

Short Communication

Factors associated with the practice of water, sanitation, and hygiene (WASH) among the Rohingya refugees in Bangladesh

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ABSTRACT

The Rohingya people are now living in overcrowded refugee camps and makeshift settlements with low standards of water, sanitation, and hygiene (WASH). This study was conducted to examine WASH practices and associated risk factors among the Rohingya refugees in Bangladesh. The present study comprised 350 participants with data collected via a semi-structured questionnaire. Most respondents (84%) did not have good knowledge concerning WASH. Furthermore, 50.3% had unsafe WASH practices, 38.6% had fair WASH practices, and 11.1% had safe WASH practices. WASH practices were significantly associated with age, education, marital status, and WASH knowledge. The implementation of an effective WASH awareness program is required along with improved water supply and sanitation to improve WASH practices among Rohingya refugees in Bangladesh.

Key words | Rohingya refugees, WASH, WASH knowledge, WASH practices, water sanitation and hygiene

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INTRODUCTION

Access to safe drinking water, improved sanitation, and good hygiene are among the prime concerns around the globe (Joshi *et al.* 2013). As of 2015, it is estimated that 2.3 billion people still lack a basic sanitation service and that 844 million people still lack a basic drinking water service (WHO & UNICEF 2017). Due to overcrowding, poor

water, sanitation, and hygiene conditions, refugees are at high risk of communicable diseases (Phillips *et al.* 2015). The Rohingya refugees originating from Myanmar are one of the most ill-treated and persecuted refugee groups in the world (Milton *et al.* 2017). They have faced government-sponsored discrimination, detention, violence, and torture in their native country of Myanmar, and have fled to neighboring countries, particularly Bangladesh (Bhatia *et al.* 2018). This includes the displacement of three-quarters of a million people from Myanmar's Rakhine State to the Cox's

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doi: 10.2166/washdev.2019.038

Bazar district of Bangladesh, bringing the total number of Rohingya refugees residing in Bangladesh to approximately 910,000 (UNHCR 2019).

This mass migration has created extensive pressure on services existing in the refugee camps and makeshift settlements (Iacucci *et al.* 2017). Essential services, including food, water, health service access, and mostly shelter and sanitation, are insufficient in properly accommodating the needs of the refugees (Iacucci *et al.* 2017). The unsanitary living conditions accompanied by poor water, sanitation, and hygiene (WASH) practices have facilitated the emergence of many infectious diseases, i.e., diarrhea, cholera, chickenpox, and diphtheria. (Ahmed *et al.* 2018; Cousins 2018; Hsan Naher & Siddique 2019). Consequently, the present study was conducted to establish baseline information concerning WASH practices and investigate factors associated with WASH practices among Rohingya refugees.

METHODS

Participants

The present study was descriptive, cross-sectional, and conducted among Rohingya refugees ($N = 350 \geq 18$ years of age) at Kutupalong and Balukhali in the Cox's Bazar district of Bangladesh from December 2017 to February 2018. Multistage sampling techniques were used to collect data. First, two refugee camps were selected using convenience sampling. Then, households were selected by using disproportionate stratified random sampling, and the sample was selected using purposive sampling.

Materials and data collection

Data were collected via face-to-face interviews using a three-section semi-structured questionnaire that was pretested among 10 refugees and developed by a team of three academic experts knowledgeable in the area. **Section 1** comprised questions relating to *socio-demographic variables* (age, sex, religion, education, marital status, family size, duration of staying in Bangladesh, etc.). **Section 2** comprised questions *assessing WASH knowledge* of refugees concerning water, sanitation, and hygiene, including the

understanding of safe water sources, adequate sanitation, critical times for handwashing, handwashing agents, the use of footwear, critical times for teeth brushing, and agents for brushing teeth. **Section 3** comprised questions *assessing the self-reported WASH practices*, including water collection, water storage, handwashing, toilet hygiene, and washing clothes. WASH knowledge and practices were categorized according to previous studies (e.g., Farah *et al.* 2015; Reshma *et al.* 2016; Mohd & Malik 2017). There were 24 multiple-choice questions in Section 2 and 18 multiple-choice questions in Section 3. Each correct response was scored as '1' and each wrong response was scored as '0'. The WASH knowledge score was classified into good knowledge ($>16/24$), average knowledge (9–16/24), or poor knowledge ($<9/24$) (Farah *et al.* 2015; Reshma *et al.* 2016). WASH practices were labeled as safe ($>14/18$), fair (9–14/18), or unsafe ($<9/18$) (Mohd & Malik 2017).

