


## Research Paper

# Psychosocial factors influencing handwashing behaviour and the design of behaviour change interventions for the Rohingya camps in Bangladesh

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## ABSTRACT

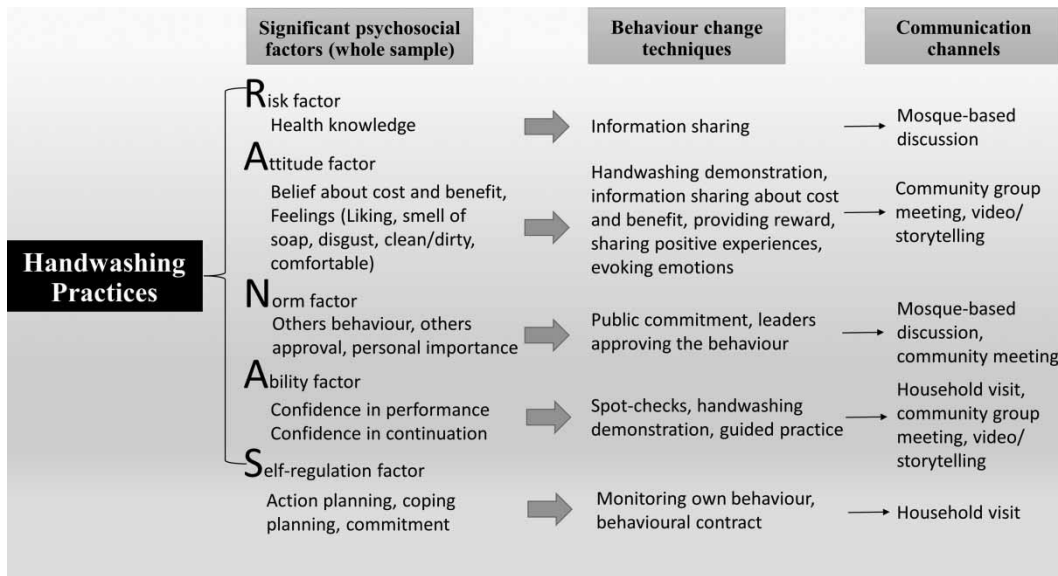
This study sought to identify the psychosocial factors that influence handwashing behaviour and to design behaviour change techniques applying the risk, attitude, norm, ability, and self-regulation (RANAS) behaviour change approach in Rohingya camps in Cox's Bazar, Bangladesh. This was a cross-sectional study conducted in four Rohingya camps located in Ukhiya and Teknaf sub-districts. Participants were selected by systematic random sampling. A structured interviewer-administered questionnaire was used. Analysis of variance testing (ANOVA) was used to determine the significant predicting variables. A total of 1,358 individuals participated in the interview. The mean age was 31.11 ranging from 13 to 75 years. The majority were female (84.9%). Around 75% of participants reported practising handwashing. Several psychosocial predictors were identified for handwashing behaviour with medium to large effect size such as health knowledge, beliefs about costs and benefits, feelings, social norms, abilities, and self-regulation factors. Significant predictors were additionally identified in individual camps. The behaviour change techniques included providing information, demonstration of handwashing, providing rewards, evoking emotions, and public commitments amongst others proposed in this study. Identified psychosocial determinants should be considered while promoting sustainable handwashing behaviour along with adequate supplies and infrastructure. This study also suggests evaluating the proposed behaviour change interventions considering the contextual factors related to handwashing.

**Key words:** behaviour change, handwashing, psychosocial factors, RANAS, refugees, Rohingya camps

## HIGHLIGHTS

- First structural assessment to identify psychosocial determinants of handwashing in Rohingya camps using the RANAS approach
- Majority of the participants performed handwashing practices
- Several factors predicted handwashing behaviours
- Behaviour change interventions designed to address each psychosocial factor

## GRAPHICAL ABSTRACT



## INTRODUCTION

Hands are the vectors for transmitting diseases from human to humans; however, handwashing with soap and water at critical times has vast health implications (Mattioli *et al.* 2013; Ramos *et al.* 2016). Handwashing with soap at key times can limit morbidity and mortality from communicable diseases even in resource-limited settings (Rabie & Curtis 2006; Ejemot *et al.* 2008). In low- and middle-income regions, the prevalence of handwashing with soap is still extremely low with a mean ranging from 13% to 17% (Freeman *et al.* 2014). Diarrhoeal disease is one of the most common causes of death during humanitarian emergencies (Wisner & Adams 2012), which can be simply prevented by washing hands with soap, the most cost-effective hygiene promotion intervention (Cairncross *et al.* 2010). Handwashing, especially at critical times, is practised infrequently in stable refugee camps despite the strong link between handwashing and positive health outcomes (Biran *et al.* 2012).

