

Impact of different promotional channels on handwashing behaviour in an emergency context: Haiti post-earthquake public health promotions and cholera response

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Abstract

Aim In a disaster context, where risk for diarrhoeal disease is elevated, personal hygiene, i.e. handwashing with soap, is especially relevant. However, to date, the promotion of hygiene in an emergency context has not been adequately addressed in the literature. The aim of the present study is to evaluate the effectiveness of hygiene promotions in post-earthquake Haiti.

Subject and Methods Cross-sectional data was collected by means of structured interviews in camps and neighbourhoods in which three affiliates of a well-known relief organisation had conducted hygiene promotions. Primary caregivers were targeted. A total sample of 811 was obtained. Data was analysed using multiple linear regression and mediation analysis.

Results Analysis revealed six promotional channels with positive associations with handwashing behaviour: hygiene radio spots, radio programs with experts answering listener's questions, material distributions with instructions for use, information from friends or neighbours, hygiene theatres, and community clubs. However, five of the promotional channels were negatively related with handwashing. Respondents who experienced a focus group, stickers, posters and paintings, hygiene songs, special hygiene days and home visits tended to wash their hands less often.

Conclusions By revealing positive but also negative associations between hygiene promotions and handwashing behaviour, the study underlines the need to apply theory-driven emergency hygiene promotions which are subjected to in-depth evaluation. Only through doing this, is it ensured that effective hygiene promotions are implemented for the most vulnerable people—those affected by a humanitarian disaster.

Keywords Handwashing with soap · Diarrhoea · Hygiene Promotion · Communication Channels · Emergency · Haiti

Introduction

On January 12, 2010, a 7.0 magnitude earthquake hit Haiti and killed an estimated 220,000 people and injured 300,000 (PAHO/WHO 2011). Around 1.5 million people found themselves homeless and had to move to spontaneously raised campsites in and around Port-au-Prince. The crowded living conditions brought about by the displacement, the disruption of the poor water and sanitation infrastructure, and the thereby prevented adequate personal hygiene, aggravated the risk of diarrhoeal disease, as is usually the case during humanitarian disasters (regarding the spread of diarrhoea after disasters see Linscott 2007; Waring and Brown 2005; Watson et al. 2007; WHO 2002). More precisely, cholera broke out in October 2010, spread to all 10 provinces of Haiti, causing 653,789 cholera cases and 8,066 fatalities (case report from April 14 2013, MSPP 2013).

Diarrhoeal disease, including cholera, is transmitted primarily via the faecal-oral route. Since hands are the main vector, the single most effective preventative measure is one of the simplest and cheapest: handwashing with soap¹ at key times (Curtis et al. 2000; Curtis et al. 2011). Consequently, to combat the aggravated risk of diarrhoeal disease during disasters, the promotion of handwashing is an essential part of nearly every emergency relief. Thus, many relief organisations responded to the Haiti earthquake with handwashing promotions, which were scaled up after the cholera outbreak. The promotions were often based on recommendations by the WASH² Cluster Haiti (DINEPA and UNICEF 2011).

¹ For simplicity, in the following text “handwashing” stands for handwashing with soap.

² Water, Sanitation and Hygiene

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Similar hygiene promotions have been used globally in various emergency situations inasmuch as the Global WASH cluster has attempted to standardise the approaches. Surprisingly, despite their wide use and standardisation efforts, the effectiveness of emergency hygiene promotions has not been adequately evaluated thus far. Instead, much of the evidence base is drawn from hygiene interventions in the development sector (Banatvala and Zwi 2000; Moss et al. 2006; Parkinson 2009). However, to ensure that the handwashing promotions applied during emergencies are effective, these promotions must be studied in exactly this context.

Furthermore, to our knowledge, there are only two studies testing the effectiveness of different communication channels in changing handwashing behaviour (Pinfold 1999; Scott et al. 2008).

This paper reports results from a cross-sectional study analysing handwashing promotions implemented by three affiliates of a relief organization in post-earthquake Haiti. The overall objective of the study was to assess the effectiveness of handwashing promotions using different communication channels within an emergency context.

Explaining behaviour change

Effective hygiene promotions change unhealthy, unhygienic behaviour into healthy, hygienic behaviour. Behaviour change rests on changing behavioural factors within the individuals. Consequently, those hygiene promotions which affect the critical behavioural factors are most effective in changing behaviour. While various models of behaviour change suggest a multitude of potential behavioural factors, so far there is no agreement about which factors determine handwashing behaviour (Biran et al. 2009; Coombes and Devine 2010; Curtis et al. 2011).

Recently, a new model of behaviour change was proposed, the Risk, Attitudes, Norms, Abilities, and Self-regulation of behavioural change model (RANAS model; Mosler 2012), which integrates the behavioural factors proposed by major theories of behaviour change such as the Health Belief Model (Rosenstock 1974), the Protection Motivation Theory (Floyd et al. 2000), or the Theory of Planned Behaviour (Fishbein and Ajzen 2010), into a comprehensive model. These factors can be neatly classified into five factor blocks: risk factors, attitude factors, norm factors, ability factors, and self-regulation factors. A description of the five factor blocks can be found in Table 1.

Being explicitly designed for the WASH sector in developing countries, the RANAS model constitutes a good basis to explore factors determining handwashing behaviour in an emergency context.

By applying the RANAS model, this study aimed to answer the following research questions:

- How was the reach of the communication channels and how were they assessed by the target population?

- Which behavioural factors influence handwashing with soap in which situations?
- Which communication channels impact which behavioural factors, and influence handwashing with soap through these factors? How strongly?

Methods

Procedure

Data was collected during 5 weeks over May and June 2011 by means of structured face-to-face interviews with the primary caregiver in a study household. Households were recruited from camps and neighbourhoods within which three affiliates of a well-known relief organisation had conducted hygiene promotions as part of their earthquake and/or cholera response. The study area was restricted to the metropolitan area of Port-au-Prince, and the nearby rural areas of Léogâne, Gressier, and Petit, and Grand Goâve. While these were the only areas where the affiliates worked during the earthquake response, during the cholera response they extended their work to additional areas in northern and southern Haiti. Due to logistical reasons these more distant areas in the north and south were not considered within this study. In total, data was collected from 20 sites. Within a site, every third household was chosen for interviewing using a modified random route sampling (Hoffmeyer-Zlotnik 2003). For that, each site was subdivided into 10 areas to which the interviewers were randomly assigned to. In each area one house was randomly selected as a starting point and the assigned interviewer was instructed to try to interview every third household when walking in a specified direction. Thirty-nine households refused to take part in the interview (4.88 %). Primary caregivers were interviewed as they are responsible for childcare and food preparation, and thus have the highest chance of passing on diarrhoeal disease to other family members. The interviews were carried out in Créole by a team of 10 local students and scientists. The team was trained in interviewing techniques in a workshop prior to data collection, and was supervised during data collection by researchers and a field assistant. Each interview took around 45 minutes. All subjects provided informed consent.