Data analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS), version 22.0. Frequency, percentages, and means were calculated, and cross-tabulations and chi-square tests were used to investigate the relationships between variables.

Ethical considerations

This study was approved by the Biosafety, Biosecurity and Ethical Committee of the Jahangirnagar University, Savar, Dhaka, Bangladesh [ref. no: BBEC, JU/M2018(12)4] alongside formal permission from the selected area's local authorities. Informed written (from literate) or verbal (from illiterate) consent was taken from all the participants prior to data collection. Strict confidentiality of information and anonymity to the participants were ensured.

RESULTS AND DISCUSSION

Socio-demographic characteristics

In this study, 70.3% of participants were males and 29.7% were females. The average age of participants was 39.31

years ($SD = 15.47$). Most were married (79.4%) and illiterate (66.6%). All participants were Muslims and almost all had registered themselves as a refugee (99.1%). Their average stay duration in refugee camps was 1.003 years ($SD = 3.009$). Most participants (98.9%) resided in a tarpaulin/plastic made house with the remainder in a tinshed house (1.1%). The average number of people living in each household was seven ($SD = 2.974$).

Knowledge of water, sanitation, and hygiene (WASH)

Of those surveyed, 39.4% had poor WASH knowledge, 44.6% had average WASH knowledge, and 16% had good WASH knowledge. The highest frequency of average WASH knowledge was found in the '18–30 years' age group (40.60%), whereas those aged 'above 60 years' had the highest frequency of poor WASH knowledge (67.5%). Predictably, most participants in the 'above secondary education' group had good WASH knowledge (61.5%). The study found no significant differences between males and females ($\chi^2 = 2.802$, $p = 0.246$) concerning WASH practice knowledge (see Table 1).

Practice of water, sanitation, and hygiene (WASH)

Good WASH practices are especially important for promoting good health (Joshi *et al.* 2013; Farah *et al.* 2015). In the present study, participants reported multiple sources of drinking water, including those that had improved (tube well [84%], piped water [8.9%], small tank [2.3%]) and those that had not (dug well [4.9%]). In addition, the study found significant gender differences in the sources used to access drinking water ($\chi^2 = 9.452$, $p = 0.024$) (Table 1). Among the total participants, 56.3% reported that responsible household members always put covers on water containers during transportation and storage time, 2.9% did it sometimes, and 40.9% had never done so.

Hand hygiene is one of the most important practices to avoid getting sick and spreading germs to others. Washing with water alone removes pathogens, but is not as effective as using soap (Phillips *et al.* 2015). However, habits and cultural norms can be disrupted in the setting of internal displacement, thereby potentially changing practices such as handwashing (Phillips *et al.* 2015). In the present study,

the self-reported frequency of handwashing was the highest in 'before eating' (94%). This was followed by handwashing after going to the toilet (92%), after touching dirty objects (84.9%), before preparing food (64%), and before feeding a child (63.4%). The study found significant gender differences with females being more likely to wash hands before feeding a child ($\chi^2 = 31.291$, $p < 0.001$) and preparing food ($\chi^2 = 4.230$, $p = 0.04$) (Table 2).

Differences in the frequency of handwashing among similar groups have been reported globally, including: among Syrian refugees in the Akkar governorate, Lebanon (after eating [88%], before eating [79%], after going to the toilet [73%], when hands look or feel dirty [69%], before preparing food [59%], and before feeding children [43%]) (UNHCR & REACH 2014), among Syrian refugees in the Za'atari Refugee Camp, Jordan (before eating [90%], before preparing food [72%], after going to the toilet [83%], after touching dirty objects [62%], and before breast feeding [36%]) (UNICEF, ACTED, Relief International, JEN & Oxfam 2013), among Burundian refugees in Rwanda (before eating [61.5%] and after going to the toilet [59.0%]) (Nahimana *et al.* 2017), and among the refugees in three long-term refugee camps in Thailand (after going to the toilet [73%], before eating [47%], before cooking [37%], and before feeding [2%]), Kenya (after going to the toilet [95%], before eating [72%], before cooking [49%], and before feeding [20%]), and Ethiopia (after going to the toilet [94%], before eating [84%], before cooking [50%], and before feeding [10%]) (Biran *et al.* 2012).