Approximately 855,000 Rohingya refugees are currently residing in densely populated camps in Cox's Bazar, Bangladesh since the influx took place in August 2017. According to a recent report, 26% of households in the camps reported at least one individual having diarrhoea and 7% of all individuals had diarrhoea (REACH 2019). Children and women are at higher risk of diarrhoeal diseases in the camps (Islam *et al.* 2019). Evidence shows that the majority of people are aware of the importance of handwashing, but a minority regularly practises it through knowledge building interventions (Vivas *et al.* 2010). A recent assessment shows that, overall, 77% of respondents from a representative sample among the Rohingya population were able to name at least three critical handwashing times (Islam *et al.* 2019). Educational programmes help to promote handwashing but additional interventions addressing the determinants and drivers of handwashing are important to improve regular handwashing practices (Curtis *et al.* 2011). Applying behaviour change theories to promotion of interventions for handwashing may enhance their possibilities for behaviour change (Al-Tawfiq & Pittet 2013).

Promoting handwashing with soap has health benefits (Aiello *et al.* 2008; Talaat *et al.* 2011) that are well established, but the way to measure the behaviour change as an effect of promotional programmes is not confirmed (Ram 2013). Many studies have reported the health outcomes of handwashing interventions but lack the information on how the programme affected the handwashing behaviour (Cairncross *et al.* 2010). Moreover, many studies have revealed that hand hygiene practices are predicted by several psychological determinants of an individual (Scott *et al.* 2007; Lopez-Quintero *et al.* 2009; Curtis *et al.* 2011). In the Rohingya camps, we did not observe any structured assessment conducted to determine those psychological predictors for handwashing behaviour and any interventions that are based on evidence. In this study, we assessed the psychosocial factors that influenced handwashing behaviour using the RANAS (risks, attitudes, norms, abilities, and self-regulation) model of behaviour change (Mosler 2012). The RANAS approach is a systematic behaviour change approach

particularly designed for behaviour change in the water, sanitation and hygiene (WASH) sector in developing countries. This model has been successfully applied to predict handwashing behaviour in many developing countries (Contzen & Mosler 2015; Seimetz *et al.* 2016, 2017) and the approach has also been proven effective to enhance handwashing practices in some regions of Ethiopia with water scarcity (Contzen *et al.* 2015). Therefore, our study aimed to identify the potential psychosocial factors that influenced handwashing behaviour which then contributed to the design of behaviour change interventions for the whole sample and specific to each camp.

## METHODS

Rohingya communities are settled in 34 different camps in two sub-districts (Ukhiya and Teknaf) of Cox's Bazar District in Bangladesh. Prior to the selection of those camps, we conducted a focus group discussion with WASH personnel from different organizations to identify the key areas for behaviour change assessments and interventions in the Rohingya camps. Then four organizations from Camp 2E, Camp 8E, Camp 8W and Camp 26 selected handwashing as a key area for behaviour change intervention.

The data we present here is the baseline data of a large pre-post behaviour change intervention project and therefore collected using cross-sectional design. We conducted face-to-face interviews with 1,358 households selected through systematic random sampling from multiple blocks of the selected camps. For interviews, we used a structured questionnaire based on the RANAS model (Mosler 2012). The RANAS model includes risk, attitude, norm, ability, and self-regulation factors, which is an effective tool to understand the association of behaviours with psychosocial aspects. The risk factors include one's perception of one's own vulnerability of getting a disease, severity of consequences after getting a disease, and knowledge about it (e.g. risk of getting diarrhoea if handwashing was not done properly at critical times). Attitude factors include feelings, and beliefs about costs and benefits of performing a specific behaviour (e.g. price of soap, time and difficulties of handwashing, benefits of handwashing). Norm factors entail the perception of a behaviour usually performed within a particular community, their approval or disapproval, and an individual's perceived obligation to perform it. Ability factors include the individual's capacity to carry out a behaviour (continue handwashing even when problems arise). The last component of the model, the self-regulation factor block, includes planning to perform a behaviour, commitment and remembering to perform the behaviour.

Including the sections on demographics and general habit of handwashing, several items in the questionnaires addressed the psychosocial factors according to the RANAS model (see questionnaires in the supplementary file). The interviewers were familiar with the Rohingya dialect having prior experience in conducting qualitative and quantitative interviews in the same context. We translated the main questionnaire into Bengali language and introduced it to the interviewers to test them in the field in the local Rohingya dialect. We measured the habit and other psychosocial factors in a 5-point Likert scale format with 1 as the minimum and 5 as the maximum for most of the questions. We have combined the score of two knowledge questions to calculate the overall health knowledge. We coded the correct responses as '1' and incorrect responses as '0' for health knowledge. We calculated the mean score for coping planning (self-regulation factor) using only two responses (yes or no, yes coded as '1' and no coded as '0').