Sample

A total sample size of 811 was achieved with the majority of study households being located in Port-au-Prince ($n=528$) and a smaller sub-sample stemming from the rural areas ($n=283$). Interviewees' ages ranged between 15 and 90 years ($M=34.68$; $SD=12.90$). In terms of gender, 713 (88 %) of the respondents were female and 98 were male. While nearly half of the sample did not finish primary school ($n=395$,

Table 1 Overview of the factor blocks specified in the RANAS model (Mosler 2012)

Factor block	Description
Risk factors	Perceived susceptibility and perceived severity of contracting a disease, and factual knowledge about the possibility of being affected by a potential contamination
Attitude factors	Instrumental beliefs about costs and benefits of the targeted behaviour, as well as affective beliefs, i.e. feelings arising when thinking about the behaviour
Norm factors	Different social influences: descriptive norms (behaviours typically performed by others), injunctive norms (behaviours typically approved or disapproved by others) and personal norms (personal standards about what should be done)
Ability factors	People's perception to perform a behaviour (perceived behavioural control) and the confidence in one's ability to organize and manage the targeted behaviour (self-efficacy)
Self-regulation factors	Help to manage conflicting goals and distracting cues when intending to implement and maintain a certain behaviour

49 %), almost a quarter did not go to school at all ($n=193$, 24 %). The mean income per person per day of $M=1.07$ US\$ was slightly below the poverty line of 1.25 US\$ (Ravallion et al. 2009).

Questionnaire and measures

The questionnaire on which the interviews were based covered socio-demographic characteristics, self-reported handwashing behaviour, behavioural factors as attitudes and beliefs, and recalled promotional activities and attitudes towards them. A pre-test verified the applicability of the questionnaire ($N=20$).

Handwashing at key times Handwashing at key times was measured by means of self-reports using 5-point Likert scales. Surveyed key times corresponded to the promoted key times, namely handwashing after defecation, after wiping a child's bottom, after other kinds of contact with faeces, before eating, before preparing food, before feeding a child, and before handling water. Exploratory factor analysis proved that two different handwashing situations are distinguishable, faeces- and food/water-related handwashing. While the former subsumes handwashing after defecation, wiping a child's bottom and other kinds of contact with faeces, the latter incorporates handwashing before eating, preparing food, feeding a child, and handling drinking water. Two mean scores were computed to represent the two factors (Cronbach's alpha $\alpha = .76$ and $\alpha = .81$, respectively). The promotions' effectiveness was tested separately for faeces- and food/water³-related handwashing.

Behavioural factors The factors described in Table 1 were measured according to suggestions in the RANAS approach

(Mosler 2012). For each determinant, one or several items were included into the questionnaire. Sample items, means and standard deviations are displayed in Table 2. If several items were used, these were in most cases combined to summary variables to facilitate the analyses (see Table 2 for item numbers and Cronbach's alpha). Furthermore, 9-point Likert scales ranging from -4 to $+4$ were used to measure bipolar variables and 5-point Likert scales ranging from 0 to 4 were used to measure unipolar variables.

Promotional channels Experience of promotional channels was surveyed by self-reports using a dichotomous format, experienced versus not experienced (see Table 3 for an overview). In addition, attitudes towards experienced promotional activities were measured by items capturing liking, convincingness, and trustworthiness.

Data analysis procedure

First, promotional activities were examined regarding their evaluation using one-way ANOVA and Tukey post-hoc comparisons.

Regression of handwashing on behavioural factors was inspected to select factors relevant in explaining handwashing. Only those factors with significant regression weights within multiple linear regression analyses were included in subsequent mediation analyses. Behavioural factors were entered into the regression model by forced-entry, which means that all factors were entered simultaneously.

Within mediation analyses the direct and indirect effects of promotional activities on handwashing behaviour were tested. Indirect effects are the influences of a promotional activity on behaviour via behavioural

³ For simplicity, in the following text food-related handwashing stands for food- and water-related handwashing.

Table 2 Overview of the behavioural factors: items, means, standard deviations and Cronbach's alphas for scales

Behavioural factor group	Behavioural factor	Questions	Range	<i>M</i>	<i>SD</i>	α
Risk factors	Perceived vulnerability (1 item)	How high or low do you feel are the chances that you or someone in your family gets cholera?	–4–4	–2.08	1.91	–
	Perceived cholera severity (3 items)	Imagine that you contracted cholera, how severe would be the impact on your life in general?	0–4	2.62	0.90	.85
	Health knowledge (4 items)	What are the effects of cholera on your body?	0–4	1.12	0.37	.64
Attitude factors	Instrumental beliefs					
	Efforts (4 items)	Do you think that washing hands with soap is time-consuming?	0–4	0.76	0.66	NA
	Response efficacy (1 item)	How certain are you that washing hands with soap after defecation and before handling food prevents you and your family from getting diarrhoea or cholera?	0–4	3.17	0.70	–
	Attractiveness (1 item)	I feel more attractive when I have washed my hands with perfumed soap	–4–4	1.68	2.42	–
	Nurture: Teaching and caring (3 items)	It is important to teach the children to wash their hands with soap	–4–4	2.93	0.75	NA
	Return (1 item)	Considering all the benefits and efforts related to washing hands with soap, how much do you think is it worthwhile for you to wash hands with soap?	–4–4	2.47	1.57	–
	Affective beliefs					
	Liking and pleasantness (2 items)	How much do you like or dislike washing hands with soap?	–4–4	2.95	0.73	.55
	Soap attributes: Smell (1 item)	How much do you like or dislike the smell of the soap?	–4–4	2.55	1.26	–
	Disgust (3 items) – faeces	I feel dirty and smelly if I don't wash my hands with soap after visiting the toilet	–4–4	2.59	1.16	NA
	Disgust (2 items) – food	I wash my hands with soap before handling food because it would be disgusting to get dirt into the food and then eat it	–4–4	2.51	1.26	NA
	Attitude towards cholera patients (1 item)	What do you think of people who have cholera?	–4–4	–0.71	1.97	–
	Norm factors	Descriptive norm family (1 item) – faeces	How many people of your relatives wash hands with soap after contact with stool?	0–4	3.62	0.76
Descriptive norm family (1 item) – food		How many people of your relatives wash hands with soap before handling food?	0–4	3.59	0.82	–
Descriptive norm community (1 item) – faeces		How many people of your community wash hands with soap after contact with stool?	0–4	2.21	1.21	–
Descriptive norm community (1 item) – food		How many people of your community wash hands with soap before handling food?	0–4	2.16	1.18	–
Injunctive norm (2 items) – faeces		Most of the people who are important to me think I should wash my hands with soap after contact with stool	–4–4	2.01	1.14	.87
Injunctive norm (2 items) – food		Most of the people who are important to me think I should wash my hands with soap before handling food	–4–4	1.99	1.14	.89
Personal norm (2 items) – faeces		I feel a strong personal obligation to wash hands with soap after contact with stool	–4–4	2.75	1.27	.72
Personal norm (2 items) – food		I feel a strong personal obligation to wash hands with soap before handling food	–4–4	2.70	1.35	.79
Compliance mobilizers (1 item)		I wash my hands with soap because that is what the hygiene mobilizers told us	–4–4	2.13	1.98	–
Ability factors	Self-efficacy (2 items) – faeces	How difficult or easy is it to always wash hands with soap after contact with stool?	–4–4	3.09	0.67	.65
	Self-efficacy (2 items) – food	How difficult or easy is it to always wash hands with soap after contact with stool?	–4–4	3.05	0.74	.69
	Maintenance self-efficacy					
	General hindrance (1 item)	How often does it happen that you want to wash hands with soap but are hindered in doing so?	0–4	0.88	0.96	–
	HW-station out of order (2 items)	How often does it happen that the hand washing station is damaged?	0–4	0.71	0.84	.65
	No water or no soap (2 items)	How often does it happen that there is no soap available at the hand washing station?	0–4	1.54	0.92	.67
Recovery self-efficacy (1 item)	Imagine you have stopped washing hands with soap for several days. How confident are you to start washing hands with soap again?	0–4	3.11	0.51	–	