In this study, the frequency of handwashing with soap was comparatively lower than in the study of Biran *et al.* (2012) who reported the frequency of using soap in the three long-term refugee camps in Thailand (after going to the toilet [16%], before eating [8%], before preparing food [37%], and before giving food to a child [12%]), Kenya (after going to the toilet [20%], before eating [6%], before preparing food [11%], and before giving food to a child [11%]), and Ethiopia (after going to the toilet [22%], before eating [11%], before preparing food [25%], and before giving food to a child [17%]).

In the present study, the majority of the participants (52.9%) reported using communal toilets (usually blocks of multiple toilets available to all individuals) as the main facility of defecation. This was followed by shared household

Table 1 | WASH knowledge and practices and gender differences

Characteristics	level	Male (n = 246) n (%)	Female (n = 104) n (%)	Total (N = 350) n (%)	Chi-square value χ^2 (df)	p-Value
WASH knowledge						
Knowledge	Poor	100 (40.6)	38 (36.5)	138 (39.42)	2.80 (2)	0.246
	Average	103 (41.9)	53 (51)	156 (44.58)		
	Good	43 (17.5)	13 (12.5)	56 (16)		
WASH practices						
Source of drinking water	Tube well	214 (87)	80 (76.9)	294 (84)	9.45 (3)	0.024*
	Piped water	21 (8.5)	10 (9.6)	31 (8.86)		
	Dug well	7 (2.8)	10 (9.6)	17 (4.86)		
	Small tank	4 (1.6)	4 (3.8)	8 (2.28)		
Use of cover on water container during transportation and storage	Regular	142 (57.7)	55 (52.9)	197 (56.28)	5.95 (2)	0.051
	Irregular	10 (4.1)	0 (0)	10 (2.86)		
	No use	94 (38.2)	49 (47.1)	143 (40.86)		
Key times of hand-washing ^a	After defecation	227 (92.3)	95 (91.3)	322 (92)	0.09 (1)	0.769
	Before eating	229 (93.1)	100 (96.2)	329 (94)	1.22 (1)	0.270
	Before preparing food	149 (60.6)	75 (72.1)	224 (64)	4.23 (1)	0.040*
	Before feeding child	133 (54.1)	89 (85.6)	222 (63.42)	31.29 (1)	<0.001*
	After toughing dirty objects	212 (86.2)	85 (81.7)	297 (84.85)	1.13 (1)	0.289
Kinds of defecation practice	Communal toilet	129 (52.4)	56 (53.8)	185 (52.86)	3.43 (3)	0.330
	Shared household toilet	103 (41.9)	37 (35.5)	140 (40)		
	Single household toilet	9 (3.7)	8 (7.7)	17 (4.86)		
	Outside	5 (2)	3 (2.9)	8 (2.28)		
Use of footwear before using toilet	Regular	184 (74.8)	76 (73.1)	260 (74.28)	1.76 (2)	0.415
	Irregular	24 (9.8)	7 (6.7)	31 (8.86)		
	No use	38 (15.4)	21 (20.2)	59 (16.86)		
Brushing of teeth	Regular	180 (73.2)	74 (71.2)	254 (72.57)	0.149 (1)	0.699
	Irregular	66 (26.8)	30 (28.8)	96 (27.43)		
Agent used for brushing teeth	Tooth paste	35 (14.2)	13 (12.5)	48 (13.71)	24.59 (4)	<0.001*
	Tooth powder	63 (25.6)	12 (11.5)	75 (21.43)		
	Stick	62 (25.2)	14 (13.5)	76 (21.72)		
	Ash	61 (24.8)	48 (46.2)	109 (31.14)		
	Salt	25 (10.2)	17 (16.3)	42 (12)		
Bathing practice	Regular	52 (21.1)	4 (3.8)	56 (16)	16.26 (1)	<0.001*
	Irregular	194 (78.9)	100 (96.2)	294 (84)		
Agent used for bathing	Water only	77 (31.3)	15 (14.4)	92 (26.28)	12.54 (2)	0.002*
	Soap	38 (15.4)	14 (13.5)	52 (14.86)		
	Irregular use of soap	131 (53.3)	75 (72.1)	206 (58.86)		
Washing of clothes	Regular	167 (67.9)	75 (72.1)	242 (69.14)	0.61 (1)	0.434
	Irregular	79 (32.1)	29 (27.9)	108 (30.86)		

^aSome of the variables comprise multiple responses.