We analysed the data using IBM SPSS Statistics software package version 26.0 (IBM 2019). To present the socio-demographic characteristics of study participants, we used descriptive statistics. We performed variance testing (ANOVA) to conduct a doers and non-doers analysis in order to determine the significant predictor variable. We also calculated the effect size for each factor for the whole sample and individually for each camp using Cohen's *d* equation and determined the small, medium and large effect size (Cohen 2013).

## RESULTS

A total of 1,358 Rohingya participants attended the interviews from four different camps. The mean age was  $31.11 \pm 10.17$  (SD). The majority of the participants were 30 years of age or below ( $n = 825$ , 60.8%). A vast majority of participants were female ( $n = 1,153$ , 84.9%). The average household size for the whole sample was  $5.50 \pm 2.38$  (SD). The average household size of the individual camps was  $5.64 \pm 3.18$  (SD) in Camp 8W,  $5.97 \pm 2.13$  (SD) in Camp 8E,  $5.54 \pm 2.13$  (SD) in Camp 26, and  $5.02 \pm 2.05$  (SD) in Camp 2E. Among the surveyed population, the majority were illiterate ( $n = 997$ , 73.4%) followed by primary education ( $n = 116$ , 8.5%). The average monthly family income was 2,368.04 Bangladeshi Taka (BDT)

(SD = 2,805.427) ranging from 0 to 21,000 BDT (USD 1 ≈ BDT 85.10). Nearly 50% ( $n = 657$ , 48.4%) of people in this surveyed population had an income of less than BDT 5,000 and 32.4% ( $n = 440$ ) of people had no income (Table 1).

Several items in the questionnaire addressed the different aspects of handwashing behaviour among the participants. Bucket ( $n = 869$ , 64.0%) and can ( $n = 864$ , 63.6%) were the devices mostly used to wet hands among the whole surveyed population. Nearly all of the participants wash both their hands ( $n = 1,328$ , 97.8%). Around 98% ( $n = 1,321$ ) of participants used soap for handwashing. The mean self-reported frequency of handwashing in general for the whole sample was 5.65 times. For individual camps, the mean frequency was 6.4 times in Camp 8W, 5.4 times in Camp 8E, 5.4 times in Camp 26, and 5.6 times in Camp 2E. Regarding the self-reported habit of handwashing, the majority of the participants replied on a scale from 1 (not at all habitually) to 5 (very habitually) that they 'habitually' washed their hands ( $n = 892$ , 65.7%) (Table 2). To determine the doers and non-doers of handwashing, we have used the question assessing habitual handwashing and decided for a cut-off on the 5-point Likert scale. Participants who answered '1-3' on the Likert scale were considered as 'non-doers', and those who answered '4-5' on the Likert scale were considered as 'doers'. By applying this cut-off 75% were classified as doers ( $n = 1,023$ , 75.3%). We found the highest number of 'doers' in Camp 2E (83.8%) (Table 2).

In a next step, we compared the doers and non-doers and calculated the mean difference for the two groups on each RANAS factor for the whole sample and individually for each camp. Then we calculated the effect size of each factor. We focused on those RANAS factors with significant mean difference and medium to large effect size (Table 3). Those are the relevant factors that need to be targeted in order to design effective behaviour change interventions. We display first the results for the whole sample and then specific findings of individual camps. Participants who washed their hands less habitually had lower levels of health knowledge (Risk factors: health knowledge) and reported less to like handwashing with soap and water before handling food (Attitude factors: liking washing hands). They felt less disgusted when not washing hands with soap and water before handling food (Attitude factors: disgust). Participants who washed their hands less habitually,