Table 2 (continued)

Behavioural factor group	Behavioural factor	Questions	Range	<i>M</i>	<i>SD</i>	α
Self-regulation factors	Forgetting (1 item) – faeces	How often does it happen that you forget to wash hands with soap after contact with stool?	0–4	0.70	1.02	–
	Forgetting (1 item) – food	How often does it happen that you forget to wash hands with soap before handling food?	0–4	0.99	1.03	–
	Control planning: detailed plan (2 items) – faeces	Have you made a detailed plan regarding how to avoid forgetting to wash hands with soap after contact with stool?	0–4	2.51	0.85	.80
	Control planning: detailed plan (2 items) – food	Have you made a detailed plan regarding how to avoid forgetting to wash hands with soap before handling food?	0–4	2.46	0.87	.78

Note. $N=745$. *NA* not applicable: items are that divers that a joint variance is not expected and thus Cronbach's alphas are not applicable. Still, the items were combined to scales due to theoretical reasons.

factors. An indirect effect is obtained by multiplying the influence a promotional activity has on a single behavioural factor with the influence that this single behavioural factor has on handwashing. Mediation analyses were realised applying the indirect method by Preacher and Hayes (2008).

Results

Reach and respondents' evaluation of the communication channels

Sixteen different communication channels promoted handwashing based on recommendations by the WASH Cluster Haiti (DINEPA and UNICEF 2011; HP sub-cluster Haiti 2010; see Table 3 for an overview of the communication channels). While the WASH Cluster Haiti has recognised that knowledge alone is not sufficient to change behaviour, the recommended hygiene promotions were still built mainly on knowledge formation by explaining the chain of contamination, handwashing key times, and/or good and bad behaviour (DINEPA and UNICEF 2011). Top-down information channels were used, as were interactive, bottom-up activities that foster mutual learning and self-help. Exemplary promotional messages were “sante'w depann de men'w ki pwòp (health depends on clean hands)” or “lave men pwoteje lavi (wash hands, protect life)”.

Table 3 displays the reach of the communication channels within the sample. The channel with the highest reach was the radio spot with a reach of 92 %. Stickers, posters and paintings with a reach of 76 % and information spread by megaphone with a reach of 73 % were the activities with second and third highest reach. At the other side of the scale were quizzes with a reach of only 16 %, followed by radio program (28 %), cinema shows (31 %), and theatres (34 %).

Respondents were asked to evaluate the experienced communication channels regarding liking, convincingness,

and trustworthiness.⁴ While all the communication channels were positively evaluated there are some differences in the magnitude.

A one-way ANOVA revealed that liking differed significantly across the communication channels, $F(13, 1699)=7.19$, $p\leq.000$.⁵ Table 4 shows that respondents favoured hygiene trainings, radio spots, and cinema shows most. Least favoured were focus groups, and stickers, posters, and paintings. Tukey post-hoc comparisons indicated that information from neighbours or friends ($M=3.07$, 95 % CI [3.02, 3.12]), along with the more favoured promotional activities, was significantly more liked than stickers, posters, and paintings ($M=2.94$, 95 % CI [2.89, 3.00]), or focus groups ($M=2.91$, 95 % CI [2.84, 2.98]), $p<.05$. Further, hygiene days ($M=2.99$, 95 % CI [2.94, 3.05]) were significantly less liked than radio spots ($M=3.14$, 95 % CI [3.10, 3.18]) and hygiene trainings ($M=3.15$, 95 % CI [3.09, 3.21]), $p<.05$.

Convincingness also differed significantly across the communication channels, $F(13, 1701)=7.87$, $p\leq.000$. Radio spots were rated as the most convincing communication channel, followed by hygiene trainings and radio programs (see Table 4). Least convincing were focus groups, followed by stickers, posters, and paintings, and hygiene days. Tukey post-hoc comparisons showed that information from neighbours or friends ($M=2.99$, 95 % CI [2.94, 3.04]), along with all higher rated communication channels, was significantly more convincing than stickers, posters, and paintings ($M=2.83$, 95 % CI [2.76, 2.89]), or focus groups ($M=2.80$, 95 % CI [2.72, 2.88]), $p<.05$. Further, hygiene days ($M=2.93$, 95 % CI [2.86, 2.99]) were significantly less convincing than radio spots ($M=3.08$, 95 % CI [3.04, 3.13]), $p<.05$.

⁴ Hygiene songs were not evaluated regarding liking, convincingness, and trustworthiness.

⁵ For all one-way ANOVA results, Welch's *F*-ratios are reported.

Table 3 Overview promotional activities and percentage of people who experienced the activity

Promotional activity	Description	% exp.
Radio spot	First step intervention tool to spread information as quickly as possible to as many persons as possible. Created, coordinated and managed by the Ministère de la Santé Publique et de la Population, Haiti in collaboration with relief organisations. Applied primarily after the cholera outbreak. Popular radio channels were identified and spots about hand washing and cholera were aired. Main goal: information/education	92 %
Radio program	First step intervention tool to spread information as quickly as possible to as many persons as possible. Interactive program with an expert from the relief organisation under study which answered listeners' questions. Main goal: information/education	28 %
Information spread by megaphone	First step intervention tool to spread information as quickly as possible to as many persons as possible. Sometimes only top down information, sometimes interactive with questions and answers. Main goal: information/education and mobilization	73 %
Group discussion/ Community reunion	Group activity with 10–12 persons of differing target (adults, children, women, men). Important tools: picture cards used for “three-pile-sorting”, chain of contamination and analysis of problem; questions and answers; brain storming etc. Goals: Discuss (remaining) questions, deepen understanding, and explore beliefs	56 %
Hygiene training	2-3 day training initially with head of household, later with other target groups. Includes several activities as group discussions, role plays, educative films etc. and focuses on a specific topic. The third day is dedicated to practical demonstration of how to use the items in a hygiene kit. Attendance of the training is rewarded with a coupon which entitles to receive a hygiene kit	32 %
Home visit/face-to-face promotion	Second step intervention tool after mass promotion, group discussion, training sessions etc. Primary recipient is head of household. Tool: picture cards used for “three-pile-sorting”, chain of contamination and analysis of problem. Main goal: clarify remaining questions, education. Sometimes combined with distribution of soap, aquatabs, flyers etc.	67 %
Material distribution with demonstration	Mass distributions where the correct use of the material is explained, demonstrated and exercised. Main goal: distribute material and ensure correct utilization	51 %
Information from a neighbour/friend	Side benefit of any promotion tool where a promotion recipient shares the gained information with its neighbours/friends	61 %
Focus group	Reunion to discuss problems within the community, to get feedback to the promotions, to assess knowledge, behaviour and attitude. Tool: questionnaires	40 %
Cinema show	Screening of educative films about health issues, sometimes in connection with a meeting. Main goal: information/education	34 %
Theatre	Plays with singing and dancing about hand washing, hygiene, chain of contamination etc. Played by professionals or lay persons (mobilizers, camp inhabitants, adults and children). In interaction with the audience which is asked questions and has to demonstrate behaviour. Sometimes only at special events like global handwashing day, sometimes without special occasion. Goal: Demonstrate good and bad behaviour	31 %
Special hygiene day	Special days that focus on a specific topic (hand washing, water consumption etc.) and apply a range of promotion tools as theatre, songs, quiz, demonstration sessions etc.	42 %
Quiz	Quiz about good and bad behaviour regarding hygiene, hand washing, cholera or diarrhoea. Sometimes with soap as a prize. Conducted during meetings and special events	16 %
Stickers/posters/paintings	Stickers, posters and paintings that inform about correct behaviour and health issues and serve as reminders. Hang up/painted at key places as latrines, hand washing station, water source etc.	76 %
Community club	Meetings of a specific target group (e.g. mothers) on a regular basis to discuss and solve problems and foster self-help	40 %
Hygiene songs	Songs about different health topics sang in the camps by megaphone, at meetings, at events, aired in the radio. Some provided by UNICEF, others created by the relief organisation under study and the communities. Goal: Spread information about good behaviour and as a reminder	50 %

