettle)	205 (51.5%)
No handwashing place in dwelling/yard/plot	96 (24.1%)
Availability of water and soap at the handwashing place	**(n= 398 households)**
No water and no soap / detergent	88 (22.1%)
Water available, but no soap/detergent	192 (48.2%)
Soap/detergent available, but no water	8 (2.0%)
Water and soap / detergent available	110 (27.6%)

*Those who answered “Don’t know”, “Refuse to answer” or “Not applicable” excluded from the analyses

Assessment of disparities in self-reported hand hygiene behaviors by availability of handwashing materials (*Table 3*) showed stark contrasts in hand hygiene at key moments between households with both water and soap at the handwashing place and households without the water and soap. In the former group, between 30% and 50% of the participants reported always washing hands at key moment, compared to almost no one in the latter group.

Table 3 Comparison of Self-reported Hand Hygiene Behaviors (Reporting "Always" Engaging in the Behavior) by Observed Availability of Water and Soap at the Handwashing Place (Row Percents)

	Always wash hands with water and soap after going to the toilet	**Always wash hands with water and soap after changing a child's soiled diaper**	**Always wash hands with water and soap before preparing food**	**Always wash hands with water and soap before feeding a child**	**Always wash hands with water and soap before eating**
No water and no soap / detergent (n=88)	3 (3.4%)	2 (5.1%)	0 (0%)	1 (2.3%)	0 (0%)
Water available, but no soap/ detergent (n=192)	9 (3.7%)	6 (7.0%)	5 (2.9%)	4 (4.4%)	7 (3.7%)
Soap/detergent available, but no water (n=8)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Water and soap / detergent available (n=110)	55 (50.0%)	37 (53.6%)	33 (33.7%)	29 (41.4%)	33 (31.1%)
P-value*	<0.001	<0.001	<0.001	<0.001	<0.001

*Tested with Fisher's exact test. Bold numbers denote statistically significant p-value at 95% level of confidence

DISCUSSION & CONCLUSION

The objective of this study was to describe the hand hygiene awareness, self-reported hand hygiene behaviors, and observed conditions of handwashing facilities among residents of Korail Slum, Dhaka, Bangladesh. We found disparities between awareness of hand hygiene and self-reported hand hygiene behaviors. We also found significant variations in self-reported hand hygiene behaviors between households with water and soap at the handwashing place and households without water and soap. The findings of the study may be of interest to government and NGO workers who work on water, sanitation, and hygiene (WASH), particularly those responsible for hygiene promotion. The findings, particularly the disparities between reported behaviors and observed availability of hygiene materials, provide basic information regarding potential social desirability bias in self-reported hand hygiene behaviors.

The findings of this study regarding differences in self-reported hygiene behaviors by events are consistent with those of previous studies (Wichaidit, Biswas, et al., 2019). Our sample size was small relative to the population of Korail slum (over 150,000 people). We did not collect more samples due to time and resource constraints, thus our findings had limited statistical power. However, we sampled our participants with the intention for our study data to include representation of all areas of Korail. Also, we only collected data during daytime, and the majority of our participants were female caregivers who were in the study households at the time of data collection, which limited the generalizability of our findings. Hand hygiene awareness and behaviors among children and men in Korail Slum might differ from those of our participants. In addition, the contexts of hygiene access and behaviors may differ in other slums (Hasan et al., 2024b). Furthermore, rapid observations only presented the availability of handwashing materials, not the actual handwashing behavior itself. Due to constraints regarding time, resources, and the study setting, we did not perform structured observation of

hand hygiene behaviors, which would have been the direct measurement of actual hand hygiene behaviors as done in previous studies(Wichaidit et al., 2020; Wichaidit, Steinacher, et al., 2019).

The association between the availability of water and soap at the handwashing place and self-reported hand hygiene behaviors is even stronger than the findings of a previous study conducted in non-slum areas of Dhaka on observed handwashing behaviors in households that received hand hygiene promotion vs. households in non-intervention areas (Wichaidit, Biswas, et al., 2019). These differences found in our study imply that the maintenance of handwashing materials may play a role in improving hand hygiene behaviors, although this association and the mechanism thereof requires further investigation. Relevant stakeholders and investigators may consider the findings of our study as the basis and rationale for designing targeted interventions to improve hand hygiene in Korail Slum and other urban communities with low resources.

The primary strength of this study was the use of rapid observation of the availability of water and soap at the primary handwashing station of the participants' household, which contributed to a more complete understanding of hygiene in Korail Slum. However, our study also contained a number of limitations. Firstly, as we collected the study data during daytime, most of our participants were stay-at-home mothers and housewives. Women and caregivers are generally more aware of hygiene than men(Eriksson et al., 2022), and our data collection procedures could have introduced selection bias to the study findings. Secondly, hand hygiene behaviors are known to be over-reported due to social desirability and self-serving tendencies(Contzen et al., 2015). Thus, the potential for information bias is potentially non-negligible in the study findings. Thirdly, we collected the study data in November 2024. Given the rapid on-going changes in Bangladesh socioeconomic and political condition, the findings of this study may not be generalizable to other periods and settings. Fourthly, we only observed the availability of handwashing materials but not handwashing behavior due to lack of time and resources, which limited the scope of our study findings.

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