**Table 1** | Socio-demographic characteristics of participants

Characteristics	Whole sample ( $N = 1,358$ )		Camp 8W ( $N = 273$ )		Camp 8E ( $N = 291$ )		Camp 26 ( $N = 394$ )		Camp 2E ( $N = 400$ )	
	$n$	%	$n$	%	$n$	%	$n$	%	$n$	%
<b>Age (years)</b>										
≤ 30	825	60.8	119	43.6	185	63.6	292	74.1	229	57.3
31–50	465	34.2	124	45.4	91	31.3	94	23.9	156	39.0
> 50	68	5.0	30	11.0	15	5.2	8	2.0	15	3.8
<b>Gender</b>										
Male	205	15.1	123	45.1	39	13.4	28	7.1	15	3.8
Female	1,153	84.9	150	54.9	252	86.6	366	92.9	385	96.3
<b>Educational level</b>										
None or do not know	997	73.4	184	67.4	188	64.6	244	61.9	381	95.3
Can read but not write	110	8.1	2	0.7	20	6.9	86	21.8	2	0.5
Can read and write	59	4.3	14	5.1	16	5.5	17	4.3	12	3.0
Primary	116	8.5	41	15.0	56	19.2	15	3.8	4	1.0
Secondary	39	2.9	27	9.9	11	3.8	0	0	1	0.3
College and higher	3	0.2	3	1.1	0	0	0	0	0	0
Other	34	2.5	2	0.7	0	0	32	8.1	0	0
<b>Income</b>										
No income	440	32.4	124	45.4	26	8.9	145	36.8	145	36.3
<BDT 5,000	657	48.4	89	32.6	195	67.0	152	38.6	221	55.3
BDT 5,000–15,000	256	18.9	57	20.9	69	23.7	97	24.6	33	8.3
BDT > 15,000	5	0.4	3	1.1	1	0.3	0	0	1	0.3

**Table 2** | Handwashing behaviour of participants

Characteristics	Whole sample (N = 1,358)		Camp 8W (N = 273)		Camp 8E (N = 291)		Camp 26 (N = 394)		Camp 2E (N = 400)	
	n	%	n	%	n	%	n	%	n	%
<b>Device used to wet hands</b>										
Bucket	869	64.0	188	30.8	216	74.2	179	45.4	286	71.5
Can	864	63.6	180	68.9	208	71.5	249	63.2	227	56.8
Plastic bottle	26	1.9	2	0.7	18	6.2	2	0.5	4	1.0
Sink filled	48	3.5	3	1.1	2	0.7	43	10.9	0	0
Flowing water from tap	151	11.1	31	11.4	8	2.7	0	0	112	28.0
<b>Hand(s) washed</b>										
Both hands	1,328	97.8	272	99.6	284	97.6	393	99.7	379	94.8
Left hand only	14	1.0	1	0.4	3	1.0	0	0	10	2.5
Right hand only	18	1.3	4	0	4	1.4	1	0.3	13	3.3
<b>Detergent used for handwashing</b>										
Soap	1,321	97.3	273	100	262	90.0	391	99.2	395	98.8
Ash	10	0.7	0	0	2	0.7	1	0.3	7	1.8
Soapy water	15	1.1	8	2.9	2	0.7	1	0.3	4	1.0
Mud	2	0.1	0	0	2	0.7	0	0	0	0
None	27	2.0	0	0	27	9.3	0	0	0	0
<b>Habit of handwashing<sup>a</sup></b>										
Not habitually at all	16	1.2	0	0	13	4.5	0	0	3	0.8
A little bit habitually	230	16.9	62	22.7	42	14.4	77	19.5	49	12.3
Rather habitually	89	6.6	33	12.1	32	11.0	11	2.8	13	3.3
Habitually	892	65.7	145	53.1	161	55.3	306	77.7	280	70.0
Very habitually	131	9.6	33	12.1	43	14.8	0	0	55	13.8
<b>Doers/Non-doers of handwashing<sup>a</sup></b>										
Non-doers	335	24.7	95	34.8	87	29.9	88	22.3	65	16.3
Doers	1,023	75.3	178	65.2	204	70.1	306	77.7	335	83.8

<sup>a</sup>How habitually do you wash your hands with soap and water before handling food?.

think that many people in their community wash their hands at a low frequency (Norm factors: others' behaviour, community members). They also think that many of their relatives wash their hands at a low frequency with soap and water before handling food (Norm factors: others' behaviour, relatives). Participants with less habitual handwashing behaviour also think that washing hands with soap and water does not make them a respected person in the community (Norm factors: personal respect) and did not see themselves as role models in the community (Norm factors: role model). Participants in the whole sample who washed their hands less habitually were also less confident about the fact that they can always wash their hands with soap and water before handling food (Ability factors: confidence performance). They were also less confident about maintaining handwashing behaviour with soap and water before handling food, especially when they are busy (Ability factors: confidence maintenance). Participants who washed their hands less habitually had fewer plans about when during the day they would wash their hands with soap and water (Self-regulation factors: action plan) and were also less committed to performing the behaviour (Self-regulation factors: commitment). In some individual camps, some factors seem to be of special importance for handwashing as they have a large effect size. For example, health knowledge (Risk factor) in Camp 2E, personal respect (Norm factor) in Camp 8W, action control (Self-regulation factor) in Camp 26, and action plan, coping plan, and commitment (Self-regulation factors) in Camp 2E.