Regarding trustworthiness, one-way ANOVA again revealed significant differences across the communication channels, $F(13, 1965)=10.50$, $p \leq .000$. Theatre was rated as the most trustworthy promotional activity, followed by cinema show and radio spot (see Table 4). Least trustworthy were focus groups, followed by stickers, posters, and paintings, and hygiene days. Tukey post-hoc comparisons depicted that information spread by megaphone ($M=2.86$, 95 % CI [2.81, 2.91]) along with all higher rated promotional activities was significantly

more trustworthy than stickers, posters, and paintings ($M=2.72$, 95 % CI [2.65, 2.79]), or focus groups ($M=2.69$, 95 % CI [2.60, 2.78]), $p < .05$. Further, hygiene days ($M=2.83$, 95 % CI [2.76, 2.90]) were significantly less trustworthy than radio spots ($M=3.01$, 95 % CI [2.96, 3.05]), cinema shows ($M=3.01$, 95 % CI [2.96, 3.07]), and theatres ($M=3.03$, 95 % CI [2.98, 3.07]), $p < .05$.

All in all, focus groups, hygiene days, and stickers, posters, and paintings were rated as less likable, less convincing, and less trustworthy than other promotional activities.

Table 4 Respondents' evaluation of the promotional activities

Promotional activity	Liking		Convincingness		Trustworthiness	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Radio spot	3.14 ^{a, c}	0.51	3.08 ^{a, c}	0.63	3.01 ^{a, c}	0.64
Radio program	3.10 ^a	0.66	3.08 ^a	0.73	3.00 ^a	0.79
Megaphone	3.01	0.52	2.93	0.66	2.86 ^a	0.65
Group discussion	3.03	0.59	2.94	0.72	2.88 ^a	0.69
Hygiene training	3.15 ^{a, c}	0.50	3.08 ^a	0.58	3.00 ^a	0.50
Home visit	3.11 ^a	0.47	3.05 ^a	0.55	3.01 ^a	0.49
Material distribution with demo	3.07 ^a	0.45	3.06 ^a	0.46	2.99 ^a	0.49
Info neighbour/friend	3.07 ^a	0.52	2.99 ^a	0.57	2.93 ^a	0.58
Focus group	2.91 ^b	0.64	2.80 ^b	0.75	2.69 ^b	0.81
Cinema show	3.13 ^a	0.52	3.03 ^a	0.56	3.01 ^{a, c}	0.49
Theatre	3.12 ^a	0.37	3.07 ^a	0.49	3.03 ^{a, c}	0.35
Special hygiene day	2.99 ^d	0.49	2.93 ^d	0.62	2.83 ^d	0.65
Quiz	3.05	0.47	3.02 ^a	0.52	2.96 ^a	0.54
Stickers, posters, paintings	2.94 ^b	0.67	2.83 ^b	0.80	2.72 ^b	0.87

Note: $N=129-745$

^a Differs at $p<.05$ in the Tuckey honestly significant difference comparison from means marked with b

^b Differs at $p<.05$ in the Tuckey honestly significant difference comparison from means marked with a

^c Differs at $p<.05$ in the Tuckey honestly significant difference comparison from means marked with d

^d Differs at $p<.05$ in the Tuckey honestly significant difference comparison from means marked with c

Influencing faeces-related handwashing

On average, respondents washed their hands frequently after contact with faeces with mean levels of $M=3.57$ ($SD=0.56$).

Forced-entry multiple linear regression analysis revealed that seven behavioural factors were associated with increased handwashing (see Table 7): return, response efficacy, pleasantness of perfume, disgust, descriptive norm of the community, self-efficacy, and coping planning. In addition, two behavioural factors were associated with decreased handwashing: general hindrance and, counterintuitively, health knowledge. These nine behavioural factors were selected to examine indirect and direct effects of promotional activities on handwashing by means of mediation analysis.

For mediation analysis the indirect method by Preacher and Hayes (2008) was used. Table 5 summarises the association of the communication channels with the behavioural factors, and their total indirect, direct, and total effects on faeces-related handwashing. Table 8 presents the results regarding the relationship between the selected behavioural factors and faeces-related handwashing.

Together, the behavioural factors and the communication channels explained 45 % of the variance in faeces-related handwashing. This corresponds to a population effect size of $f^2=.82$, which is a large effect (Cohen 1992).

When looking at the total effects, four communication channels were significantly associated with increased faeces-

related handwashing: radio spots, radio programs, material distributions, and information from neighbours or friends. Against expectations, three communication channels were associated with decreased faeces-related handwashing: focus groups, stickers, posters, and paintings, and hygiene songs. While most of the remaining nine communication channels (information spread by megaphone, group discussion, hygiene training, home visit, cinema show, theatre, special hygiene day, quiz, and community club) were significantly related with some of the behavioural factors, none had a significant total effect on faeces-related handwashing.

Further, none of the 16 communication channels was significantly associated with the behavioural factor "return". Additional promotional activities are needed to trigger this behavioural factor (see Discussion).

Influencing food-related handwashing

For food-related handwashing, the mean level of handwashing was again rather high with an average of $M=3.04$ ($SD=0.82$).