*Significant p-value (<0.05).

Table 2 | Association between WASH practice and study variables (i.e., breakdown by age, sex, education, marital status, family size, duration of camp stay, and WASH knowledge)

Characteristics	level	Unsafe practice n (%)	Fair practice n (%)	Safe practice n (%)	Chi-square value χ^2 (df)	p-Value
Age (years)	18–30	50 (28.4)	57 (42.2)	24 (61.5)	25.24 (8)	0.001*
	31–40	36 (20.5)	31 (23.0)	8 (20.5)		
	41–50	36 (20.5)	26 (19.3)	3 (7.7)		
	51–60	27 (15.3)	9 (6.7)	3 (7.7)		
	Above 60	27 (15.3)	12 (8.9)	1 (2.6)		
Sex	Male	118 (67.0)	98 (72.6)	30 (76.9)	2.051 (2)	0.359
	Female	58 (33.0)	37 (27.4)	9 (23.1)		
Education	Illiterate	135 (76.7)	87 (64.4)	11 (28.2)	42.73 (8)	<0.001*
	Preschool (lower primary)	22 (12.5)	13 (9.6)	11 (28.2)		
	Primary	13 (7.4)	17 (12.6)	9 (23.1)		
	Secondary	5 (2.8)	10 (7.4)	4 (10.3)		
	Above secondary	1 (0.6)	8 (5.9)	4 (10.3)		
Marital status	Married	153 (86.9)	101 (74.8)	24 (61.5)	15.46 (2)	<0.001*
	Unmarried	23 (13.1)	34 (25.2)	15 (38.5)		
Family size	1–4	47 (26.7)	33 (24.4)	15 (38.5)	12.58 (6)	0.050
	5–8	61 (34.7)	61 (45.2)	19 (48.7)		
	9–12	55 (31.3)	32 (23.7)	3 (7.7)		
	Above 12	13 (7.4)	9 (6.7)	2 (5.1)		
Duration of stay in refugee camp	Less than 6 month	108 (61.4)	95 (70.4)	23 (59.0)	6.64 (6)	0.356
	6–11 month	49 (27.8)	25 (18.5)	9 (23.1)		
	1–5 years	9 (5.1)	10 (7.4)	4 (10.3)		
	Above 5 years	10 (5.7)	5 (3.7)	3 (7.7)		
WASH knowledge	Participants with poor knowledge	85 (61.6)	43 (31.2)	10 (7.2)	15.98 (4)	0.003*
	Participants with average knowledge	72 (46.2)	66 (42.3)	18 (11.5)		
	Participants with good knowledge	19 (33.9)	26 (46.4)	11 (19.6)		

*Significant p-value (<.05).

toilets (exclusively used by a small set of nearby households) (40%) and single household latrines (4.9%). In contrast, defecation practices outside (open defecation) were infrequently reported (2.3%). These findings are similar to the study by REACH (2018) among the Rohingya refugees (communal/public toilets [50%], shared household toilets [44%], single household latrines [4%], and open defecation [2%]).

The majority of the participants brushed their teeth regularly (72.6%), and 31.1% participants used ash for brushing their teeth. In contrast, only 16% of participants took a bath regularly, and only 14.9% used soap during a bath. Most participants (69.1%) regularly washed their clothes. Significant gender differences were found in the agent used for brushing teeth ($\chi^2 = 0.149$, $p < 0.001$), bathing practices ($\chi^2 = 16.263$, $p < 0.001$), and agent used

when bathing ($\chi^2 = 12.535$, $p < 0.001$). Among the total participants, 50.3% had unsafe WASH practices, 38.6% had fair WASH practices, and 11.1% had safe WASH practices.