The following findings might imply interventions on additional behavioural factors in individual camps but did not show up in the whole sample. In Camp 8W, participants with less habitual handwashing behaviour thought that there is no risk of

**Table 3** | Mean difference of doers and non-doers and effect size of RANAS factors

Factors	Whole sample		Camp 8W		Camp 8E		Camp 26		Camp 2E	
	Mean difference	Effect size	Mean difference	Effect size	Mean difference	Effect size	Mean difference	Effect size	Mean difference	Effect size
<b>Risk</b>										
Vulnerability 1	0.11	0.1	0.79***	0.57	0.07	0.06	0.05	0.08	- 0.08	0.09
Vulnerability 2	0.12	0.15	0.21*	0.28	0.25*	0.38	0.07	0.11	- 0.06	0.08
Severity	0.86	0.12	0.11	0.25	0.19*	0.27	- 0.12	0.21	0.36**	0.58
Health knowledge	1.01***	0.46	- 0.40	0.24	1.30***	0.59	0.36	0.21	2.22***	1.49
<b>Attitude</b>										
Beliefs about costs and benefits (germ free)	0.13*	0.16	0.20	0.21	0.23**	0.36	- 0.24***	0.34	0.58***	0.61
Beliefs about costs and benefits (time-consuming)	0.10	0.10	0.62***	0.51	- 0.38*	0.36	0.39***	0.49	- 0.20*	0.29
<b>Feelings</b>										
1. Like/Dislike washing hands	0.21***	0.42	0.28***	0.59	0.26***	0.51	0.02	0.09	0.32***	0.53
2. Smell of soap	0.13***	0.22	- 0.05	0.09	0.19*	0.31	0.19***	0.46	0.20*	0.30
3. Disgust	- 0.42***	0.35	- 0.83***	0.66	- 0.39**	0.37	0.19*	0.18	- 0.54**	0.42
4 Clean/ Dirty	0.20***	0.19	0.23	0.26	0.28*	0.28	- 0.05	0.11	0.44**	0.53
5. Comfortable	0.12**	0.15	0.78***	0.61	- 0.03	0.03	0.01	0.06	0.04	0.08
<b>Norms</b>										
Others' behaviour (Number of people in the community)	0.37***	0.38	- 0.02	0.0	0.28*	0.30	0.39***	0.73	0.31**	0.39
Others' behaviour (Number of relatives)	0.40***	0.41	0.11	0.19	0.44**	0.46	0.41***	0.69	0.28*	0.35
Others' (dis)approval (People who are important)	0.13***	0.18	- 0.03	0.03	0.23*	0.29	0.01	0.06	0.16*	0.28
<b>Personal importance</b>										
1. Important/ Unimportant	0.23***	0.36	0.24**	0.38	0.38***	0.72	- 0.01	0.06	0.44**	0.50
2. Respected person	0.26***	0.34	0.54***	0.87	0.46***	0.58	- 0.21***	0.49	0.38**	0.41
3. Role-model	0.26***	0.33	0.58***	0.73	0.40**	0.41	- 0.16**	0.25	0.30*	0.36
<b>Abilities</b>										
Confidence in performance	0.19***	0.41	0.31***	0.70	0.40***	0.71	- 0.06	0.24	0.22**	0.48
Confidence in continuation	0.27***	0.51	0.32***	0.78	0.48***	0.72	- 0.02	0.12	0.28***	0.49
<b>Self-regulation</b>										
Action control	0.05	0.05	0.31**	0.30	0.70***	0.77	- 0.63***	0.88	- 0.18	0.14
Action plan	0.80***	0.50	0.03	0.02	0.46**	0.38	0.38*	0.25	2.13***	1.45
Coping plan	0.08**	0.24	0.13**	0.31	0.04	0.10	- 0.01	0.06	0.39***	1.34
Remembering	0.04	0.05	0.08	0.08	0.51***	0.55	- 0.87***	0.79	0.30**	0.36
Lazy	- 0.09	0.07	0.40*	0.27	- 0.77***	0.55	1.01***	0.79	- 0.31	0.24
Commitment	0.39***	0.57	0.37***	0.58	0.44***	0.45	0.02	0.08	0.71***	0.99

\* $p \leq 0.05$ , \*\* $p \leq 0.01$ , \*\*\* $p \leq 0.001$ .