Eight behavioural factors were significantly associated with increased food-related handwashing (see Table 9): perceived severity, pleasantness of perfume, feeling attractive, family's descriptive norm, injunctive norm, self-efficacy, control planning, and, counterintuitively, hindrance due to impaired handwashing stations. In addition, four behavioural factors were associated with decreased handwashing:

Table 5 Mediation results: Effects of promotional activities on behavioural factors explaining faeces-related handwashing, and total indirect, direct and total effects of promotional activities on faeces-related handwashing

Promotional activity	Behavioural factors										Direct effects	Total indirect effects	Total effects
	Risk		Attitude		Norm		Ability		Self-regul.				
	Knowledge	Smell of soap	Resp. efficacy	Return	Disgust	Descr. norm	Self-efficacy	Hiindrance	Coping planning				
Radio spot	-0.01	0.17***	0.04	0.09	0.08	-0.02	-0.11***	-0.08*	0.09**	0.06, 95 % CI [0.02, 0.09]	0.00	0.06**	95 % CI [0.02, 0.10]
Radio program	0.01	0.01	0.04*	0.01	0.02	-0.02	0.01	0.02	-0.02	-0.00, 95 % CI [-0.01, 0.01]	0.04***	0.04***	95 % CI [0.02, 0.06]
Megaphone	0.02*	0.00	0.01	0.02	-0.05	-0.01	-0.01	0.03	-0.00	-0.01, 95 % CI [-0.02, 0.01]	-0.00	-0.01, 95 % CI [-0.02, 0.02]	
Group discussion	-0.01	0.01	0.05**	0.04	0.08**	-0.06*	0.02	-0.01	0.03	0.02, 95 % CI [-0.00, 0.03]	0.01	0.02, 95 % CI [-0.00, 0.05]	
Hygiene training	-0.01	0.04	-0.02	-0.02	0.02	0.04	0.02	-0.02	0.03	0.01, 95 % CI [-0.00, 0.03]	-0.01	-0.00, 95 % CI [-0.03, 0.02]	
Home visit	0.01	-0.10**	-0.02	-0.03	-0.03	0.02	-0.02	0.03	-0.01	-0.02, 95 % CI [-0.03, 0.00]	-0.00	-0.02, 95 % CI [-0.04, 0.01]	
Material distribution	-0.00	0.10***	0.04**	-0.00	0.02	0.06*	0.05***	-0.08***	0.08***	0.04, 95 % CI [0.02, 0.06]	0.00	0.04***	95 % CI [0.02, 0.06]
Info neighbour / friend	-0.02**	0.04	-0.02	0.03	0.06*	0.10***	0.07***	-0.06**	0.05**	0.04, 95 % CI [0.02, 0.05]	-0.01	0.03*	95 % CI [0.00, 0.05]
Focus group	0.03***	-0.08*	-0.00	-0.02	-0.07*	0.03	-0.06***	0.04	-0.06**	-0.03, 95 % CI [-0.05, -0.02]	-0.00	-0.04**	95 % CI [-0.06, -0.01]
Cinema show	-0.02**	0.03	0.01	-0.00	0.00	0.02	0.04*	-0.01	0.03	0.02, 95 % CI [0.00, 0.03]	-0.02	0.00, 95 % CI [-0.02, 0.03]	
Theatre	-0.01	0.04	-0.00	0.03	0.07*	0.04	0.01	-0.06**	0.05*	0.02, 95 % CI [0.01, 0.04]	0.00	0.03, 95 % CI [-0.00, 0.05]	
Special hygiene day	0.02*	-0.00	-0.02	-0.06	-0.04	-0.04	-0.04**	0.06**	-0.06**	-0.03, 95 % CI [-0.05, -0.01]	0.02*	-0.01, 95 % CI [-0.03, 0.02]	
Quiz	0.01	0.01	-0.01	-0.07	-0.00	0.01	-0.01	-0.00	-0.01	-0.01, 95 % CI [-0.03, 0.01]	0.02	0.01, 95 % CI [-0.02, 0.04]	
Stickers, posters, paintings	0.02*	-0.08*	0.01	-0.05	-0.00	-0.08**	-0.02	0.06*	-0.02	-0.02, 95 % CI [-0.04, -0.01]	-0.02	-0.04**	95 % CI [-0.06, -0.01]
Community club	-0.01	0.09**	-0.00	0.00	-0.01	0.07*	0.04*	-0.05*	0.05*	0.03, 95 % CI [0.01, 0.05]	-0.01	0.02, 95 % CI [-0.01, 0.04]	
Hygiene song	0.05***	-0.09**	0.00	-0.02	-0.09***	0.01	-0.09***	0.07***	-0.08***	-0.05, 95 % CI [-0.06, 0.03]	0.01	-0.04***	95 % CI [-0.06, -0.02]

Note. N=653. Displayed are unstandardized coefficients. * $p < .05$. ** $p < .01$. *** $p < .001$.

attitudes towards cholera patients, general hindrance, hindrance due to lack of soap or water, and forgetting. While these 12 behavioural factors were initially selected for further analyses, three of them lacked significance with-in mediation analyses: attitudes towards cholera patients, hindrance due to impaired handwashing stations, and hindrance due to lack of soap or water. Consequently, they were excluded from further analyses.

In Table 6, the association of the communication channels with behavioural factors and their total indirect, direct, and total effects on food-related handwashing are presented. Results regarding the relationship between the selected behavioural factors and food-related handwashing are shown in Table 10.

The communication channels together with the behavioural factors accounted for 61 % of the variance in food-related handwashing. The according population effect size is $f^2=1.56$. This is a large effect (Cohen 1992).

Regarding total effects, mediation analysis revealed five communication channels which were significantly associated with increased food-related handwashing: radio spots, material distributions, information from neighbours or friends, theatre, and community clubs. Counterintuitively, five significant associations with decreased food-related handwashing were revealed: home visits, focus groups, special hygiene days, and stickers, posters, and paintings. Of the remaining six communication channels (radio program, information spread by megaphone, group discussion, hygiene training, cinema show, and quiz), most were significantly related with at least one of the behavioural factors. However, none of them had a significant total effect on food-related handwashing.

Discussion

Summary and interpretation of the results

The present study is one of the first to investigate handwashing promotions in emergency relief. Herewith, a first step is taken towards establishing a much-needed evidence base for emergency hygiene promotions. Due to the lack of previous research, however, the study's results could not be compared with existing findings in this context. Instead, findings from other contexts served as reference for comparison.

The study aimed to specify which promotional activities are associated with which behavioural factors, and, accordingly, how strong their association is with faeces- and food-related handwashing in an emergency situation. In order to make these investigations, the first step was to determine the behavioural factors which explain faeces- and food-related handwashing in an emergency context.

Attitude factors appeared to be essential, particularly in explaining faeces-related handwashing; while pleasantness of perfume was associated with faeces- and food-related

handwashing, and attractiveness explained food-related handwashing, response efficacy, return, and disgust were relevant regarding faeces-related handwashing.

In terms of norms, the descriptive norm community was relevant in explaining faeces-related handwashing, while descriptive norm family and injunctive norm were important with regards to food-related handwashing.

With self-efficacy and hindrance being relevant regarding both types of handwashing, ability factors proved to be important too.

Of the self-regulation factors, only coping planning was revealed to explain faeces- and food-related handwashing.