FACTORS ASSOCIATED WITH WASH PRACTICES

This study is the first to assess the factors associated with WASH practices among the Rohingya refugees in Bangladesh. The study found that WASH practices were significantly associated with age ($\chi^2 = 25.237$, $p = 0.001$), education ($\chi^2 = 42.734$, $p < 0.001$), marital status ($\chi^2 = 15.462$, $p < 0.001$), and WASH knowledge ($\chi^2 = 15.978$, $p = 0.003$) (Table 2).

LIMITATIONS

The present study has some limitations. First, the study's cross-sectional nature cannot provide any indication of causality. Second, the study used self-reported data which might have influenced the results through well-known biases (e.g., social desirability and memory recall biases). The study was also limited by the relatively small sample size at only two Rohingya refugee camps; therefore, generalizability to other refugee camp samples (and populations) in the country (and other countries) may be limited. Finally, the sample comprised mainly males because the majority of female Rohingya refugees did not want to participate. This may have been due to cultural differences although qualitative research would be needed to confirm such a speculation. Future studies should overcome such limitations by employing longitudinal designs with larger and more representative samples.

CONCLUSIONS AND RECOMMENDATIONS

The present study reported baseline information and associated risk factors concerning several WASH practices among Rohingya refugees in Bangladesh. Findings showed that the majority of participants had unsafe WASH practices. Findings showed that knowledge of WASH, age, education, and marital status were associated with engaging in WASH practices. Based on these findings, a number of recommendations are suggested (i) an effective WASH awareness program for Rohingya refugees is required, (ii) any WASH awareness program needs to take into account that high numbers of refugees are illiterate and that programs based on written literature alone will only have limited success, (iii) awareness programs need to include educated WASH 'ambassadors' from within the refugee community, because this group is more knowledgeable about (and engages in more) WASH practices, and (iv) the refugee camps need an improved water supply and sanitation to help improve WASH practices.

AUTHOR CONTRIBUTIONS

Kamrul Hsan (KH), Shabnam Naher (SN), Mark D. Griffiths (MDG), Hakimul Hasan Shamol (HHS),

Mohammad Azizur Rahman (MZR): All authors contributed to the manuscript. Specifically, KH and SN designed the study; KH and HHS performed data collection; KH performed data analysis and interpretation; KH and MZR drafted the work with input from MDG; MDG oversaw the final manuscript for publication; and all authors revised it critically and participated in editing the manuscript. All authors read and approved the final manuscript.

ACKNOWLEDGEMENTS

We would like to express our deepest appreciation to Dr. Ruhul Furkan Siddique, Professor, Department of Public Health & Informatics, Jahangirnagar University, Dhaka-1342, Bangladesh and Dr. Md. Mahmudul Haque, Associate professor, Department of Community Medicine, National Institute of Preventive and Social Medicine (NIPSOM), Mohakhali, Dhaka, Bangladesh, for their kind support.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

FUNDING

Self-funded.

REFERENCES

- Ahmed, B., Orcutt, M., Sammonds, P., Burns, R., Issa, R., Abubakar, I. & Devakumar, D. 2018 *Humanitarian disaster for Rohingya refugees: impending natural hazards and worsening public health crises*. *The Lancet Global Health* 6 (5), e487–e488. doi:10.1016/S2214-109X(18)30125-6.
- Bhatia, A., Mahmud, A., Fuller, A., Shin, R., Rahman, A., Shatil, T., Sultana, M., Morshed, K. M., Leaning, J. & Balsari, S. 2018 *The Rohingya in Cox's Bazar: when the stateless seek refuge*. *Health and Human Rights* 20 (2), 105–122.
- Biran, A., Schmidt, W., Zeleke, L., Emukule, H., Khay, H., Parker, J. & Peprah, D. 2012 *Hygiene and sanitation practices amongst residents of three long-term refugee camps in*

