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5 Short Communication

7 Factors associated with practice of water, sanitation and hygiene (WASH) among the 8 Rohingya refugees in Bangladesh

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28 Specifically, KH and SN designed the study; KH and HHS performed data collection; KH
29 performed data analysis and interpretation; KH and MZR drafted the work with input from
30 MDG; MDG oversaw the final manuscript for publication; all authors revised it critically and
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47 **Abstract**

48 The Rohingya people are now living in overcrowded refugee camps and makeshift settlements
49 having low standards of water, sanitation, and hygiene (WASH). This study was conducted to
50 examine WASH practices and associated risk factors among the Rohingya refugees in
51 Bangladesh. The present study comprised 350 participants with data collected via a semi-
52 structured questionnaire. Most respondents (84%) did not have a good knowledge concerning
53 WASH. Furthermore, 50.3% had unsafe WASH practices, 38.6% had fair WASH practices, and
54 11.1% had safe WASH practices. WASH practices were significantly associated with age,
55 education, marital status, and WASH knowledge. The implementation of an effective WASH
56 awareness program is required along with improved water supply and sanitation to improve
57 WASH practices among Rohingya refugees in Bangladesh.

58

59 **Keywords:** Water sanitation and hygiene; WASH; Rohingya refugees; WASH knowledge;
60 WASH practices

61 **Introduction**

62 Access to safe drinking water, improved sanitation, and good hygiene are among the prime
63 concerns around the globe (Joshi, et al., 2013). As of 2015, it is estimated that 2.3 billion people
64 still lack a basic sanitation service and that 844 million people still lack basic drinking water
65 service (WHO & UNICEF, 2017). Due to overcrowding, poor water, sanitation, and hygiene
66 conditions, refugees are at high risk of communicable diseases (Phillips et al., 2015). The
67 Rohingya refugees originating from Myanmar are one of the most ill-treated and persecuted
68 refugee groups in the world (Milton et al., 2017). They have faced government-sponsored
69 discrimination, detention, violence, and torture in their native country of Myanmar, and have fled
70 to neighboring countries, particularly Bangladesh (Bhatia et al., 2018). This includes the
71 displacement of three-quarters of a million people from Myanmar's Rakhine State to the Cox's
72 Bazar district of Bangladesh, bringing the total number of Rohingya refugees residing in
73 Bangladesh to approximately 910,000 (UNHCR, 2019).

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

83

84

85 **Methods**

86 *Participants*

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

93

94 *Materials and data collection*

95 Data were collected via face-to-face interviews using a three-section semi-structured
96 questionnaire that was pretested among 10 refugees and developed by a team of three academic
97 experts knowledgeable in the area. **Section 1** comprised questions relating to *socio-demographic*
98 *variables* (age, sex, religion, education, marital status, family size, duration of staying in
99 Bangladesh, etc.). **Section 2** comprised questions *assessing WASH knowledge* of refugees
100 concerning water, sanitation, and hygiene including understanding of safe water sources,
101 adequate sanitation, critical times for handwashing, handwashing agents, use of footwear, critical
102 times for teeth brushing, agents for brushing teeth, etc.. **Section 3** comprised questions *assessing*
103 *the self-reported WASH practices* including water collection, water storage, handwashing, toilet
104 hygiene, washing clothes, etc. WASH knowledge and practices were categorized according to
105 previous studies (e.g., Farah et al., 2015; Mohd & Malik, 2017; Reshma et al., 2016). There were
106 24 multiple-choice questions in Section 2 and 18 multiple-choice questions in Section 3. Each

107 correct response was scored as “1” and each wrong response was scored as “0”. WASH
108 knowledge score was classified into good knowledge (>16/24), average knowledge (9-16/24), or
109 poor knowledge (<9/24) (Farah et al. 2015; Reshma et al. 2016). WASH practices were labeled
110 as safe (>14/18), fair (9-14/18), or unsafe (<9/18) (Mohd & Malik, 2017).

111

112 ***Data analysis***

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

116 ***Ethical considerations***

117 The study was approved by the research team’s university Biosafety, Biosecurity and Ethical
118 Committee alongside formal permission from the selected area’s local authorities. Informed
119 written (from literate) or verbal (from illiterate) consent was taken from all the participants prior
120 to data collection. Strict confidentiality of information and anonymity to the participants was
121 ensured.

122

123 **Results and discussion**

124 ***Socio-demographic characteristics***

125 In the present study, 70.3% participants were males and 29.7% were females. The average age of
126 participants was 39.31 years (SD=15.47). The majority were married (79.4%) and illiterate
127 (66.6%). All participants were Muslims and almost all had registered themselves as a refugee
128 (99.1%). Their average stay duration in refugee camps was 1.003 years (SD=3.009). Most

129 participants (96.9%) resided in a tarpaulin/plastic made house with the remainder in a tin-shed
130 house (1.1%). The average number of people living in each household was seven (SD=2.974).