Little support was found for the importance of risk factors: perceived cholera severity was relevant only regarding food-related handwashing. Health knowledge explained only faeces-related handwashing. Moreover, the latter association was even negative. While in previous research knowledge was never negatively associated with handwashing, results were mixed with some studies revealing positive associations and some indicating no association (e.g. Biran et al. 2009; Devine et al. 2012).

In terms of explained variance, the behavioural factors together with the promotional activities were somewhat more effective in explaining food-related handwashing. Still, with large effect sizes for faeces- and food-related handwashing, the amount of explained variance was satisfying regarding both behaviour types. All in all, the factors specified in the RANAS model seem to be adequate to explain handwashing behaviour in an emergency context.

In terms of promotional activities, for both types of handwashing, the most effective promotions were material distributions with demonstrations and radio spots. To our knowledge, thus far material distributions with demonstrations were not evaluated with regard to handwashing. However, a meta-analysis on HIV prevention interventions showed that condom provisions and behavioural skills trainings are very effective in changing behaviour (Albarracín et al. 2005). In addition to the positive effect of radio spots on both types of behaviour, radio programs also had a significant positive total effect on faeces-related handwashing. These results are in line with research in Kenya where radio shows (along with other mass media approaches) were more effective than community events in promoting handwashing (Scott et al. 2008). In contrast, results from other prevention interventions such as HIV/AIDS or smoking, revealed that mass media was less effective than interpersonal communication (Agha and Rossem 2002; Korhonen et al. 1998).

In terms of food-related handwashing, community clubs and theatres were relevant in addition to the aforementioned activities. Similarly to the latter result, dramas were effective in promoting sexual responsibility among young people in Zimbabwe (Kim et al. 2001), and proved successful in delivering HIV/AIDS information in Uganda (Mitchell et al. 2001).

Table 6 Mediation results: Effects of promotional activities on behavioural factors explaining food-related handwashing, and total indirect, direct and total effects of promotional activities on food-related handwashing

Promotional activity	Behavioural factors												Direct effects	Total effects
	Risk		Norm			Ability			Self-regulation			Total indirect effects		
	Severity	Attitude	Attractiveness	Descr. norm	Inj. norm	Self-efficacy	Hindrance	Forgetting	Coping planning					
Radio spot	0.01	0.18***	0.10	0.08**	0.12**	0.08***	-0.04	-0.07	0.05	0.07, 95 % CI [0.02, 0.12]	-0.00	0.07**	0.07**	95 % CI [0.02, 0.12]
Radio program	0.02	0.01	0.07	-0.04*	0.04	0.01	0.01	0.04	-0.02	-0.01, 95 % CI [-0.03, 0.02]	0.04**	0.03	0.03	95 % CI [-0.00, 0.06]
Megaphone	0.00	0.02	-0.05	0.02	0.01	-0.03*	0.02	0.02	-0.01	-0.01, 95 % CI [-0.03, 0.01]	0.00	-0.01	-0.01	95 % CI [-0.04, 0.02]
Group discussion	0.03	-0.00	-0.06	-0.02	0.01	0.04*	-0.00	0.00	0.02	0.01, 95 % CI [-0.01, 0.04]	0.02	0.03	0.03	95 % CI [-0.00, 0.07]
Hygiene training	0.01	0.04	0.06	0.03	0.03	-0.00	-0.01	-0.03	0.02	0.02, 95 % CI [-0.01, 0.05]	0.01	0.03	0.03	95 % CI [-0.00, 0.07]
Home visit	-0.03	-0.10**	-0.07	-0.04*	-0.04	-0.02	0.03	0.02	-0.02	-0.03, 95 % CI [-0.06, -0.00]	-0.02	-0.05**	-0.05**	95 % CI [-0.09, -0.02]
Material distribution	0.04*	0.10***	0.18***	0.06***	0.11***	0.08***	-0.08***	-0.04	0.08***	0.07, 95 % CI [0.05, 0.10]	0.00	0.08***	0.08***	95 % CI [0.05, 0.11]
Info neighbour/friend	-0.02	0.05	0.18***	0.06***	0.07**	0.06***	-0.05**	-0.06**	0.05**	0.05, 95 % CI [0.03, 0.08]	0.00	0.06***	0.06***	95 % CI [0.03, 0.09]
Focus group	0.05*	-0.07*	-0.17**	-0.03	-0.10***	-0.09***	0.03	0.03	-0.05*	-0.05, 95 % CI [-0.08, -0.02]	-0.02	-0.07***	-0.07***	95 % CI [-0.11, -0.03]
Cinema show	0.02	0.02	0.05	0.07***	0.02	0.04*	-0.00	0.00	0.04*	0.03, 95 % CI [0.00, 0.05]	-0.03*	0.00	0.00	95 % CI [-0.03, 0.04]
Theatre	-0.04*	0.02	0.12*	0.04	0.10***	0.03*	-0.06**	-0.09***	0.03	0.05, 95 % CI [0.02, 0.07]	0.02	0.06***	0.06***	95 % CI [0.03, 0.10]
Special hygiene day	-0.03	-0.01	-0.15**	-0.04*	0.12***	-0.08***	0.07**	0.05*	-0.06**	-0.07, 95 % CI [-0.09, -0.04]	-0.00	-0.07***	-0.07***	95 % CI [-0.10, -0.03]
Quiz	-0.06*	0.01	-0.01	0.01	0.04	0.01	-0.02	-0.01	-0.00	0.00, 95 % CI [-0.03, 0.03]	0.02	0.02	0.02	95 % CI [-0.02, 0.07]
Stickers, posters, paintings	-0.01	-0.05	-0.10	-0.04*	-0.03	-0.01	0.06*	0.04	-0.01	-0.03, 95 % CI [-0.06, -0.00]	-0.01	-0.04*	-0.04*	95 % CI [-0.08, -0.00]
Community club	-0.01	0.10**	0.29***	0.06**	0.07**	0.06***	-0.05*	-0.07**	0.06**	0.06, 95 % CI [0.04, 0.09]	0.00	0.07***	0.07***	95 % CI [0.05, 0.10]
Hygiene song	0.02	-0.09***	-0.19***	-0.07***	-0.14***	-0.08***	0.06**	0.04	-0.09***	-0.08, 95 % CI [-0.10, -0.05]	0.01	-0.06***	-0.06***	95 % CI [-0.09, -0.03]

Note. N=701. Displayed are unstandardized coefficients. * $p < .05$. ** $p < .01$. *** $p < .001$.

Spontaneous, unplanned promotions by friends and neighbours were also influential regarding both handwashing behaviours. Similar results were found regarding various health prevention such as reproductive health (Valente and Saba 1998) or smoking (Korhonen et al. 1998). These person-to-person channels could be deliberately utilised by motivating beneficiaries to talk with their peers on the subject of handwashing.

Although the afore-mentioned promotional activities seem to be quite successful, their impact could be improved inasmuch as they could target critical behavioural factors not yet adequately addressed. In the case of faeces-related handwashing, none of the promotional activities tackle return (the belief that it is worthwhile to wash hands), and only a few target response efficacy (the belief that handwashing prevents diarrhoea) and descriptive norm community (the belief that community members do wash their hands). In the case of food-related handwashing, only a few of the promotional activities address the perceived severity of cholera contagion and forgetting. The promotional activities should be modified in order to target these factors.