becoming sick if they do not wash their hands with soap and water before handling food (Risk factors: vulnerability (1). Similarly, in Camp 8E, participants with less habitual handwashing behaviour do not think that the risk of becoming sick is high if they do not wash their hands properly with soap and water (Risk factors: vulnerability (2). People with less habitual handwashing behaviour in Camp 2E also think that the impact on their life of becoming sick from not washing hands properly is not so severe (Risk factors: severity). The population in Camp 8E and Camp 2E who washed their hands less habitually think that washing hands with soap and water does not make them germ free (Attitude factors: germ free). For the population in Camp 8E and Camp 26 with less habitual handwashing behaviour, washing hands with soap and water was quite time-consuming (Attitude factors: time-consuming). People with less habitual handwashing behaviour in Camp 8E, Camp 26, and Camp 2E did not like the smell of soap on their hands after washing (Attitude factors: smell of soap). In Camp 2E, participants who washed their hands less habitually did not feel clean after washing hands with soap and water before handling food (Attitude factors: feeling clean). In Camp 8W, participants with less habitual handwashing behaviour did not feel comfortable after washing hands with soap and water (Attitude factors: feeling comfortable). People in Camp 8W and 8E who washed their hands less habitually had washed their hands more only with water but without soap (Self-regulation factors: action control). People in Camp 8W and Camp 26 with less habitual handwashing behaviour did not have a plan to cope with barriers for handwashing (Self-regulation factors: coping plan). People who washed their hands less habitually also forget to wash their hands with soap and water (Self-regulation factors: remembering). This was true for people in Camp 8E and Camp 2E. People in Camp 8E with less habitual handwashing behaviour agreed that they are sometimes too lazy to wash their hands with soap and water (Self-regulation factors: lazy) (Table 3).

## DISCUSSION

In this study, we used the RANAS model to identify the potential psychosocial factors of handwashing behaviour among the Rohingya refugees in Bangladesh. Then we designed behaviour change interventions accordingly using the RANAS approach (Table 4). Behaviour change techniques (BCTs) can influence or redirect the process that controls a behaviour, and should therefore be included as part of intervention planning. The designed BCTs against each psychosocial factor were derived from the catalogue of BCTs provided in the RANAS guideline (Mosler & Contzen 2016).

For the whole sample, the behaviour change interventions were designed to address health knowledge (risk factor), liking of handwashing and disgust (attitude factors), others' behaviour and personal importance (norm factors), confidence in performance and continuation (ability factors), and action planning and commitment (self-regulation factors). RANAS factors such as vulnerability, severity, beliefs about cost and benefit, feelings (smell of soap, feeling lazy, and comfortable), action control, remembering, or coping plan, were considered individually for different camps (Table 4). This will help the policy makers (camp authority, implementing partners, etc.) in the camp to design their hygiene promotion programmes in order to improve handwashing practices.

The results show that the self-reported habit of handwashing (doers) among the study participants was high in the whole sample as well as in individual camps. The results in this study also show that participants with low self-reported handwashing habit had low levels of perceived health risk (knowledge of diarrhoea) (Risk factor: health knowledge). Evidence also suggests that increasing awareness of handwashing importance and increasing hygiene knowledge improves proper handwashing practices (O'Reilly *et al.* 2008; Patel *et al.* 2012; Saboori *et al.* 2013). Therefore, WASH implementing agencies in the surveyed camps can design hygiene promotion activities considering the following psychosocial factors identified in this study and behaviour change techniques to address each individual factor.

Two attitude factors, liking handwashing and feeling of disgust, were significant predictors of handwashing for doers. Participants who felt less disgusted at not washing hands with soap and water washed their hands less habitually. A study conducted in Haiti and Ethiopia had similar findings where people tended to wash their hands more frequently than others when they believed that it is disgusting not to wash their hands after defecation or before preparing food (Contzen *et al.* 2015). The importance of disgust in triggering handwashing is also reported in many other studies (Porzig-Drummond *et al.* 2009; Aunger *et al.* 2010). To address those factors, WASH agencies can find role models who wash their hands at key times and ask them to share their positive feelings and experiences, and share why and how they washed their hands and why it is important for everyone. The idea is to evoke emotions among the non-doers of handwashing. These interventions can be delivered through community group meetings and mosque-based discussion at camps (Table 4).