- Thailand, Ethiopia and Kenya. *Tropical Medicine & International Health* 17 (9), 1133–1141.
- Cousins, S. 2018 Rohingya threatened by infectious diseases. *The Lancet Infectious Diseases* 18 (6), 609–610. doi: 10.1016/S1473-3099(18)30304-9.
- Farah, S., Karim, M., Akther, N., Begum, M. & Begum, N. 2015 Knowledge and practice of personal hygiene and sanitation: a study in selected slums of Dhaka city. *Delta Medical College Journal* 3 (2), 68. doi:10.3329/dmcj.v3i2.24425.
- Hsan, K., Naher, S. & Siddique, M. R. F. 2019 Chickenpox outbreak among Rohingya refugees in Bangladesh: strategies for prevention and control. *Journal of Epidemiology and Global Health*. doi:10.2991/jegh.k.190508.001.
- Iacucci, A. A., Copeland, R., Mahmood, Z., Campbell, A., Hanley, B. & Jameel, P. 2017 *Information Needs Assessment: Cox's Bazar – Bangladesh*. Internews, London. Available from: https://www.internews.org/sites/default/files/2017-11/Internews_Coxs_Bazar_Publication_30Nov_web.pdf (accessed 23 August 2019).
- Joshi, A., Prasad, S., Kasav, J. B., Segan, M. & Singh, A. K. 2013 Water and sanitation hygiene knowledge attitude practice in urban slum settings. *Global Journal of Health Science* 6 (2), 23–34. doi:10.5539/gjhs.v6n2p23.
- Milton, A., Rahman, M., Hussain, S., Jindal, C., Choudhury, S., Akter, S., Ferdousi, S., Mouly, T., Hall, J. & Efir, J. 2017 Trapped in statelessness: Rohingya refugees in Bangladesh. *International Journal of Environmental Research and Public Health* 14 (8), 942. doi:10.3390/ijerph14080942.
- Mohd, R. & Malik, I. 2017 Sanitation and hygiene knowledge, attitude and practices in urban setting of Bangalore: a cross-sectional study. *Journal of Community Medicine & Health Education* 07 (04), 2–6. doi:10.4172/2161-0711.1000540.
- Nahimana, M.-R., Ngoc, C. T., Olu, O., Nyamusore, J., Isiaka, A., Ndahindwa, V., Dassanayake, L. & Rusanganwa, A. 2017 Knowledge, attitude and practice of hygiene and sanitation in a Burundian refugee camp: implications for control of a *Salmonella typhi* outbreak. *Pan African Medical Journal* 28 (1), 54. doi:10.11604/pamj.2017.28.54.12265.
- Phillips, R. M., Vujcic, J., Boscoe, A., Handzel, T., Aninyasi, M., Cookson, S. T., Blanton, C., Blum, L. S. & Ram, P. K. 2015 Soap is not enough: handwashing practices and knowledge in refugee camps, Maban County, South Sudan. *Conflict and Health* 9 (1), 1–8. doi:10.1186/s13031-015-0065-2.
- REACH 2018 *Water, Sanitation and Hygiene Baseline Assessment: Cox's Bazar, Rohingya Refugee Response – April 2018*. Available from: https://reliefweb.int/sites/reliefweb.int/files/resources/reach_bgd_report_wash_hh_survey_april_2018_0.pdf (accessed 14 March 2019).
- Reshma, Pai, M. S. & Manjula 2016 A descriptive study to assess the knowledge and practice regarding water, sanitation and hygiene among women in selected villages of Udipi district. *Nitte University Journal of Health Science* 6 (1), 21–27.
- UNHCR 2019 *Situation Refugee Response in Bangladesh*. Available from: https://data2.unhcr.org/en/situations/myanmar_refugees (accessed 14 March 2019).
- UNHCR & REACH 2014 *WASH Assessment of Syrian Refugee Households in Akkar Governorate, Lebanon – December 2014*. Available from: <https://data2.unhcr.org/fr/documents/download/46280> (accessed 14 March 2019).
- UNICEF, ACTED, Relief International, JEN & Oxfam 2013 *WASH Sector Knowledge, Attitude and Practices Survey in Zaatari Refugee Camp*. Available from: <https://data2.unhcr.org/en/documents/details/40149> (accessed 14 March 2019).
- WHO & UNICEF 2017 *Progress on Drinking Water, Sanitation and Hygiene*. Available from: <https://www.who.int/mediacentre/news/releases/2017/launch-version-report-jmp-water-sanitation-hygiene.pdf> (accessed 14 March 2019).

First received 17 March 2019; accepted in revised form 23 September 2019. Available online 21 October 2019