While all the applied promotional activities aim to foster handwashing behaviour in an emergency situation, the analyses revealed some of the activities were significantly negatively related with handwashing at key times. Three promotional activities were related with decreased faeces- and food-related handwashing: focus groups, hygiene songs, and stickers, posters, and paintings. In terms of hygiene songs, the result contrasted with previous findings in the field of handwashing (Scott et al. 2008) and nutrition (Hussain et al. 1997). In terms of stickers and posters, Pinfold (1999) found mixed results in Thailand; while stickers and posters were significantly positively related with campaign knowledge, they were in tendency negatively related with handwashing behaviour.

Two additional promotional activities were negatively associated with food-related handwashing: home visits and hygiene days. Again, this is in contrast with previous research showing the positive effects of home visits (Agha and Rossem 2002; Hussain et al. 1997), and special events such as hygiene days (Kim et al. 2001).

While the five promotional activities with negative associations are rather different in form and content, three of them have one commonality: respondents evaluated focus groups, hygiene days, and stickers, posters, and paintings significantly less positively than the other promotional activities.⁶

Focus groups were primarily held to evaluate the relief organisations' work, and to discuss problems within the

community. As every promotional program has its qualities and flaws, evaluation reveals not only positive but as well negative aspects of a program. The discussion of problems in the community clearly focuses on arisen difficulties, and, hence, negative aspects of a program as well. Respondents who participated in a focus group might have been primarily confronted with negative aspects of a promotional program, and hence doubted its convincingness and trustworthiness. Further, it might be that people were adversely recruited to participate in a focus group, that the expectations of people attending a focus group were not met, or that the focus group was perceived as too much effort (e.g. bad timing, time consuming, not entertaining).

While the affiliates organised several hygiene days, the biggest event was the global handwashing day on October 15, 2010. Although this event in itself might have been a success, it was retrospectively overshadowed by the fact that cholera broke out just days following the event. Ironically, rumours circulated that the global handwashing day caused the cholera outbreak, despite the fact this day celebrated one of the most crucial preventers of cholera. This negative coincidence might have lowered the trustworthiness and convincingness of the promotional activity.

While a decrease in liking, convincingness, and trustworthiness may explain why focus groups, hygiene days, and stickers, posters, and paintings are negatively related with handwashing, this is not true for home visits. Although home visits were negatively associated with food-related handwashing as well, they were rated rather favourably regarding liking, convincingness, and trustworthiness.

Implications for practitioners

To change behaviour successfully, promotional activities must address the factors which influence behaviour. The study revealed that attitude, norm, ability, and self-regulation factors are more important in explaining handwashing behaviour in an emergency situation than risk factors. Current promotional approaches in the WASH sector, however, still focus primarily on risk factors (DINEPA and UNICEF 2011). Consequently, these should be additionally adapted to address critical factors such as forgetting or disgust. Special attention should be given to the factor return which was not associated with any of the implemented handwashing promotions in Haiti. Hence, future promotional activities should trigger the belief that it is worthwhile to wash hands, that is, that handwashing is instrumental for attractiveness and reputation, and to avoid evoking disgust.

Of the applied handwashing promotions, material distributions and radio spots seem to be most promising, and can be recommended for use during emergencies. In addition, both promotion activities can reach a large group of beneficiaries within a short period of time, what is essential especially in the

⁶ While home visits are rated more favourably, hygiene songs were not evaluated within the interviews. Thus, it is not clear if hygiene songs were rated favourably or unfavourably.

beginning of an emergency relief. Still, additional evaluation studies are required to further the evidence base in an emergency setting. In contrast, focus groups, stickers, posters, and paintings, hygiene songs, hygiene days, and home visits were negatively related with handwashing. Consequently, additional research in emergency contexts should study their effects thoroughly to rule out behaviour-impairing effects.

Strength, limitations, and future studies

By revealing negative associations of several promotional activities with behaviour, the present study highlights the urgent need to carefully evaluate emergency hygiene promotions. However, studies in an emergency context are especially prone to the following limitations.

During emergencies, baseline data collections are not feasible due to time pressure. Further, use of control groups is not appropriate due to ethical concerns. As a consequence, the present study is based on cross-sectional, correlational data, and reveals associations between promotional activities, behavioural factors, and behaviour. However, no conclusions regarding causality are possible.

The affiliates applied several promotional activities without applying different intervention groups. Consequently, beneficiaries experienced various combinations of activities. It is possible that the combination of some activities were especially effective or hindering, or that a promotional activity on its own would have been effective but not in combination with the others. Hence, interaction effects should be taken into account. However, out of the sheer number of applied promotional activities, it was not feasible to test for interaction effects exhaustively.

Further, several scholars emphasised the problem of inflated self-reports in terms of socially desirable behaviour, and argue that handwashing behaviour should be observed instead (Biran et al. 2008; Curtis et al. 1993; Halder et al. 2010; Manun'Ebo et al. 1997). Still, due to feasibility issues in the present study data regarding handwashing had to be collected by means of self-report. However, since the study focused on relations and did not aim to draw conclusions about frequencies in the population, self-reports should not cause a problem. Overestimations do not affect relations, and their relative magnitude should not be biased. Still, a validation of the results by means of observational data would be preferable.

Targets of the study were primary caregivers. As a consequence, female adults are highly over represented in the sample. Hence, the research findings primarily apply to women. It might be that different conclusions would be drawn for male beneficiaries or children. This should be tested in subsequent analysis.

Focus groups, stickers, posters, and paintings, hygiene songs, hygiene days, and home visits were negatively related with handwashing. While the result is partly substantiated by

the fact that these promotional activities tended to be evaluated as less likable, less convincing, and less trustworthy, the negative relations are not fully explained so far. As a consequence, subsequent research should analyse these negative relations in-depth to further reveal the reason and mechanism of action.

Conclusions

The present study demonstrates that hygiene promotions in emergency relief should not be designed and implemented according to standard approaches based solely on the personal experience of relief workers (Aboud and Singla 2012). Instead, theories of behaviour change should be taken into account, and promotions should be designed based on evidence in order to specifically target those behavioural factors critical in eliciting the behaviour in question. Further, in-depth evaluations of promotional activities are inevitable to maximise their effectiveness and eliminate unwanted effects such as behaviour impairment. This is especially true for emergency interventions for which the evidence base is still limited but the number of lives at stake is high.

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Conflict of interest The authors declare that they have no conflict of interest.