**Table 4** | Behaviour change interventions

RANAS block	RANAS factors	Interventions	Communication channels
Risk	Vulnerability	Demonstration of risk if anyone doesn't wash their hands properly (BCT 3) <i>Specific for Camp 8W and Camp 8E</i>	Community meeting with video or storytelling
	Severity	Provide threatening information and severity of contracting a disease if they do not wash hands properly (BCT 4) <i>Specific for Camp 2E</i>	
	Health knowledge <sup>a</sup>	Short information about washing hands properly at key times (BCT 1 & 2)	Mosque-based discussions
Attitude	Beliefs about costs and benefits (germ-free)	Handwashing demonstration to show how hands get germ free, provide information about costs and benefits of handwashing (BCT 5) and reward a person each time he or she performs handwashing and makes it germ-free (BCT 6). <i>Specific for Camp 8E, Camp 26, and Camp 2E</i>	Community meeting with video or storytelling
	Beliefs about costs and benefits (time-consuming)	Invite participants to talk to others about how handwashing saves time and health (BCT 7). <i>Specific for Camp 8E and Camp 26</i>	
	Feelings <sup>a</sup>	Find people who already wash their hands at key times. Those role models shall talk about their positive experiences with washing hands properly at key times, why and how they do it and why it is good for everyone to do it. <b>Evoke emotions.</b> Message: I feel clean and comfortable when washing hands at key times with soap and water, I feel disgusted when not washing hands properly (BCT 8).	Community meeting, mosque-based discussions
Norm	Others' behaviour <sup>a</sup>	Find parents or other family members who already wash hands properly at key times. Emphasize women as they do not have the same access as men to a mosque (BCT 9). Make people commit to handwashing in public (BCT 10).	Community meeting, mosque-based discussions
	Others' (dis)approval <sup>a</sup>	Important leaders and authority figures like the Imam and the Majhi talk about washing hands properly at key times in a positive way and express that they approve of it. They tell parents how important it is to help their children and elderly to wash hands properly at key times (BCT 11).	Community meeting, mosque-based discussions
Ability	Confidence in performance <sup>a</sup>	Spot check: observation and joint monitoring at the handwashing site and support the community to set up infrastructure (BCT 16). Demonstrate handwashing and prompt participants to pay attention to others' performing the behaviour and its consequences in their everyday life (BCT 17). Train participants on handwashing through guided practice and giving feedback (BCT 18 & 19).	Household visits, community meeting with video or storytelling
	Confidence in continuation <sup>a</sup>	Prompt participants that failures to wash hands at key times are a temporary lack of skill or adverse circumstances instead of personal deficiency and their successes are personal achievements.	Household visits
Self-regulation	Action control	Prompt participants to monitor their own behaviour by means of recording it (BCT 27) and provide feedback on performance (BCT 28). <i>Specific to Camp 8W, Camp 8E, and Camp 26</i>	Household visits
	Action plan <sup>a</sup>	Prompt participants not only to do handwashing, but also when, where and how they intend to achieve their goals (BCT 26)	
	Coping plan	Invite role models who already wash hands properly at key times to talk about their positive experiences and give recommendations about problem solving then ask participants to identify their barriers and plan for solutions	Mosque-based discussion, community meeting

(Continued.)



Table 4 | Continued

RANAS block	RANAS factors	Interventions	Communication channels
	Remembering	(BCT 30). <i>Specific for Camp 8W and Camp 2E</i> Prompt to remember handwashing at key times. Show compassion for how difficult it is to remember each key time when washing hands properly is really important. Introduce a bracelet with handwashing images. Explain each image as a key time to wash hands properly (BCT 34). <i>Specific for Camp 8E, Camp 26, and Camp 2E</i>	Household visits
	Lazy	Prompt participants to exploit environmental cues so as to trigger handwashing in the right situation (BCT 34). <i>Specific for Camp 8E and Camp 26</i>	
	Commitment <sup>a</sup>	Behavioural contract to wash hands properly at key times (BCT 36).	

BCT, behaviour change technique.

<sup>a</sup>Interventions designed for the whole sample.

Multiple norm factors were of significant importance to predict handwashing behaviour. People who washed their hands less habitually also believed that a significant number of people in their community and relatives were also less likely to wash their hands. Similar conclusions were drawn in many other different types of studies (Judah *et al.* 2009; Auger *et al.* 2010; World Bank 2012; Contzen *et al.* 2015). Participants with high handwashing habits also believed that washing hands with soap and water makes a person respected and a role model in their community. The potential behaviour change interventions to address the norm factors are to find family members or relatives who wash their hands at key times and ask them to share their experiences in front of the community. People should also make commitments in public that they would wash their hands regularly. Community leaders (Imam and Majhi) and other authority figures should also share their positive experience about handwashing and express that they approve of handwashing by the community members (Table 4). Implementing partners can use those techniques through community meetings and mosque-based discussion as a channel of communication.

Two ability factors had significant mean difference between the doers and non-doers. Participants who washed their hands more habitually were also confident to wash their hands at all times. The result was in line with the findings of a study conducted in Haiti and Ethiopia (Contzen *et al.* 2015). Confidence in maintaining handwashing behaviour even during busy days or with impediments was high among the doers in this study. It is also evident that certain impediments or access influence handwashing habits (World Bank 2012). Spot check observations of handwashing infrastructure, handwashing demonstration publicly, guided handwashing practice and giving feedback through hygiene promoters are some of the interventions to address those ability factors. The WASH actors in the camps can deliver those interventions by household visits, community meetings, video or storytelling (Table 4).