131

132 ***Knowledge of water, sanitation, and hygiene (WASH)***

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

140

141 ***Practice of water, sanitation, and hygiene (WASH)***

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

150 Hand hygiene is one of the most important practices to avoid getting sick and spreading
151 germs to others. Washing with water alone removes pathogens, but is not as effective as using

152 soap (Phillips et al., 2015). However, habits and cultural norms can be disrupted in the setting of
153 internal displacement, thereby potentially changing practices such as handwashing (Phillips et
154 al., 2015). In the present study, self-reported frequency of hand-washing was highest ‘before
155 eating’ (94%). This was followed by handwashing after going to the toilet (92%), after touching
156 dirty objects (84.9%), before preparing food (64%), and before feeding a child (63.4%). The
157 study found significant gender differences with females being more likely to wash hands before
158 feeding a child ($\chi^2=31.291, p<0.001$) and preparing food ($\chi^2=4.230, p=0.04$) (Table 2).

159 Differences in the frequency of handwashing among similar groups have been reported
160 globally, including: among Syrian refugees in the Akkar governorate, Lebanon [after eating
161 (88%), before eating (79%), after going to the toilet (73%), when hands look or feel dirty (69%),
162 before preparing food (59%), and before feeding children (43%)] (UNHCR & REACH, 2014),
163 among Syrian refugees in the Za’atari Refugee Camp, Jordan [before eating (90%), before
164 preparing food (72%), after going to the toilet (83%), after touching dirty objects (62%), and
165 before breast feeding (36%)] (UNICEF, ACTED, Relief International, JEN & Oxfam, 2013),
166 among Burundian refugees in Rwanda [before eating (61.5%) and after going to the toilet
167 (59.0%)] (Nahimana et al., 2017), and among the refugees in three long-term refugee camps in
168 Thailand [after going to the toilet (73%), before eating (47%), before cooking (37%), and before
169 feeding (2%)], Kenya [after going to the toilet (95%), before eating (72%), before cooking
170 (49%), and before feeding (20%)], and Ethiopia [after going to the toilet (94%), before eating
171 (84%), before cooking (50%), and before feeding (10%)] (Biran et al., 2012).

172 In the present study, the frequency of handwashing with soap was comparatively lower
173 than in the study of Biran et al. (2012) who reported the frequency of using soap in the three
174 long-term refugee camps in Thailand [after going to the toilet (16%), before eating (8%), before

175 preparing food (37%), and before giving food to a child (12%)], Kenya [after going to the toilet
 176 (20%), before eating (6%), before preparing food (11%), and before giving food to a child
 177 (11%)], and Ethiopia [after going to the toilet (22%), before eating (11%), before preparing food
 178 (25%), and before giving food to a child (17%)].

179 In the present study, the majority of the participants (52.9%) reported using communal
 180 toilets (usually blocks of multiple toilets available to all individuals) as the main facility of
 181 defecation. This was followed by shared household toilets (exclusively used by a small set of
 182 nearby households) (40%), and single household latrines (4.9%). In contrast, defecation practices
 183 outside (open defecation) were infrequently reported (2.3%). These findings are similar to the
 184 study by REACH (2018) among the Rohingya refugees [communal/public toilets (50%), shared
 185 household toilets (44%), single household latrines (4%), and open defecation (2%)].

186 The majority of the participants brushed their teeth regularly (72.6%) and 31.1%
 187 participants used ash for brushing their teeth. In contrast, only 16% participants took a bath
 188 regularly and only 14.9% used soap during a bath. Most participants (69.1%) regularly washed
 189 their clothes. Significant gender differences were found in the agent used for brushing teeth
 190 ($\chi^2=0.149$, $p<0.001$), bathing practices ($\chi^2=16.263$, $p<0.001$), and agent used when bathing
 191 ($\chi^2=12.535$, $p<0.001$). Among the total participants, 50.3% had unsafe WASH practices, 38.6%
 192 had fair WASH practices, and 11.1% had safe WASH practices.

193
 194 **Table 1: WASH knowledge and practices and gender differences**
 195

Characteristics	Level	Male (n=246) n (%)	Female (n=104) n (%)	Total sample (n=350) (%)	Chi-square value χ^2 (df)	p-value
WASH knowledge						
Knowledge	Poor	100 (40.7)	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 touching 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)		
<p><i>p</i>-values were calculated using the Pearson's chi-square test. * Significant <i>p</i>-value (<0.05). ^a Some of the variables comprise multiple responses.</p>						

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

202
 203
 204 **Table 2: Association between WASH practice and study variables (i.e., breakdown by age, sex, education,**
 205 **marital status, family size, duration of camp stay, and WASH knowledge)**
 206

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 <i>p</i> -value (<.05)						

207

208 **Limitations**

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

219

220 **Conclusions and recommendations**

221 The present study reported baseline information and associated risk factors concerning several
 222 WASH practice among Rohingya refugees in Bangladesh. Findings showed that majority of
 223 participants had unsafe WASH practices. Findings showed that knowledge of WASH, age,
 224 education, and marital status were associated with engaging in WASH practices. Based on these
 225 findings, a number of recommendations are suggested: (i) an effective WASH awareness
 226 program for Rohingya refugees is required, (ii) any WASH awareness program needs to take into
 227 account that high numbers of refugees are illiterate and that programs based on written literature
 228 alone will only have limited success, (iii) awareness programs need to include educated WASH

229 ‘ambassadors’ from within the refugee community because this group is more knowledgeable
230 about (and engages in more) WASH practices, and (iv) the refugee camps need an improved
231 water supply and sanitation to help improve WASH practices.

232

233

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