Appendix

Table 7 Linear regression analysis for behavioural factors explaining faeces-related handwashing

Behavioural factor group	Behavioural factor	<i>B</i>	SE <i>B</i>	<i>p</i>	CI (95 %) for <i>B</i>
	Constant	2.39	0.17	.000	[2.05, 2.73]
Risk factors	Perceived vulnerability	0.00	0.01	.730	[-0.02, 0.01]
	Perceived cholera severity	0.00	0.02	.980	[-0.04., 0.03]
	Health knowledge ^a	-0.10 ^a	0.05 ^a	.038 ^a	[-0.19, -0.01] ^a
Attitude factors	Instrumental beliefs				
	Efforts	-0.02	0.02	.328	[-0.07, 0.02]
	Response efficacy ^a	0.06 ^a	0.02 ^a	.014 ^a	[0.01, 0.10] ^a
	Attractiveness	-0.02	0.01	.060	[-0.03, 0.00]
	Nurture: teaching and caring	0.03	0.02	.141	[-0.01, 0.08]

Table 7 (continued)

Behavioural factor group	Behavioural factor	<i>B</i>	<i>SE B</i>	<i>p</i>	CI (95 %) for <i>B</i>
	Return ^a	0.03 ^a	0.01 ^a	.005 ^a	[0.01, 0.05] ^a
	Affective beliefs				
	Liking and pleasantness	−0.04	0.03	.117	[−0.10, 0.01]
	Soap attributes: smell ^a	0.06 ^a	0.01 ^a	.000 ^a	[0.03, 0.09] ^a
	Disgust ^a	0.05 ^a	0.02 ^a	.001 ^a	[−0.02, 0.08] ^a
	Attitude towards cholera patients	0.00	0.01	.611	[−0.02, 0.01]
Norm factors	Descriptive norms				
	Family	0.00	0.03	.919	[−0.05, 0.05]
	Community ^a	0.04 ^a	0.01 ^a	.005 ^a	[0.01, 0.07] ^a
	Injunctive norm	0.02	0.02	.204	[−0.01, 0.06]
	Personal norm	0.01	0.02	.669	[−0.03, 0.05]
	Compliance mobilizers	0.01	0.01	.219	[−0.01, 0.03]
Ability factors	Self-efficacy ^a	0.12 ^a	0.04 ^a	.002 ^a	[0.04, 0.19] ^a
	Maintenance self-efficacy				
	General hindrance ^a	−0.06 ^a	0.02 ^a	.003 ^a	[−0.10, −0.02] ^a
	HW-station out of order	0.00	0.02	.944	[−0.04, 0.04]
	No water or no soap	−0.04	0.02	.029	[−0.08, 0.00]
	Recovery self-efficacy	0.04	0.03	.241	[−0.03, 0.10]
Self-regulation factors	Forgetting	−0.03	0.02	.129	[−0.06, 0.01]
	Control Planning: Detailed plan ^a	0.12 ^a	0.02 ^a	.000 ^a	[0.07, 0.17] ^a

Note. *N*=745. Adjusted *R*² = .45. CI=Confidence interval

^a Factors are significantly related with faeces-related handwashing and were selected for subsequent mediation analysis.

Table 8 Mediation results: effects of behavioural factors on faeces-related handwashing

Behavioural factor group	Behavioural factor	<i>B</i>	<i>SE B</i>	<i>p</i>
Risk factors	Health knowledge	−0.13	0.05	.008
Attitude factors	Return	0.03	0.01	.001
	Smell of soap	0.05	0.01	.000
	Disgust	0.04	0.02	.005
Norm factors	Descriptive norm community	0.04	0.01	.003
Ability factors	Self-efficacy	0.18	0.03	.000
	Response efficacy	0.06	0.02	.022
	General hindrance	−0.09	0.02	.000
Self-regulation factors	Control planning: detailed plan	0.14	0.02	.000

Note. *N*=653. Adjusted *R*² = .48.

Table 9 Linear regression analysis for behavioural factors explaining food-related handwashing

Behavioural factor group	Behavioural factor	<i>B</i>	<i>SE B</i>	<i>p</i>	CI (95 %) for <i>B</i>
	Constant	1.09	0.22	.000	[0.65, 1.52]
Risk factors	Perceived vulnerability	−0.01	0.01	.446	[−0.03, 0.01]
	Perceived cholera severity ^a	0.06 ^a	0.02 ^a	.006 ^a	[0.02, 0.10] ^a
	Health knowledge	0.02	0.06	.787	[−0.10, 0.13]
Attitude factors	Instrumental beliefs				
	Efforts	−0.01	0.03	.678	[−0.07, 0.05]
	Response efficacy	0.04	0.03	.162	[−0.02, 0.10]
	Attractiveness ^a	0.03 ^a	0.01 ^a	.007 ^a	[0.01, 0.05] ^a
	Nurture: Teaching and caring	0.04	0.03	.188	[−0.02, 0.09]
	Return	0.02	0.01	.055	[0.00, 0.05]
	Affective beliefs				
	Liking and pleasantness	0.04	0.03	.199	[−0.02, 0.11]
	Soap attributes: smell ^a	0.05 ^a	0.01 ^a	.007 ^a	[0.01, 0.08] ^a
	Disgust	0.03	0.02	.078	[0.00, 0.06]
	Attitude towards cholera patients ^b	−0.02 ^b	0.01 ^b	.041 ^b	[−0.04, 0.00] ^b
Norm factors	Descriptive norms				
	Family ^a	0.09 ^a	0.03 ^a	.004 ^a	[0.03, 0.15] ^a
	Community	0.02	0.02	.210	[−0.01, 0.06]
	Injunctive norm ^a	0.09 ^a	0.02 ^a	.000 ^a	[0.04, 0.13] ^a
	* Personal norm				
	Compliance mobilizers	0.02	0.01	.114	[−0.01, 0.04]
Ability factors	Self-efficacy ^a	0.12 ^a	0.04 ^a	.007 ^a	[0.03, 0.21] ^a
	Maintenance self-efficacy				
	General hindrance ^a	−0.14 ^a	0.03 ^a	.000 ^a	[−0.19, −0.09] ^a
	HW-station out of order ^b	0.06 ^b	0.03 ^b	.031 ^b	[0.01, 0.11] ^b
	No water or no soap ^b	−0.09 ^b	0.03 ^b	.001 ^b	[−0.14, −0.04] ^b
	Recovery self-efficacy	0.01	0.04	.821	[−0.07, 0.09]
Self-regulation factors	Forgetting ^a	−0.10 ^a	0.02 ^a	.000 ^a	[−0.14, −0.05] ^a
	Control planning: detailed plan ^a	0.16 ^a	0.03 ^a	.000 ^a	[0.10, 0.22] ^a

Note. *N*=748. Adjusted *R*² = .61. CI=Confidence interval

^a Factors are significantly related with food-related handwashing and were selected for subsequent mediation analysis.

^b Factors are significantly related with food-related handwashing but had to be excluded from mediation analysis.

* Factor had to be excluded due to high multicollinearity.

Table 10 Mediation results: effects of behavioural factors on food-related handwashing

Behavioural factor group	Behavioural factor	<i>B</i>	SE <i>B</i>	<i>p</i>
Risk factors	Perceived cholera severity	0.08	0.02	.000
Attitude factors	Attractiveness	0.02	0.01	.039
	Smell of soap	0.03	0.02	.038
Norm factors	Descriptive norm family	0.13	0.03	.000
	Injunctive norm	0.09	0.02	.000
Ability factors	Self-efficacy	0.13	0.04	.000
	General hindrance	-0.17	0.02	.000
Self-regulation factors	Forgetting	-0.14	0.02	.000
	Control planning: detailed plan	0.20	0.03	.000

Note. $N=701$. Adjusted $R^2 = .63$.

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