Two self-regulation factors, action planning and commitment, were of significant importance to predict handwashing habits among doers and non-doers for the whole sample. Participants who had more plans for handwashing tended to wash hands more habitually. Action planning was also a predictor of effective handwashing techniques in a study in Zimbabwe (Friedrich *et al.* 2017). Participants who had high handwashing habits were also more committed to handwashing with soap and water. This finding was in accordance with another relevant study conducted in Haiti and Ethiopia (Contzen *et al.* 2015). In order to help participants with planning and committing towards handwashing, WASH agencies prompt community members not only to wash hands but also to plan when, where and how they intend to achieve this goal. Hygiene promoters can also ask for a behavioural contract of handwashing from the community members. The above-mentioned interventions can be delivered through household visits (Table 4).

Looking at the individual camps, we have identified other psychosocial factors of significant importance among the doers and non-doers. For example, lower perceived vulnerability to diarrhoea was found among the non-doers in Camp 8W and Camp 8E which is also a significant determinant for handwashing technique in a study in Zimbabwe (Friedrich *et al.* 2017). To address the vulnerability in both of the camps, hygiene promoters can demonstrate the risk if anyone does not wash their hands properly. The channel of communication could be community meeting, video or storytelling (Table 4). In Camp 8W and Camp 2E,

participants who had plans to deal with obstructions washed their hands more habitually (Self-regulation factor: coping planning). Similarity was also observed in another study (Contzen *et al.* 2015). To address coping planning among the community members, hygiene promoters can invite role models in the community who already wash their hands at key times to talk about their positive experiences and give recommendations about problem solving for handwashing. Then they can also ask the community members to talk about their barriers and help them to plan and find solutions. This intervention can be delivered through mosque-based discussion or community meetings in those camps. Participants with handwashing habits in Camp 8E, Camp 26, and Camp 2E stated that they remember to wash hands even when they are in a rush. Similar findings were also observed in a study in Haiti and Ethiopia (Contzen *et al.* 2015); though the finding is opposite in Camp 26 (negative mean difference), where participants with less handwashing habits tend to remember to wash hands even when they are in a hurry. In many cases, we have observed different findings in Camp 26, which is difficult to explain (negative mean difference between doers and non-doers) (Table 3). A possible explanation could be that the Rohingya population in Camp 26 live nearby the registered camp, which was established approximately 30 years ago, and have embraced the habits of people from that camp, or they may have arrived in Bangladesh long ago (approximately 30 years), therefore they have adapted their behaviour in a different way or are less attentive to the promotional activities, unlike the new arrivals.

It is therefore recommended to the WASH implementing agencies working in those Rohingya camps to tailor their hygiene promotion activities for handwashing following the above identified psychosocial factors and proposed interventions targeting the non-doers of handwashing. The listed communication channel would help to deliver the interventions which were finalized following a discussion with the hygiene promoters working in the camps. WASH agencies working in other camps can also use these findings and interventions, and tailor their activities, as all camp populations live in the same context and mostly share similar socio-economic conditions, cultural values, and similar levels of service from the national and international organizations providing services in the camps. The WASH sector can also use the findings as evidence and recommend the designed interventions as a sector-wide approach for handwashing in a hygiene promotion strategy.

## LIMITATIONS

There was no similar study found in this context; therefore, we could not compare our results. We designed this survey in a cross-sectional manner, meaning the results do not signify causality. Most of the results shown in this study were self-reported behaviours of participants and therefore should be considered with caution. Evidence shows that self-reported handwashing behaviour overestimates when compared to the actual observations (Curtis *et al.* 1993; Manun'Ebo *et al.* 1997). The use of a long questionnaire for the interview was another limitation. However, field practice made the interviewers familiar with all questions and they were able to save time. However, selecting interviewers from the local host community who are familiar with the local dialect, training, and pre-testing of the questionnaire encountered this issue.

## CONCLUSIONS

We observed high frequency of self-reported handwashing habit among the surveyed participants. Health knowledge, liking handwashing, feeling disgusted, beliefs about cost and benefits, personal importance, confidence in performance and continuation, action plan, and commitment are the potential psychosocial factors determining handwashing behaviour for the whole sample. These factors should be considered in handwashing promotional events. The proposed behaviour change interventions in this study will guide the service providers to implement handwashing programmes using different communication channels to improve sustainable handwashing practices along with adequate infrastructure and supplies.

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## ETHICAL APPROVAL

This study was a part of the UNICEF hygiene promotion intervention project entitled 'Integration of Risks, Attitudes, Norms, Abilities, and Self-Regulation (RANAS) methodology for behaviour change in Hygiene Promotion approaches in the WASH Rohingya response: Analysis, testing and evaluation'. The project obtained ethical approval from the Institutional Review

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## DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

## CONFLICT OF INTEREST

The authors declare there is no conflict.

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